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(54) **Hearing test probe**

Hörtestsonde

Sonde de test auditif

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Description

[0001] The present disclosure relates to a hearing test probe and the use of such a probe. In particular, the present disclosure relates to a probe used to perform an audiologic test, such as a tympanometric and/or an otoacoustic emission test.

BACKGROUND

[0002] In order to perform a tympanometric and/or an otoacoustic emission test, it is important that a probe entering the ear canal of a person to be tested is correctly positioned in the ear canal. Furthermore it is important that a suitable pressure is provided to the probe to ensure an air tight seal between the ear canal and the probe. Existing probes are difficult to handle in order to ensure correct positioning.

[0003] US3882848A discloses a test probe for use in a clinical evaluation of hearing loss. There are a number of increasingly important acoustic impedance tests for providing an evaluation of hearing system losses which involve the use of impedance audiometry measurements in patients' external ear canals. A probe is described for use in these tests which is inserted in the patient's ear and which includes a number of tubes for transmitting audio signals and air for the tests. The inner end of the probe is constructed to assure a satisfactory closed test cavity of adequate size in the ear canal and to form an air-tight seal for the closed cavity using a cooperating resilient cuff.

[0004] US2010191144 AA discloses an ear canal obstruction detecting acoustical stimulation ear probe. It has an illuminated or variable frequency emitter associated with an ear canal probe with an acoustical stimulator sized with structure to fit within and seal to the ear canal. Specifically, it comprises a housing with an exterior sized for hand positioning the probe. The housing has a tip structured to fit and seal within an ear canal. The housing interior defines a light transmission and inspection passageway with an opening at the tip through which light may pass and project into the inner ear for inspection. The passageway may be open or translucent, such as when an optical cable is housed within the housing interior. A translucent or partly translucent probe tip could also be an optical duct.

[0005] US2118523A discloses an illuminating observation telescope, comprising an elongated tube means for supporting said tube for rotation about its longitudinal axis, said tube having a fenestral opening, adjacent one end, an objective lens at said opening, and means in the tube aligned with said opening located within the Hold of vision of the telescope for indicating the angular position of the fenestral opening.

SUMMARY

[0006] Despite the known solutions there is still a need for probe for audiologic testing, which is easy to handle and easy to position correctly.

[0007] The present invention is disclosed by the subject of the independent claims. Further aspects of the invention are subject of the dependent claims. Examples which are not covered by the claims are examples which are useful for understanding the invention.

[0008] Accordingly, a probe for conducting an audiologic test is provided. The probe extends along a longitudinal axis from a first end to a second end, the first end is configured (e.g., by having a certain size and/or shape) for insertion into an ear-canal of a person and the second end opposite to the first end, wherein the probe comprises a probe part between the first end and the second end, the probe part having a first port. The probe further comprises a holder fixed to the probe part. The holder is configured to be held by an operator of the probe, e.g. in a three-finger grip.

[0009] Also disclosed is a method of conducting an audiologic test. The method comprises inserting at least a part of a probe according to the probe disclosed herein in an ear-canal of a person. A device for performing the audiologic test is communicatively coupled to the probe via the first port of the probe.

[0010] It is an advantage of the disclosed probe that the probe provides for easy handling of the probe by an operator. The holder of the probe facilitates a three finger grip, such that an operator may grip the holder between his thumb and index finger and/or middle finger, while, at the same time, the operator is able to apply pressure to the probe using his thumb.

[0011] It is a further advantage of the probe that an operator of the probe is able to apply a pressure to the probe in a longitudinal direction of the probe. For example, the operator may apply pressure to the holder thereby easily pressing the probe into or against the ear canal of a person with a suitable force. Thereby, the operator may easily provide an air tight seal of the ear canal of the person and/or between the probe and the ear canal of the person.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The above and other features and advantages of the present invention will become readily apparent to those skilled in the art by the following detailed description of exemplary embodiments thereof with reference to the attached drawings, in which:

Fig. 1 schematically illustrates a side view of an exemplary hearing test probe

Fig. 2 schematically illustrates a front view of an exemplary hearing test probe

Fig. 3 schematically illustrates a cross section of an exemplary hearing test probe

Fig. 4 a)-d) schematically illustrates end views of exemplary hearing test probes

Fig. 5 schematically illustrates an exemplary system

comprising an exemplary probe

Fig. 6 schematically illustrates an exemplary system comprising an exemplary probe

DETAILED DESCRIPTION

[0013] The figures are schematic and simplified for clarity, and they merely show details which are essential to the understanding of the invention, while other details have been left out. Throughout, the same reference numerals are used for identical or corresponding parts.

[0014] The probe has a first end and the first end may be an end of a section, such as a first section, of the probe part.

[0015] The probe part may have a plurality of ports, such as the first port and a second port and/or a third port.

[0016] The part of the probe for insertion into the ear-canal of the person for conducting an audiologic test may be a section of the probe part, such as the first section of the probe part.

[0017] The holder may be fixed on or near the second end of the probe, e.g. within 2 cm from the second end, such as within 1 cm from the second end, such as within 0.5 cm. from the second end, such as within 0.2 cm. from the second end.

[0018] The holder may have a first holder cross-sectional dimension (e.g. a first holder-diameter) measured along a first axis perpendicular to the longitudinal axis. The first holder cross-sectional dimension may be larger than a cross-sectional dimension of the probe part along the first axis. For example, the difference between the maximum probe part cross-sectional dimension and the first holder cross-sectional dimension may be at least 5 mm.

[0019] The holder may have a second holder cross-sectional dimension (e.g. a second holder-diameter) measured along a second axis perpendicular to the longitudinal axis. The second holder cross-sectional dimension may be larger than a cross-sectional dimension (e.g. diameter) of the probe part (e.g. measured along a direction of the second axis). For example, the difference between the maximum probe part diameter and the second holder cross-sectional dimension may be at least 5 mm.

[0020] A cross-sectional dimension (e.g. a diameter), such as the first holder cross-sectional dimension and/or the second holder cross-sectional dimension and/or the probe cross-sectional dimension, may be defined as the largest straight distance between two points on the perimeter of the form. For example, the first holder cross-sectional dimension may be the largest distance along the first axis between two points on the perimeter of the holder. Similarly, the second holder cross-sectional dimension may be the largest distance along the second axis between two points on the perimeter of the holder.

[0021] The first axis and the second axis may form an angle larger than 30 degrees, such as larger than 40 degrees, such as larger than 60 degrees. The first axis and the second axis may be perpendicular.

[0022] The probe, the probe part and/or the holder may have a circular or a non-circular cross section perpendicular to the longitudinal axis of the probe, such as an oval, polygonal, rectangular, polygonal with rounded corners, etc.

[0023] Providing the probe, the probe part, and/or the holder, with a non-circular cross section may allow easy twisting of the probe.

[0024] The holder may have a holder cross-sectional dimension (e.g. diameter) D2 in a direction perpendicular to the longitudinal axis of the probe, e.g. along the first axis (first holder cross-sectional dimension) or a second axis (second holder cross-sectional dimension). The probe part may have a probe cross-sectional dimension (e.g. diameter) D1 in a direction perpendicular to the longitudinal axis, e.g. along the first axis or the second axis. D2 may be greater than D1. For example, D2 may be of the order 40 mm, e.g. 25-45 mm, such as 30-35 mm, and D1 may be of the average ear canal cross-sectional dimension (e.g. diameter), e.g. 5-15 mm. D1 and D2 may be along the same axis, such as the first axis or the second axis.

