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(54) **Ergonomic housing for electroacoustic transducers and ultrasound probe with said housing**

Ergonomisches Gehäuse fur einen elektroakustischen Wandler und Ultraschallsonde mit einem solchen Gehäuse

Boîtier ergonomique pour un transducteur électro-acoustique et sonde à ultrasons comportant un tel boîtier

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Description

[0001] The present invention relates to an ergonomic housing for electroacoustic transducers, particularly for ultrasound imaging, comprising at least an inner space housing one or more electroacoustic transducers and possible further electric and/or electronic components according to the preamble of claim 1.

[0002] Housings of said type are known in the technical field. The ultrasound imaging is considerably widespread and it is often used. By means of studies in the field it has been found that users of ultrasound systems have muscle-skeletal diseases of the hand, wrist, neck and back coinciding with the use of ultrasound probes.

[0003] In order to avoid or at least to reduce above drawbacks, housings whose shape has been ergonomically modified are known. However the difficulty is that on one hand observed diseases can be eliminated or reduced by allowing the hand and the muscle-skeletal structure associated thereto to have relaxation moments, however without losing the control of the probe such that when the examination is carried out the probe can be gripped with a sufficient security in order to guide it and to exert the necessary pressure against the patient.

[0004] A solution to this drawback is described in the document WO2005/053537 (Koninklijke Philips electronics N.V.) wherein in the location opposite to the acoustic window from which soundproofing pulses are emitted the probe housing has a cap-like surface that is enough wide and it is such to allow the surface of the palm of the hand to grip the housing. Said gripping surface called palmar gripping surface is a kind of spherical or spheroidal gripping member that is gripped by the hand as a ball.

[0005] A similar solution is provided in the document US2006/0173331 (Siemens Corporation). In this case the housing of the probe provides a palmar gripping surface provided in an opposite location with respect to the acoustic window.

[0006] However said palmar grip does not completely solve the above drawback, since it does not allow to relax the hand without losing the grip on the housing of the probe. So the hand has to remain substantially tight on the surface of the housing forming the manual handle part. Even if during rest moments the tightening force can somewhat be relaxed, the hand cannot be absolutely stretched in the correct relaxation position of the muscle-skeletal structure.

[0007] Even if such configuration of the housing for ultrasound probes providing the palmar grip increases somewhat the situation with respect to the conventional pen type grip by which the probe is held between the fingers (position called pinching in the technical jargon) for performing the canning (task defined pushing in the field jargon), probes providing a palmar grip do not allow to alternatively grip the probe by a pen type grip (pinching).

[0008] The document us 5752517 discloses an intra-operative ultrasound probe having contoured side surface which enable the probe to be held between the fingers.

[0009] Particularly opposing sides 20 and 22 of the enclosure 12 are formed in a contoured shape. As shown in the drawings the strain relief and the cable have an upward orientation when the transducer and lens cover are held against the surface of an organ or tissue.

[0010] This means that during the examination of the tissue, the hand and the arm of the operator are always parallel to the surface under examination.

[0011] The document JP2003 334190 discloses a probe with a pair of narrowed section 14, 15, on the right side and the left side. As shown in figure 2 and 3 the probe case can be picked up by two or three fingers but considering the form of the top face section 12A with the semicircle 26 and the form of the narrowed section 14, 165 said probe does not allow to relax the hand without losing the grip of the housing of the probe.

[0012] The document JP 2003 339706 (see figures 11 and 3) shows a classic probe held between the fingers (pinching). Said probe does not allow relaxation moments during the examination, without losing the control of the probe. Said document discloses a probe with a housing 3 having a grip covering the ultrasonic element 6 and the wire. The grip has a pole with an elliptical section and a bulge formed at its central part. Since a recess is formed at the root of the grip, the grip is familiar to the hand by grasping the recess by a thumb and an index finger. Said housing 3 does not allow to relax the hand without losing the grip on the housing of the probe.

[0013] The document US 5897503 and US 2003/060714 disclose a probe with a conventional pan type grip.

[0014] The document US 5997503 (figure 2) discloses a case handle with elastomeric compounds over at least a portion or all of the handle portions: in figure 2 the thumb and the middle fingers are holding the probe on the sides of the cases handle near the nosepiece 112, with forefinger on the top edge; in figure 3 the forefinger rests near the cable , while the sides and the edge of this probe are held by the fingers and the thumb.

[0015] These figures and the description show a conventional pen type grip (pinching) and said probe is not fit for being gripped by inserting it in the hallow between two adjacent fingers on the hand so that said probe can not be surely held in the hand even in a position of substantial complete relaxation of the muscle-skeletal structure thereof.

