

Wind noise in hearing devices is a severe problem. Wind noise may reach magnitudes of 100 dB Sound Pressure Level (SPL) and even more. Users of hearing devices therefore often switch their device off in windy conditions, because acoustical perception with the hearing device in windy surroundings may become worse than without the hearing device.

Depending upon wind speed, direction of the wind with respect to the device, hair length of the individual, mechanical obstructions like hats and other factors, magnitude and spectral content of wind noise vary significantly. With respect to noise, effects and causes reference is made to H. Dillon et al., "The sources of wind noise in hearing aids", IHCON 2000, as well as to I. Roe et al., "Wind noise in hearing aids: Causes and effects", submitted to the Journal of the Acoustical Society of America.

It has been suggested to counteract wind noise by mechanical constructional measures, but these are generally too big or too bulky for implementation in a hearing aid.

In addition such approaches often lead to increased acoustic attenuation of the desired sound.

It is therefore a feature of the present invention to overcome at least these drawbacks and provide a hearing aid with improved wind noise suppression.

SUMMARY OF THE INVENTION

The invention, in a first aspect, provides a hearing aid according to claim 1. In accordance with the first aspect, there is provided a hearing aid comprising a microphone, a signal processing unit, an electrical-acoustical output transducer, a housing and a wind shield cover, wherein:

- the housing has a surface with a microphone inlet, and
- the wind shield cover is adapted to be attached to the housing, to cover the microphone inlet, to provide together with the housing a gap, the gap providing a conduit for the transmission of sound from the surroundings and to said microphone inlet, wherein the spacing between the housing and the wind shield cover is in the range between 0.15 mm and 0.5 mm, and wherein the minimum distance along the gap from the microphone inlet and to an edge of the wind shield cover, is at least 3 mm.

This provides a hearing aid with a wind shield and a hearing aid housing that efficiently suppresses wind noise.

The invention, in a second aspect, provides a hearing aid according to claim 1044. In accordance with the second aspect, there is provided a hearing aid adapted for suppression of wind noise comprising a microphone inlet, a housing, and a sound transmission channel adapted to provide for sound to be guided from the surroundings, through the interior of the housing and to the microphone inlet, wherein a first dimension of a cross-section of the sound transmission channel is in the range between 0.15 mm and 0.5 mm, and a second dimension of a cross-section of the sound transmission channel, is at least 3 mm, and the length of the sound transmission channel is at least 3 mm.

This provides a hearing aid that is specifically adapted for suppression of wind noise and miniaturization.

Further advantageous features appear from the dependent claims.

CLAIMS

1. A hearing aid comprising a microphone, a signal processing unit, an electrical-acoustical output transducer, a housing and a wind shield cover wherein:
 - the housing has a surface with a microphone inlet, and
 - 5 • the wind shield cover is adapted to be attached to the housing, to cover the microphone inlet, to provide together with the housing a gap, hereby providing a conduit for the transmission of sound from the surroundings and to said microphone inlet, wherein the average spacing between the housing and the wind shield cover is in the range between 0.15 mm and 0.5 mm, wherein the
10 minimum distance along the gap from the microphone inlet and to an edge of the wind shield cover, is at least 3 mm.
2. The hearing aid according to claim 1, wherein the wind shield cover is adapted such that sound is transmitted into the gap between the wind shield cover and the housing through an opening formed by the edge of the wind shield cover and the
15 housing.
3. The hearing aid according to any one of the preceding claims, wherein the housing comprises distance holding means adapted for providing a support for the wind shield cover hereby securing a well defined spacing between the wind shield cover and the housing.
- 20 4. The hearing aid according to any one of the preceding claims, wherein the minimum distance along the gap from the microphone inlet and to an edge of the wind shield cover is at least 4 mm.
5. The hearing aid according to any one of the preceding claims, wherein the spacing between the housing and the wind shield cover is in the range between 0.20 mm
25 and 0.35 mm.
6. The hearing aid according to any one of the preceding claims, wherein the width of the gap, at the edge of the wind shield cover is at least 3 mm.

7. The hearing aid according to any one of the preceding claims, wherein the width of the gap, at the edge of the wind shield cover is at least 5 mm.
8. The hearing aid according to any one of the preceding claims, wherein
 - the housing has a cross-section with a circumference in a plane perpendicular to the general longitudinal axis of the housing and intersecting the microphone inlet,
 - the wind shield cover, when arranged on the housing, has in said plane a cross-section with a total length that is more than 30 % of the length of said first circumference.
9. The hearing aid according to claim 8, wherein the general longitudinal axis is defined by a line connecting the first microphone inlet and a second microphone inlet.
10. The hearing aid according to any one of the preceding claims, wherein the wind shield cover extends substantially all the way around the hearing aid housing except for a gap opening formed between the ends of the wind shield cover.
11. A hearing aid adapted for suppression of wind noise comprising a microphone inlet, a sound transmission channel adapted to provide for sound to be guided from the surroundings and to the microphone inlet, wherein a first dimension of a cross-section of the sound transmission channel is in the range between 0.15 mm and 0.5 mm, and a second dimension of a cross-section of the sound transmission channel, is at least 3 mm, and the length of the sound transmission channel is at least 3 mm.
12. The hearing aid according to claim 11, wherein the length of the sound transmission channel is at least 4 mm.
13. The hearing aid according to any one of claims 11 to 12, wherein the first dimension of a cross-section of the sound transmission channel is in the range between 0.20 mm and 0.35 mm.