[0025] The size and/or shape of different cross-sections of the probe, the holder and/or probe part perpendicular to the longitudinal axis taken at different positions along the longitudinal axis may vary. For example, the probe may have a first section having a first cross section perpendicular to the longitudinal axis of the probe, and a second section having a second cross section perpendicular to the longitudinal axis of the probe. The first cross section and the second cross section may be different in size and/or shape.

[0026] Additionally or alternatively, a first cross-section of the holder at a first position along the longitudinal axis may have a different size and/or shape than a second cross-section of the holder at a second position along the longitudinal axis, the first position being different from the second position.

[0027] The holder may have a first surface. The holder may further have a second surface opposite the first surface. The first surface may face the probe part. The second surface may face away from the probe part. The holder may be fixed to the probe part by the first surface, i.e. the first surface and a part of the probe part may be joined together.

[0028] The first port may be located at least 5 mm from the first surface along the longitudinal axis, such as at least 7 mm, such as at least 10 mm. Providing a minimum space between the first port and the first surface may allow the operator to place a finger, such as the index finger or the middle finger, on the first surface without obstructing the first port.

[0029] The first surface may be a convex surface, a concave surface or a straight surface. The second surface may be a concave surface, a concave surface or a straight surface. The holder may be configured for being held by the operator in a three-finger grip, e.g. by an

operator placing the index finger and the middle finger on the first surface on each side of the probe part, and the thumb on the second holder-surface.

[0030] A first point of the first surface may have a first tangent plane with a first normal. The first normal and the longitudinal axis may form an angle less than 45 degrees, such as less than 35 degrees, such as less than 30 degrees. The first point may be located at a first distance from a center axis of the probe. The first distance may be larger than a first threshold. The first threshold may be at least 4 mm, such as 6 mm or 8 mm.

[0031] Alternatively, the first distance may be larger than the distance from the center axis to a point on the perimeter of a cross-section of the probe part perpendicular to the longitudinal axis, such as a cross-section of the probe part proximal to the second end, such as a cross-section of the probe part between the second end and 1 cm from the second end along the longitudinal axis.

[0032] The angle between the longitudinal axis and the first normal being less than 45 degrees, or less than 35 degrees, or less than 30 degrees, has the effect, that the holder has a surface, e.g. the first surface which is approximately perpendicular to the longitudinal axis. This provides a surface, e.g. the first surface, for placing the index and/or middle finger, when handling the probe, such as handling the probe with a three finger grip.

[0033] The probe part may comprise a first section. The first section may be configured for hermetically sealing the ear-canal of the person. Alternatively or additionally, the first section may be configured for engagement with a tip. The tip may be configured to hermetically seal the ear-canal of the person, at least during the audiologic test. The tip may be chosen from a plurality of tips with different sizes and/or properties to accommodate different ear and/or ear-canal sizes. The tip may be flexible. For example, the tip may be made of a flexible material, e.g. a thermoplastic elastomer, a rubber etc. The tip may be replaceable and/or disposable. A disposable tip may prevent requirement of sterilizing the probe because the disposable tip may be sterile and disposed of after use. A replaceable tip facilitates adaption of the test probe for different ear canal geometries/sizes.

[0034] The holder may be fixed to the probe part using fixation means. Fixation means may be any one or more of a click lock, a twist on lock, a screw, a press-fit lock, glue, bayonet-clutch etc.

[0035] The probe part and the holder may be cast together. Casting the probe part and the holder together may improve durability of the probe. Additionally or alternatively, casting the probe part and the holder together may lower manufacturing costs. However, providing a holder which is separable from the probe part, may allow a holder which is attachable to conventional test probes.

[0036] The holder may be cast in the same material as the probe part. Casting the probe part and the holder in same materials may incur lower manufacturing costs. Alternatively, the holder may be cast in a different material than the probe part. Different materials may provide different desirable properties such as flexibility, opacity, rigidity, durability etc.

[0037] The holder and the probe part may exhibit different mechanical properties such as flexibility, rigidity, durability etc. Different mechanical properties may be acquired for example by varying the material and/or thickness of parts. The holder may be made from a material that is more flexible than the material of the probe part. The thickness of the holder may be such that the holder is more flexible than the probe part.

[0038] The holder and the probe part may exhibit different visual properties such as colour, opacity, reflection, etc. Different visual properties may be realized for example by making the holder and the probe part in different materials and/or thickness. For example, the holder may be transparent or substantially transparent.

[0039] The first port may be configured to accommodate at least one tubular input (tubular structure). The at least one tubular input may be configured to accommodate an electrical wire e.g. a first wire and/or a second wire. The at least one tubular input may be configured to accommodate air under pressure.

[0040] The probe may comprise a second port. The probe may comprise a channel connecting the first port and the second port. The channel may be formed in the probe part. The channel may allow fluid communication between the first port and the second port. For example, the probe part may be substantially tubular. The probe part may taper having a smaller cross-sectional dimension (e.g., a smaller diameter) towards the first end. Alternatively or additionally, the probe part may comprise a tube extending from the first port to the second port.

[0041] The first port may be connectable to a tubular member. The tubular member may comprise a tube and/or a wire, or a tube containing a wire or a double tube, wherein a first tube of the double tube contains a wire or a cable and a second tube of the double tube is configured to accommodate a fluid such as air. The first port may be connectable to a first end of the tubular member. A second end of the tubular member may be connectable to a device for performing an audiologic test. The device may be configured for pumping a fluid such as atmospheric air into the ear canal in order to increase/decrease pressure against the tympanic membrane, e.g. the device may pump fluid into the ear canal via the tubular member and the channel extending from the first port to the second port.

[0042] The probe part may accommodate a receiver (loudspeaker), such as a first and/or second receiver. The receiver may be connectable to an electrical wire, e.g. the first wire. The receiver may be connectable to a device configured for performing an audiologic test, e.g. via an electrical wire, such as the first wire.

[0043] The probe part may accommodate a microphone, such as a first microphone and/or a second microphone. The microphone may be connectable to an electrical wire, e.g. the second wire. The microphone may be connectable to a device configured for performing an

audiologic test, e.g. via an electrical wire, such as the second wire.

[0044] The audiologic test to be performed may be chosen from a group consisting of tympanometric test and otoacoustic emission test.

[0045] The operator and the person, as described, may be two individuals. However, the operator and the person may be the same person.

[0046] Fig. 1 schematically illustrates a side view of an exemplary probe 100 for conducting an audiologic test. The probe 100 comprises a first end 111 and a second end 112. The probe 100 further comprises a probe part 113 between the first end 111 and the second end 112. The probe 100 further comprises a first port 125.

[0047] The probe 100 extends along a longitudinal axis 160. The probe part 113 has a first section 114 and a second section 116.

[0048] The probe 100 further comprises a holder 150. The holder 150 has a first surface 151 and a second holder surface 152. The second holder surface 152 being opposite the first surface 151. The holder 150 is attached to the probe part 113 proximal to the second end 112. The first surface 151 is facing the probe part 113 and the second holder surface 152 is facing away from the probe part.

[0049] A first point 200 of the first surface 151 has a first tangent plane 202 with a first normal 204. The first normal 204 and the longitudinal axis 160 form an angle 206 less than 45 degrees. As illustrated in Fig. 1 the angle 206 is approximately 30 degrees. In other exemplary probes, the angle 206 may be between 0-20 degrees.