[0016] The document US 4898177 relates to a pencil type (narrow and elongate shape) ultrasonic probe provided with an adapter on which operator's fingers can be hocked to allow the probe to be held by the operator so that a bean radiation surface of the ultrasonic probe can be stably held with respect to a body surface to be examined in order to accurately execute an ultrasonic diagnosis. The operator can use the probe with or without attaching the adapter to the probe, in fact the adapter is

deigned to be detachably mounted on the probe. The adapter comprises a body including a through-hole in which the probe is inserted and a finger grip portion protruding from this body and allowing the fingers to be hocked thereon.

[0017] Said probe is formed by different elements so that the structure of the probe does not avoid drastic change to the conventional structure of the probe and does not make simple the manufacturing of the ultrasonic probes.

[0018] Considering the above, the invention aims at providing an ergonomic housing for electroacoustic transducers, particularly for ultrasound imaging, allowing to overcome drawbacks of known housings and above all allowing to surely hold the probe in the hand even in a position of substantial complete relaxation of the muscle-skeletal structure thereof.

[0019] The invention aims also at improving said housing such to avoid drastic changes to the conventional structure of probes and moreover such to make simplier and to rationalize the manufacturing of ultrasound probes.

[0020] The invention achieves above aims by providing an ergonomic housing for electroacoustic transducers, particularly for the ultrasound imaging, of the type described hereinbefore, wherein the housing further comrises the features of the claim 1.

[0021] Advantageously the shape and sizes of the housing are such that the adjacent fingers of the hand holding the housing do not force fingers of the hand to be opened wide or to be tightened lending fingers to not be relaxed. On the contrary, particularly the shape and sizes of the housing are such to allow the holding between the two fingers in a natural relative spacing position thereof.

[0022] An advantageous embodiment provides the gripping surface of the housing to have a gripping surface that is ergonomically shaped in order to be gripped between the fingers, i.e. by interposing it in the hollow between two adjacent fingers of the hand.

[0023] The gripping extension to be held between the fingers is shaped such to be anatomically adapted to be engaged in the hollow between the fingers between two adjacent fingers of the hand, particularly between the forefinger and the middle finger or between the middle finger and the ring finger.

[0024] The gripping surface of the housing from which the gripping extension to be held between the fingers comes out has a resting part that is like a spherical or spheroidal cap or dome and that is provided opposing the acoustic window, the gripping extension to be held between the fingers being provided at the top of said resting part.

[0025] The gripping extension to be held between the fingers may have various shapes and sizes. It can be also composed of an elongated member like a pin or the like having a rounded shape in section.

[0026] According to a further characteristic improving the security of grip between the fingers, the gripping extension to be held between the fingers has at least a pair of opposite gripping recesses with a laid down U-shaped section, each of which is intended for housing one of the two adjacent fingers for the engagement between the fingers of said gripping extension.

[0027] As a further improvement, the gripping extension to be held between the fingers has an annular recess having substantially a laid down U-shaped section, whose bottom surface is formed by a band of shell axial surface connected in a rounded way with the two side surfaces that are formed by surfaces transversal to the longitudinal axis of the extension and connected to said bottom surface, possibly only one or both in a rounded way, while one of said two side surfaces of the annular recess is composed of the resting part of the gripping surface and the other side surface is composed of the surface of a radial annular enlargement provided at a certain distance from said resting part of the gripping surface.

[0028] The gripping extension to be held between the fingers may have a rotation symmetrical shape or a not circular shape of the section, with a greater axis substantially oriented towards the fingers gripping it and/or in the antero-posterior direction of the hand and/or in the direction of the hollow between the fingers and with a smaller axis oriented in the direction transversal to the longitudinal axis of the fingers and/or to the antero-posterior direction of the hand.

[0029] Still according to an advantageous characteristic, the gripping extension to be held between the fingers is a sleeve for the introduction of an electrical cable for connecting the transducer.

[0030] Various relative arrangements of the acoustic window with respect to the gripping surface and with respect to the gripping extension to be held between the fingers are possible. A particular choice for example provides gripping extension to be held between the fingers to have a longitudinal axis that coincides with the prolongation of a vector perpendicular to the center of the acoustic window.

[0031] As regards the acoustic window, it has to be shaped in a way corresponding to the array of electroacoustic transducers that can be linear, i.e. flat or curved such as in convex probes or the curvature may be according to two axes that are perpendicular one with respect to the other or anyway they are not parallel. In this case, the acoustic window is composed of a flat member or it has a curved configuration respectively only according to a curvature axis or according to two or more curvature axes there being possible also the fact that the curvature can be opposite to the one of the gripping surface.