14. The hearing aid according to any one of claims 11 to 13, wherein the second dimension of a cross-section of the sound transmission channel, is at least 5 mm.
15. The hearing aid according to any one of claims 11 to 14, wherein the sound transmission channel is formed as part of an insert adapted for accommodating the electronic components inside the hearing aid housing.
16. The hearing aid according to any one of the claims 11 to 15, wherein the sound transmission channel comprises at least one bend arranged for increasing the length of the sound transmission channel.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A hearing aid comprising a microphone, a signal processing unit, an electrical-acoustical output transducer, a housing and a wind shield cover, wherein:
 - the housing has a surface with a microphone inlet, and
 - 5 • the wind shield cover is adapted to be attached to the housing, to cover the microphone inlet, to provide together with the housing a gap, the gap providing a conduit for the transmission of sound from the surroundings and to said microphone inlet, wherein the spacing between the housing and the wind shield cover is in the range between 0.15 mm and 0.5 mm, and wherein the minimum
 - 10 distance along the gap from the microphone inlet and to an edge of the wind shield cover, is at least 3 mm.
2. The hearing aid according to claim 1, wherein the wind shield cover is adapted such that sound is transmitted into the gap between the wind shield cover and the housing through an opening formed by the edge of the wind shield cover and the
- 15 housing.
3. The hearing aid according to claim 1 or 2, wherein the housing comprises distance holding means adapted for providing a support for the wind shield cover hereby securing a uniform spacing between the wind shield cover and the housing.
4. The hearing aid according to any one of the claims 1-3, wherein the minimum
- 20 distance along the gap from the microphone inlet and to an edge of the wind shield cover is at least 4 mm.
5. The hearing aid according to any one of the claims 1-4, wherein the spacing between the housing and the wind shield cover is in the range between 0.20 mm and 0.35 mm.
- 25 6. The hearing aid according to any one of the claims 1-5, wherein the width of the gap, at the edge of the wind shield cover is at least 3 mm.
7. The hearing aid according to any one of the claims 1-6, wherein the width of the gap, at the edge of the wind shield cover is at least 5 mm.
8. The hearing aid according to any one of the claims 1-7, wherein

- the housing has a cross-section with a circumference in a plane, perpendicular to an axis of the housing defined by a line connecting the first microphone inlet and a second microphone inlet, and intersecting the microphone inlet, and
 - the wind shield cover, when arranged on the housing, has in said plane a cross-section with a total length of more than 30 % of the length of said first circumference.
- 5
9. The hearing aid according to any one of the claims 1-8, wherein the wind shield cover extends substantially all the way around the hearing aid housing except for a gap opening formed between the ends of the wind shield cover.
- 10 10. A hearing aid adapted for suppression of wind noise comprising a microphone inlet, a housing, and a sound transmission channel adapted to provide for sound to be guided from the surroundings, through the interior of the housing and to the microphone inlet, wherein a first dimension of a cross-section of the sound transmission channel is in the range between 0.15 mm and 0.5 mm, and a
- 15 second dimension of a cross-section of the sound transmission channel, is at least 3 mm, and the length of the sound transmission channel is at least 3 mm.
11. The hearing aid according to claim 10, wherein the length of the sound transmission channel is at least 4 mm.
12. The hearing aid according to any one of claims 10 to 11, wherein the first
- 20 dimension of a cross-section of the sound transmission channel is in the range between 0.20 mm and 0.35 mm.
13. The hearing aid according to any one of claims 10 to 12, wherein the second dimension of a cross-section of the sound transmission channel, is at least 5 mm.
14. The hearing aid according to any one of claims 10 to 13, wherein the sound
- 25 transmission channel is formed as part of an insert adapted for accommodating the electronic components inside the hearing aid housing.
15. The hearing aid according to any one of the claims 10 to 14, wherein the sound transmission channel comprises at least one bend arranged for increasing the length of the sound transmission channel.

16. A hearing aid comprising a microphone, a signal processing unit, an electrical-acoustical output transducer, a housing and a wind shield cover substantially as described with reference to the accompanying figures.
17. A hearing aid adapted for suppression of wind noise substantially as described with
5 reference to the accompanying figures.