[0050] In the depicted example, the first point is located at a first distance 208 along a first axis 212. The first axis 212 is perpendicular to the longitudinal axis 160. The first distance 208 is larger than a second distance 209 along the first axis 212. The first distance 208 is the distance between a center axis 210 and the first point 200. The second distance 209 is the distance between the center axis 210 and a point on the perimeter of the probe part 113 proximal to the second end 112, such as less than 2 cm from the first point along the longitudinal axis 160. The first distance 208 may be larger than the second distance 209, such as at least 2 mm larger than the second distance 209, such as at least 4 mm larger than the second distance.

[0051] The holder 150 is configured (e.g. by having certain size and/or shape) to allow an operator using the probe 100 to utilize a three-finger-grip, wherein the thumb is positioned on the second holder surface 152, and the index and middle finger are positioned against the first surface 151 on either side of the probe part 113. The operator may thus be permitted to apply pressure to the probe 100 in a longitudinal direction of the probe 100, i.e. towards a person's ear canal.

[0052] To provide for a comfortable and firm grip on the probe 100, the second holder surface 152 may be concave, as shown in Fig. 1. The first surface 151 may be convex as shown in Fig. 1.

[0053] Fig. 2 schematically illustrates a front view of an exemplary hearing probe 100. Fig. 2 furthermore illustrates an exemplary circular shape of the holder 150 and circular shape of the probe part 113. Alternatively, the shape of the holder 150 and/or probe part 113 may be triangular, rectangular, oval, etc. The probe part 113 and the holder 150 may have different shapes. A cross-section of the probe part 113 may vary along the longitudinal axis. For example, the probe part 113 may have a circular cross-sectional shape proximal to the first end 111, and the probe part 113 may have an oval or polygonal shape proximal to the second end 112.

[0054] The holder 150 may be symmetrical about an axis perpendicular to the longitudinal axis, such as the first axis 212 or a second axis.

[0055] In the depicted example, the probe part 113 has a probe cross-sectional dimension (e.g. a diameter) D1, and the holder has a holder cross-sectional dimension (e.g. diameter) D2. The cross-sectional dimensions D1, D2 may be defined as the largest straight distance between two points on the perimeter of a cross-section perpendicular to the longitudinal axis. The probe cross-sectional dimension D1 may vary along the longitudinal axis. The probe cross-sectional dimension D1 may be smaller proximal to the first end 111 than proximal to the second end 112. The probe cross-sectional dimension D1 may be smallest at the first end 111.

[0056] Fig. 3 schematically illustrates a cross section of an exemplary hearing test probe 100 along the longitudinal axis. The cross section A-A shown in Fig. 3 is the cross section as indicated on Fig. 2. The probe part 113 has a first section 114 and a second section 116. The first section 114 is proximal to the first end 111, and the second section 116 is proximal to the second end 112.

[0057] The probe 100 comprises a probe channel 126 extending from the first port 125 to a second port 127. The second port 127 is located at the first end 111. The probe channel 126 and the second port 127 allows fluid communication between the first port 125 and the ear canal of the person, when a part of the probe 100 is inserted into the person's ear canal. The probe channel 126 depicted consists of straight parts, however, the probe channel 126 may just as well be curved and/or have curved parts.

[0058] In the depicted example, the first port 125 is formed in the second section 116, and the second port 127 is formed in the first section 114. Alternatively, the first port 125 and the second port 127 may be formed in the same section, e.g. the first section 114.

[0059] The first section 114 is configured to accommodate a disposable and/or flexible tip 170. The tip 170 may be fitted onto the first section 114 in order to ensure a tight fit of the first end 111 in an ear canal. Furthermore, a disposable tip 170 may prevent requirement of sterilizing the probe 100 after use.

[0060] Figs. 4a-d schematically illustrates exemplary shapes of a holder 150 seen from end views. Figs 4a-b shows the holder 150, 150', 150", 150'" having a first

holder cross-sectional dimension 220 along a first axis 212. The first axis 212 is perpendicular to the longitudinal axis 160. The holder 150, 150', 150", 150'" has a second holder cross-sectional dimension 222 along a second axis 214. The second axis 214 is perpendicular to the longitudinal axis 160. In Figs. 4a-d the first axis 212 and the second axis 214 are perpendicular, i.e. the angle 216 formed by the first 212 and the second axis 214 is 90 degrees. The angle 216 formed by the first 212 and the second axis 214 may be more than 30 degrees, such as more than 45 degrees, such as more than 60 degrees, such as more than 75 degrees, such as 90 degrees.

[0061] The first holder cross-sectional dimension 220 and/or the second holder cross-sectional dimension 222 may be in the range between 25-100 mm, such as in the range between 30-70 mm, such as 40 mm.

[0062] Fig. 4a schematically illustrates an exemplary holder 150 having a circular shape with the same first holder cross-sectional dimension 220 and second holder cross-sectional dimension 222 of about 25 mm.

[0063] Fig. 4b schematically illustrates an exemplary holder 150' having an oval shape. The first holder cross-sectional dimension 220 and the second holder cross-sectional dimension 222 are different. The first holder cross-sectional dimension 220 is in Fig. 4b larger than the second holder cross-sectional dimension 222. The second holder cross-sectional dimension may be half of the first holder cross-sectional dimension, or less than 1/3 of the first holder cross-sectional dimension, or less than half of the first holder cross-sectional dimension. The first holder cross-sectional dimension may be 50 mm and the second holder cross-sectional dimension may be 25 mm. The smallest of the first and second holder cross-sectional dimension, e.g. the second holder cross-sectional dimension, may be the same or substantially the same cross-sectional dimension as a cross-sectional dimension of the probe part.

[0064] Fig. 4c schematically illustrates an exemplary holder 150" having a polygonal shape. The specifically depicted exemplary holder 150" has a pentagonal shape. The first holder cross-sectional dimension 220 and the second holder cross-sectional dimension 222 are in Fig. 4c different. The second holder cross-sectional dimension 222 is in Fig. 4c larger than the first holder cross-sectional dimension 220.

[0065] Fig. 4d schematically illustrates an exemplary holder 150'" having an arbitrary shape. The first holder cross-sectional dimension 220 and the second holder cross-sectional dimension 222 are the greatest distance along a straight line parallel to the respective first and second axis between two points on the perimeter of the holder 150'". The first holder cross-sectional dimension 220 and the second holder cross-sectional dimension 222 are in Fig. 4d different. The first holder cross-sectional dimension 220 is in Fig. 4d larger than the second holder cross-sectional dimension 222.

[0066] Fig. 5 schematically illustrates an exemplary system comprising an exemplary probe 100 and an exemplary device 140 for performing an audiologic test. The probe 100 is inserted into a person's ear canal 10. The ear canal 10 comprises a tympanic membrane 11.

[0067] The probe 100 comprises a microphone 120. The microphone 120 is adapted to record a first audio signal. For example, the microphone 120 may be configured for recording an audio signal, e.g. the first audio signal, reflected from the tympanic membrane 11.

[0068] The probe 100 comprises a receiver (loudspeaker) 121. The receiver 121 is adapted to transmit a second audio signal. For example, the receiver 121 may be configured for transmitting an audio signal, e.g. the second audio signal, towards the tympanic membrane 11.