[0032] In order to allow the gripping of the housing with a so called pen type grip (pinching), the housing has such a shape and such a thickness at least in a direction perpendicular to the longitudinal axis to be gripped with a position of the hand corresponding to the so called pen

type grip, said shape and said thickness being provided for a part of the housing associated to the end having the acoustic window.

[0033] Other manufacturing variants improving the gripping comfort may provide said housing to have two opposite recesses with a section rounded shape, at an intermediate region of the housing, between the gripping surface and the acoustic window. Moreover the housing may have, from said intermediate region and in the direction of the acoustic window, two different thicknesses in the direction of each one of two axes perpendicular one with respect to the other and enclosed in the plane perpendicular to the axis of the gripping extension to be held between the fingers or in a plane tangential or parallel to the acoustic window.

[0034] The handle part of the housing forming the cap-like gripping surface opposite to the acoustic window, is advantageously composed of a spheroidal body that is flattened on two sides that are diametrically opposite one with respect to the other such to have two different diameters a greater one and a smaller one in the plane perpendicular to the axis of the gripping extension to be held between the fingers, the two opposite side recesses provided in the intermediate region of the housing being made as hollow ones in the direction of said greater axis.

[0035] Therefore the invention provides a housing made of a first housing part and a second housing part, which parts are harmonically completed one with the other and are divided along an intermediate separation plane between a part that is shaped such to form a gripping handle with a pencil type grip position and a gripping handle part that is shaped such to be hold by gripping it between fingers.

[0036] It is possible to provide said two housing parts to be integrally made or to be movably fastened one to the other or it is possible to provide said two housing parts to be movably fastened one to the other.

[0037] Still according to an advantageous characteristic of the invention, the housing is provided in combination with one or more transducers, an electronic circuit, a cable connecting the electronic circuit to remote processing and control devices and a member connecting the cable to the electronic circuit.

[0038] The invention relates also to an ultrasound probe comprising a housing of the type described hereinbefore

[0039] Further improvements of the housing, of the probe according to the present invention are object of sub-claims.

[0040] Characteristics of the invention and advantages deriving therefrom will be more clear from the following description of some not limitative embodiments shown in annexed drawings wherein:

Fig.1 is a side elevation view taken on the larger side of an ultrasound probe according to the present invention.

Fig.2 is a side elevation view of the probe according to figure 1 but taken from the smaller side thereof.

Figs. 3 and 4 show conditions of the hand in positions holding the probe between the fingers under the relaxed condition of the hand and under the operating condition when the hand firmly grasps the probe and corresponding to functionalities that can be achieved by conventional gripping modes known as pinching and pushing.

Figs. 5A to 5E are different positions for gripping a convex probe according to the present invention for alternatively the pen type grip and the grip between the fingers.

Figs. 6A to 6E are different positions for gripping a linear probe according to the present invention for alternatively the pen type grip and the grip between the fingers.

Figures 7 and 8 are two views similar to figures 1 and 2 of a convex probe according to the present invention and wherein the probe housing can be separated in two parts thereof along a median plane one of which part is the pen type grip part and the other part is the gripping part to be held between the fingers.

Figures 9 and 10 are two views similar to figures 1 and 2 of a linear probe according to the present invention and wherein the probe housing can be separated in two parts thereof along a median plane one of which part is the pen type grip part and the other part is the gripping part to be held between the fingers.

Figure 11 is a variant embodiment of probes according to figures 7 to 10 wherein the pen type gripping part and housing electroacoustic transducers and possible electronics of different configurations of probes can be movably fastened to an housing part composing the between finger gripping part that is identical for all probes.

Figs. 12 and 13 are a cross-section according to a median plane longitudinal and parallel to the wider face of a convex probe and a linear probe respectively and wherein the array of electroacoustic transducers and the possible electronics or electric circuitry are schematically indicated.

[0041] In figures 1 and 2 there is shown a probe of the type called convex and i.e. wherein electroacoustic transducers generating ultrasound pulses and receiving reflected ultrasound pulses being part of a transducer set, so called array, are arranged on a curved surface or are moved along a curved surface.

[0042] In this case the probe has an housing 1 that at one end, the one proximal to the object to be examined and particularly to the epithelial region coinciding with the anatomical region to be examined, has an acoustic window 2 behind which there is arranged the transducer array housed in a space enclose by the housing 1.

[0043] The acoustic window 2 is composed of a wall portion that is permeable i.e. transparent to ultrasound

pulses, both the ones transmitted by transducers and the ones reflected towards the transducers.