[0069] The first port 125 may be coupled to the device 140 by a tubular member 130. The tubular member 130 may comprise a tube or a wire, or a tube containing a wire, or a double tube, wherein a first tube of the double tube contains a wire and a second tube of the double tube is configured to accommodate a fluid. The tubular member 130 may comprise a tube wherein a wire, or a plurality of wires, is cast in the wall of the tubular member 130. The wire(s) may electrically connect the receiver 121 and/or the microphone 120 with the device 140.

[0070] The device 140 may comprise a processing unit 141. The processing unit 141 may be communicatively coupled to the microphone 120 via a first wire 131 contained in the tubular member 130 The processing unit 141 may be communicatively coupled to the receiver 121 via a second wire 132 contained in the tubular member 130.

[0071] The device 140 may comprise a pump 142. The pump 142 may be in fluid communication 133 with the ear canal 10 via the tubular member 130, the first port 125, the probe channel 126, and the second port 127. Hence, the device 140 may be able to pump fluid, such as atmospheric air, into the ear canal in order to increase pressure against the tympanic membrane. Alternatively or additionally, the device 140 may be able to remove fluid, such as atmospheric air, from the ear canal in order to decrease pressure against the tympanic membrane.

[0072] The receiver 121 and/or the microphone 120 may be positioned distal to the first end 111, e.g. in the tubular member 130 proximal to the first port 125, and acoustic signals may be conducted between the ear canal 10 and the receiver 121 and/or the microphone 120 via the channel 126 and second port 127.

[0073] Fig. 6 schematically illustrates another exemplary system comprising an exemplary probe 100 and an exemplary device 140 for performing an audiologic test. The exemplary system depicted in Fig. 6 comprises the same features as the system depicted in Fig. 6. However, the system in Fig. 6 illustrates a system wherein the microphone 120 and the receiver 121 are contained in the device 140. Acoustic signals between the ear canal 10 and the receiver 121 and/or the microphone 120 is transmitted through the tubular member 130, the first port 125, the channel 126, and the second port 127.

[0074] Although particular embodiments have been shown and described, it will be understood that it is not intended to limit the claimed inventions to the preferred embodiments. The specification and drawings are, accordingly, to be regarded in an illustrative rather than restrictive sense.

LIST OF REFERENCES

[0075]

10	ear canal
11	tympanic membrane
100	probe
111	first end
112	second end
113	probe part
114	first section
116	second section
120	microphone
121	receiver
125	first port
126	probe channel
127	second port
130	tubular member
131	first wire
132	second wire
133	fluid communication
140	device
141	processing unit
142	pump
150	holder
151	first surface
152	second surface
160	longitudinal axis
170	tip
200	first point
202	first tangent plane
204	first normal
206	angle formed by longitudinal axis and first normal
208	first distance
209	second distance
210	center axis
212	first axis
214	second axis
216	angle formed by first and second axis
220	first holder cross-sectional dimension
222	second holder cross-sectional dimension
D_1	probe cross-sectional dimension
D_2	holder cross-sectional dimension

Claims

1. A probe (100) for conducting an audiologic test, the probe (100) extending along a longitudinal axis (160) from a first end (111) to a second end (112), the first end (111) configured for insertion into an ear-canal (10) of a person and the second end (112) opposite to the first end (111), wherein the probe (100) comprises a probe part (113) between the first end (111) and the second end (112); wherein the probe part (113) has a first port (125) arranged in a lateral surface of the probe part (113), the first port (125) being configured to accommodate at least one tubular input configured to accommodate one or more electrical wires and/or air under pressure; wherein the probe (100) further comprises a holder (150) fixed to the probe part (113), the holder (150) being configured to being held by an operator of the probe (100), **characterized in that** the holder (150) has a non-circular shape, seen from an end view.

2. Probe (100) according to claim 1, wherein the holder (150) has a first holder cross-sectional dimension (220) along a first axis (212) perpendicular to the longitudinal axis (160), wherein the first holder cross-sectional dimension (220) is larger than a cross-sectional dimension of the probe part (113) along the first axis (212).

3. Probe (100) according to claim 2, wherein the holder (150) has a second holder cross-sectional dimension (222) along a second axis (214) perpendicular to the longitudinal axis (160), wherein the second holder cross-sectional dimension (222) is larger than a cross-sectional dimension of the probe part (113) along the second axis (214).

4. Probe (100) according to claim 3, wherein the first axis (212) and the second axis (214) form an angle (216) larger than 30 degrees.

5. Probe (100) according to any of the preceding claims, wherein the holder (150) has a first surface (151) facing the probe part (113).

6. Probe (100) according to claim 5, wherein the first surface (151) is a convex surface.

7. Probe (100) according to any of claims 5-6, wherein a first point (200) of the first surface (151) has a first tangent plane (202) with a first normal (204), and wherein the first normal (204) and the longitudinal axis (160) form an angle (206) less than 45 degrees.

8. Probe (100) according to claim 7, wherein the first point (200) is located at a first distance (208) from a center axis (210) of the probe (100), the first distance (208) being larger than a first threshold, such as 4 mm.

9. Probe (100) according to any of the preceding claims, wherein the holder (150) has a second surface (152) facing away from the probe part (113), wherein the second surface (152) is a concave sur-

face.

10. The probe (100) according to anyone of the previous claims, wherein the probe part (113) comprises a first section (114) configured for engagement with a tip (170) for hermetically sealing the ear-canal (10) of the person during the audiologic test.

11. The probe (100) according to any of the preceding claims, wherein the holder (150) is configured for being held by the operator in a three-finger grip.

12. The probe (100) according to anyone of the previous claims, wherein the probe (100) comprises a second port (127) and a channel (126) connecting the first port (125) and the second port (127).

13. The probe (100) according to anyone of the preceding claims, wherein the audiologic test to be performed is chosen from the group consisting of tympanometric test and otoacoustic emission test.

14. A method of conducting an audiologic test, wherein the method comprises inserting at least a part (113) of a probe (100) according to anyone of claims 1 to 13 into an ear-canal (10) of a person, wherein a device (140) for performing the audiologic test is communicatively coupled to the probe (100) via the first port (125).

Patentansprüche

1. Sonde (100) zur Durchführung eines audiologischen Tests, wobei sich die Sonde (100) entlang einer Längsachse (160) von einem ersten Ende (111) bis zu einem zweiten Ende (112) erstreckt, wobei das erste Ende (111) zum Einsetzen in einen Gehörgang (10) einer Person ausgelegt ist, und das zweite Ende (112) zum ersten Ende (111) entgegengesetzt ist, wobei die Sonde (100) ein Sondenteil (113) zwischen dem ersten Ende (111) und dem zweiten Ende (112) umfasst; wobei das Sondenteil (113) einen in einer Seitenfläche des Sondenteils (113) angeordneten ersten Eingang (125) aufweist, wobei der erste Eingang (125) zur Aufnahme von mindestens einem rohrförmigen Eingang ausgelegt ist, der zur Aufnahme von einer bzw. mehreren elektrischen Leitung(en) und/oder Luft unter Druck ausgelegt ist; wobei die Sonde (100) ferner einen an dem Sondenteil (113) befestigten Halter (150) aufweist, wobei der Halter (150) ausgelegt ist, um von einem Betreiber der Sonde (100) gehalten zu werden, **dadurch gekennzeichnet, dass** der Halter (150), von einer Endansicht betrachtet, eine nicht-kreisförmige Form aufweist.

2. Sonde (100) nach Anspruch 1, wobei der Halter (150) eine erste Halterquerschnittsabmessung (220) entlang einer zur Längsachse (160) senkrechten ersten Achse (212) aufweist, wobei die erste Halterquerschnittsabmessung (220) größer als eine Querschnittsabmessung des Sondenteils (113) entlang der ersten Achse (212) ist.

3. Sonde (100) nach Anspruch 2, wobei der Halter (150) eine zweite Halterquerschnittsabmessung (222) entlang einer zur Längsachse (160) senkrechten zweiten Achse (214) aufweist, wobei die zweite querschnittsabmessung (222) des Halters größer als eine Querschnittsabmessung des Sondenteils (113) entlang der zweiten Achse (214) ist.

4. Sonde (100) nach 3, wobei die erste Achse (212) und die zweite Achse (214) einen Winkel (216) bilden, der größer als 30 Grad ist.

5. Sonde (100) nach einem der vorgehenden Ansprüche, wobei der Halter (150) eine dem Sondenteil (113) zugewandte erste Fläche (151) aufweist.

6. Sonde (100) nach Anspruch 5, wobei die erste Fläche (151) eine konvexe Fläche ist.

7. Sonde (100) nach einem der Ansprüche 5-6, wobei ein erster Punkt (200) der ersten Fläche (151) eine erste Tangentialebene (202) mit einer ersten Normale (204) aufweist, und wobei die erste Normale (204) und die Längsachse (160) einen Winkel (206) von kleiner als 45 Grad bilden.

8. Sonde (100) nach Anspruch 7, wobei der erste Punkt (200) in einem ersten Abstand (208) zu einer Mittelachse (210) der Sonde (100) angeordnet ist, wobei der erste Abstand (208) größer als ein erster Schwellenwert, wie beispielsweise 4 mm, ist.

9. Sonde (100) nach einem der vorgehenden Ansprüche, wobei der Halter (150) eine dem Sondenteil (113) abgewandte zweite Fläche (152) aufweist, wobei die zweite Fläche (152) eine konkave Fläche ist.

10. Sonde (100) nach einem der vorgehenden Ansprüche, wobei das Sondenteil (113) einen ersten Abschnitt (114) umfasst, der zum Eingriff mit einer Spitze (170) zum hermetischen Dichten des Gehörgangs (10) der Person während des audiologischen Tests ausgelegt ist.

11. Sonde (100) nach einem der vorgehenden Ansprüche, wobei der Halter (150) ausgelegt ist, um durch den Betreiber in einem Dreifingergriff gehalten zu werden.

12. Sonde (100) nach einem der vorgehenden Ansprüche, wobei die Sonde (100) einen zweiten Eingang

(127) und einen Kanal (126) aufweist, die den ersten Eingang (125) und den zweiten Eingang (127) verbinden.

13. Sonde (100) nach einem der vorgehenden Ansprüche, wobei der durchzuführende audiologische Test aus der Gruppe bestehend aus tympanometrischem Test und otoakustischem Emissionstest ausgewählt ist.

14. Verfahren zur Durchführung eines audiologishen Tests, wobei das Verfahren das Einsetzten von mindestens einem Teil (113) einer Sonde (100) nach einem der Ansprüche 1 bis 13 in einen Gehörgang (10) einer Person umfasst, wobei eine Vorrichtung (140) zur Durchführung des audiologischen Tests über den ersten Eingang (125) mit der Sonde (100) kommunikativ gekoppelt ist.

Revendications

1. Sonde (100) pour réaliser un test audiologique, la sonde (100) s'étendant le long d'un axe longitudinal (160) d'une première extrémité (111) à une deuxième extrémité (112), la première extrémité (111) étant configurée pour être insérée dans le canal auriculaire (10) d'une personne et la deuxième extrémité (112) opposée à la première extrémité (111), dans lequel la sonde (100) comprend une partie sonde (113) entre la première extrémité (111) et la deuxième extrémité (112); dans lequel la partie sonde (113) présente un premier port (125) arrangé dans une surface latérale de la partie sonde (113), le premier port (125) étant configuré pour loger au moins une entrée tubulaire configurée pour loger un ou plusieurs fils électrique et / ou de l'air sous pression; la sonde (100) comprenant en outre un support (150) fixé à la partie sonde (113), le support (150) étant configuré pour être maintenu par un opérateur de la sonde (100), **caractérisée en ce que** la sonde (150) présente une forme non circulaire, observée depuis une vue d'extrémité.

2. Sonde (100) selon la revendication 1, dans laquelle le support (150) présente une première dimension transversale de support (220) selon un premier axe (212) perpendiculaire à l'axe longitudinal (160), la première dimension transversale du support (220) étant supérieure à une dimension transversale de la partie sonde (113) le long du premier axe (212).

3. Sonde (100) selon la revendication 2, dans laquelle le support (150) présente une deuxième dimension transversale de support (222) le long d'un deuxième axe (214) perpendiculaire à l'axe longitudinal (160), la deuxième dimension transversale du support (222) étant supérieure à une dimension transversale de la partie sonde (113) le long du deuxième axe (214).

4. Sonde (100) selon la revendication 3, dans laquelle le premier axe (212) et le deuxième axe (214) forment un angle (216) supérieur à 30 degrés.

5. Sonde (100) selon l'une quelconque des revendications précédentes, dans laquelle le support (150) présente une première surface (151) faisant face à la partie sonde (113).

6. Sonde (100) selon la revendication 5, dans laquelle la première surface (151) est une surface convexe.

7. Sonde (100) selon l'une quelconque des revendications 5 à 6, dans laquelle un premier point (200) de la première surface (151) présente un premier plan tangent (202) avec une première normale (204), et dans laquelle la première normale (204) et l'axe longitudinal (160) forment un angle (206) inférieur à 45 degrés.

8. Sonde (100) selon la revendication 7, dans laquelle le premier point (200) est situé à une première distance (208) d'un axe central (210) de la sonde (100), la première distance (208) étant supérieure à un premier seuil, tel que 4 mm.

9. Sonde (100) selon l'une quelconque des revendications précédentes, dans laquelle le support (150) présente une deuxième surface (152) opposée à la partie sonde (113), la deuxième surface (152) étant une surface concave.

10. Sonde (100) selon l'une quelconque des revendications précédentes, dans laquelle la partie sonde (113) comprend une première section (114) configurée pour s'engager avec une pointe (170) pour sceller hermétiquement le conduit auriculaire (10) de la personne pendant le test audiologique.

11. Sonde (100) selon l'une quelconque des revendications précédentes, dans laquelle le support (150) est configuré pour être maintenu par l'opérateur dans une prise à trois doigts.

12. Sonde (100) selon l'une quelconque des revendications précédentes, dans laquelle la sonde (100) comprend un deuxième port (127) et un canal (126) connectant le premier port (125) et le deuxième port (127).

13. Sonde (100) selon l'une quelconque des revendications précédentes, dans laquelle le test audiologique à effectuer est choisi dans le groupe consistant en un test tympanométrique et un test d'émission otoacoustique.

14. Procédé de réalisation d'un test audiologique, dans lequel le procédé comprend l'insertion d'au moins une partie (113) d'une sonde (100) selon l'une quelconque des revendications 1 à 13 dans le conduit auriculaire (10) d'une personne, un dispositif (140) permettant d'effectuer le test audiologique étant couplé de manière communicative à la sonde (100) via le premier port (125).

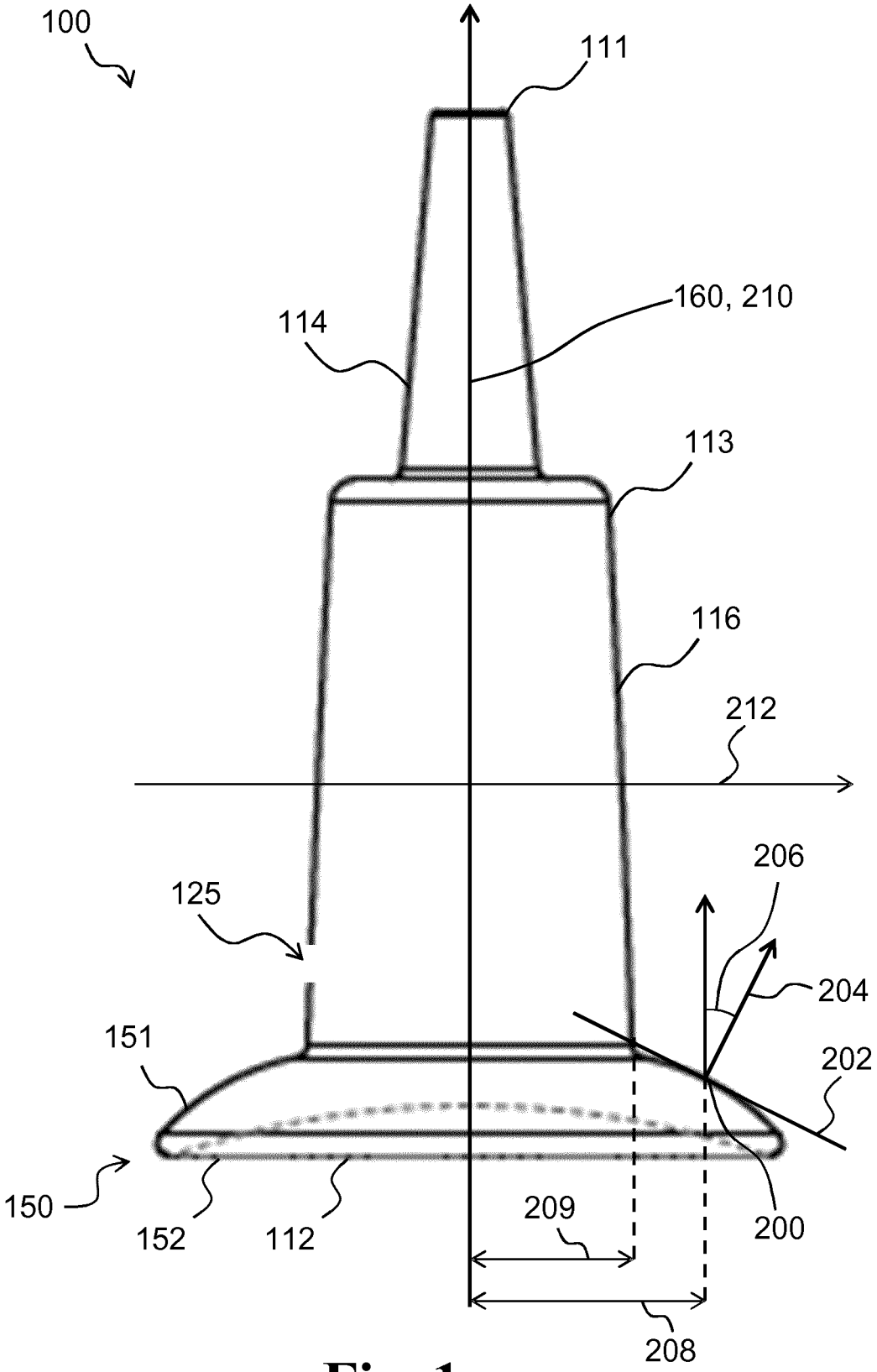

100
111
160, 210
114
113
116
212
125
206
204
151
202
150
152
112
209
200
208

Fig. 1

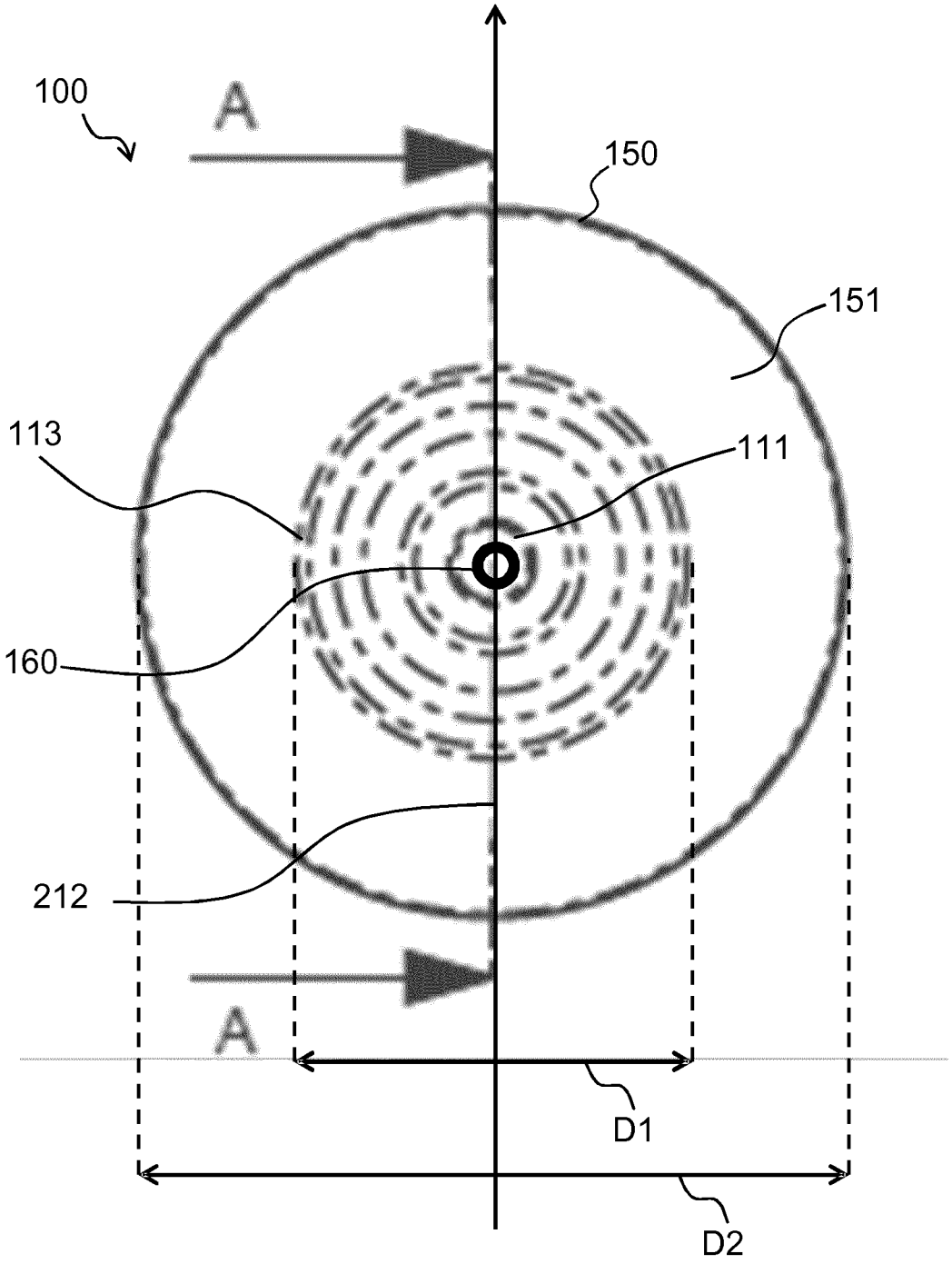
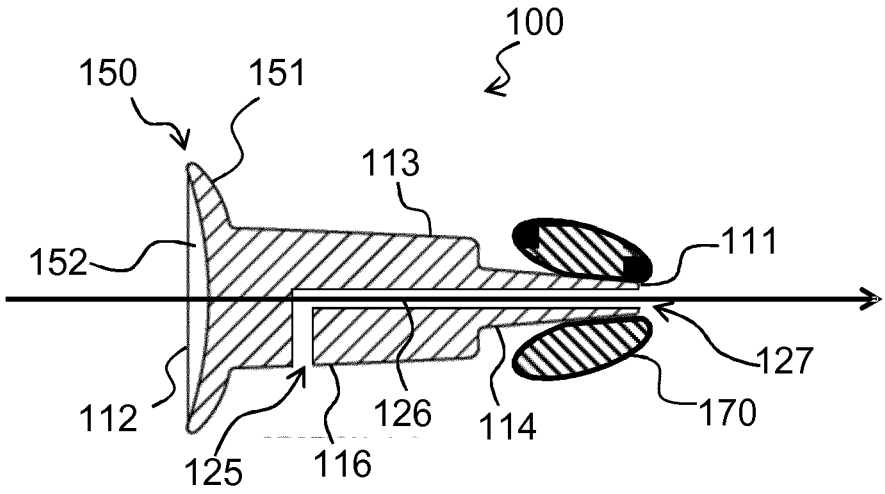


Fig. 2



SECTION A-A

Fig. 3

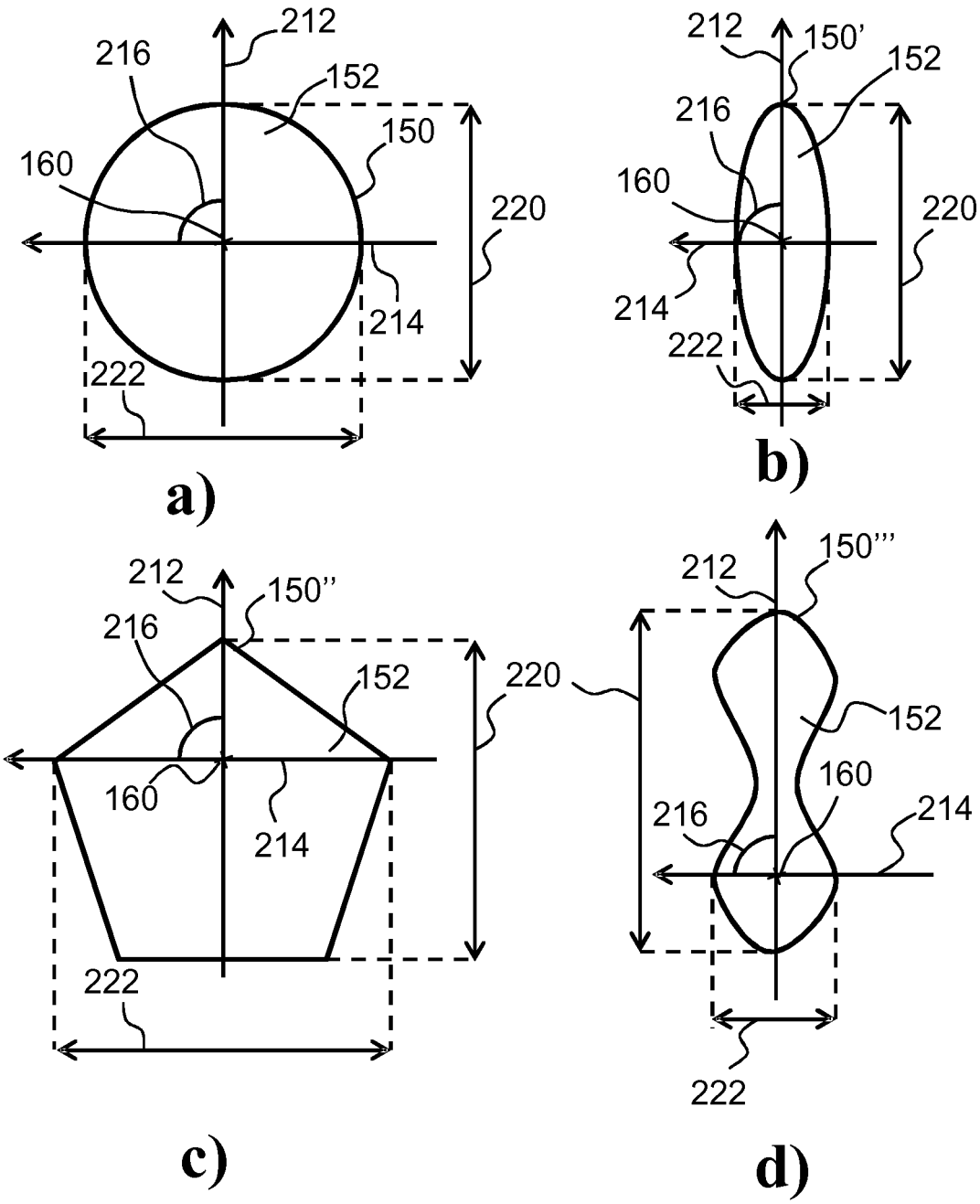

212
216
152
150
160
220
214
222
a)
212
150'
152
216
160
220
214
222
b)
212
150''
216
152
220
160
214
222
c)
150'''
212
152
160
216
214
222
d)

Fig. 4

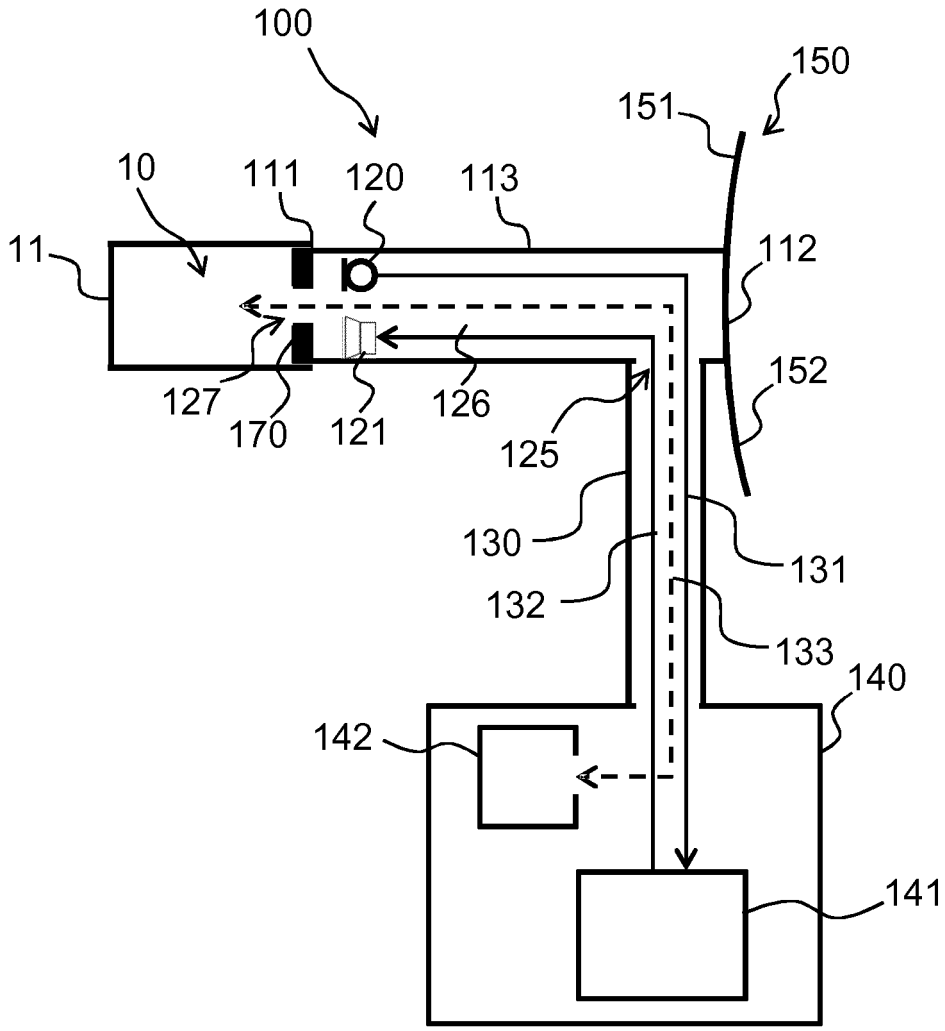

100
150
151
10
111
120
113
11
112
152
127
170
121
126
125
130
131
132
133
140
142
141

Fig. 5

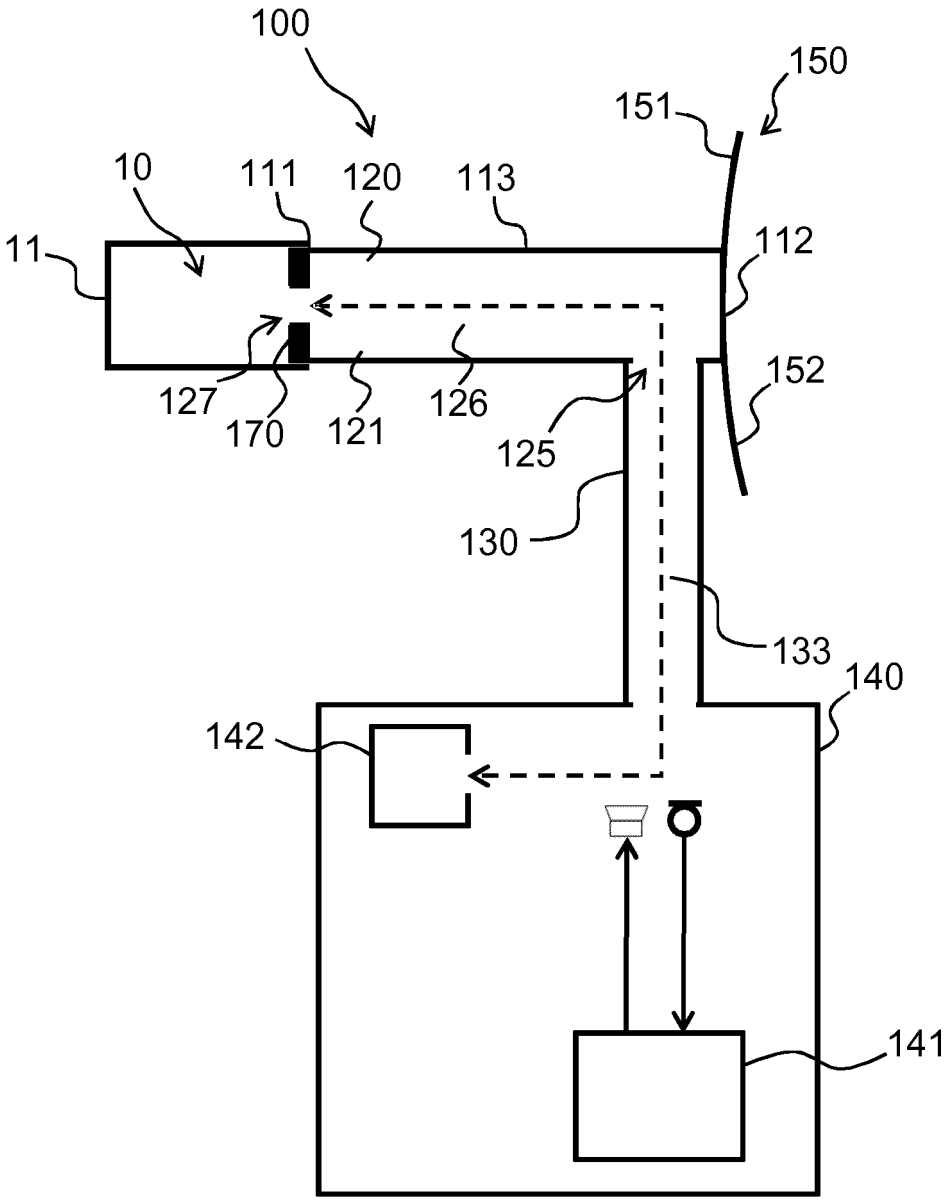

100
150
151
10
111
120
113
11
112
127
170
121
126
125
152
130
133
140
142
141

Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 3882848 A **[0003]**
- US 2010191144 AA **[0004]**
- US 2118523 A **[0005]**

专利名称(译)	听力测试探针		
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[标]申请(专利权)人(译)	GN尔听美公司		
申请(专利权)人(译)	GN OTOMETRICS A / S		
当前申请(专利权)人(译)	NATUS医疗INCORPORATED		
[标]发明人	SMITH ANDERS		
发明人	SMITH, ANDERS		
IPC分类号	A61B1/227 A61B5/12 A61B5/00		
CPC分类号	A61B5/126 A61B1/2275 A61B5/121 A61B5/6817		
优先权	201400063 2014-02-04 DK		
其他公开文献	EP2901916A1		
外部链接	Espacenet		

摘要(译)

公开了一种用于进行听力测试的方法和探针。探针沿纵向轴线从第一端延伸到第二端，第一端构造成插入人的耳道，第二端构造成与第一端相对。探针包括位于第一端和第二端之间的探针部分;其中探针部分具有第一端口;探针还包括固定在探针部分上的固定器，所述固定器配置成由探针的操作者保持，例如探针。用三指握住。

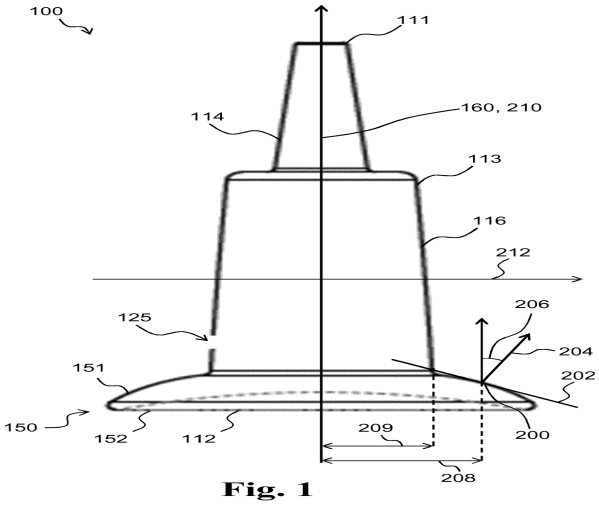

Fig. 1