[0044] The housing extends from the acoustic window in the direction of a distal end i.e. an end opposite to the one of the acoustic window. At such end the housing 1 forms an handle part 101 having a gripping and/or resting surface 201 that is rounded like a spherical or spheroidal cap or dome extending in the direction opposite to the end provided with the acoustic window 2 by a gripping extension to be held between the fingers denoted by 301. Such extension having a shape with a rounded cross section is connected to the gripping or resting surface 201 by at least two diametrically opposite recesses being shaped like a laid down U denoted by 401 and which recesses 401 have a rounded bottom wall connected to a first side wall radially oriented with respect to the axis of the gripping extension 301 to be held between the fingers and composed of the region of the top of said gripping/resting surface 201. The opposite wall laterally delimiting the opposite U shaped recesses 401 is composed of two diametrically opposite radial enlargements of the gripping extension 301 to be held between the fingers.

[0045] advantageously such as shown in examples of figures instead of two opposite laid down U shaped recesses it is advantageous to provide an annular groove of the gripping extension 301 to be held between the fingers delimited by two radial walls spaced in the direction of the axis of said extension and one of which is composed of the top portion of the gripping/resting surface 201, while the other one is composed of the radial annular surface of a radial enlargement 501 of said extension 401 that is provided as being spaced to a certain extent from the gripping/resting surface 201. The bottom of the annular groove is connected to said two annular, radial walls in a rounded and harmonic way.

[0046] Advantageously the distance between said two annular radial walls substantially corresponds to the average diameter or it is adapted to said average diameter of two adjacent fingers of an hand such that they can be partially housed in said groove or in said opposite recesses and such that the annular radial surface that is more far away from the acoustic window 2 partially overlaps the top of the hand and so of the corresponding two adjacent fingers between which the gripping extension to be held between the fingers is intended to be gripped.

[0047] The section of said extension is advantageously rounded and it can have different shapes.

[0048] In order to avoid the two adjacent fingers, generally but not exclusively the forefinger and the middle finger to take an unnatural and too much wide apart position at least at the region of the two opposite laid down U-shaped recesses 401 or of the annular groove, the section of the extension part corresponding to the region of the bottom of the groove is not round but it is flattened at the sides intended to be faced towards the two adjacent fingers. Therefore, in this case, the section is made oval or flattened such to have a smaller axis in the direction transversal to the fingers and to the hollows therebetween and a greater axis in the direction parallel to the longitudinal extension of the fingers and of the hollow therebetween. This allows to reduce the spreading of fingers such to have such a position guaranteeing a relaxed condition of the muscle-skeletal structure of the hand during the gripping condition between the fingers but also to guarantee a condition for the sufficient control or holding of the extension between the two fingers by means of an increased surface contacting the fingers in the longitudinal direction thereof.

[0049] The gripping/resting surface 201 is composed of an handle part like a spheric or spheroidal member or however a rounded member that is not a palmar gripping surface and having a maximum outwardly projecting equatorial line beyond which said handle part tapers connecting with a thinned handle part having a pen type grip denoted by 601 and ending by the end provided of the acoustic window 2.

[0050] The spheroidal handle part is connected to the tapered handle part 601 having the pen type grip with two hollow recesses 701 at diametrically opposite sides and that in the gripping condition between the fingers condition are a recess for gripping or housing the thumb of the hand. Said two opposite recesses 701 are provided at the two side ends of the larger sides of the pen type grip tapered handle part 601, while the two narrower sides of said the pen type grip tapered handle part are connected by a continuous faring to the spheroidal handle part such as shown in figure 2.

[0051] In the median region of the two wider sides of the pen type grip tapered part 601 of the probe, said two wider sides have a hollow 801 for gripping or housing fingertips of the fingers in the pen type grip respectively.

[0052] Even if such characteristic is not to be considered a limitative one, but it is a simple advantageous configuration, in the shown embodiments the gripping extension 301 to be held between fingers is tubular and it is opened both at the end for the connection to the housing and to the opposite end and it is a sleeve for passing the cable for a cable for the control and communication of transducers and possible electronic and/or electric components associated to transducers with other units of an ultrasound machine. Such characteristic is seen in greater details by sections according to diametral planes of figures 12 and 13. However such double functionality of the gripping extension 301 to be held between fingers is only a particular case and it can be provided also in combination with an housing provided with different inlets for the control and communication cable (not shown in details in figures).

[0053] The above housing has such a shape that at an head end and particularly at the head end proximal to or contacting the epithelium of the patient is provided with an acoustic window 2 composed of a surface having a narrower side and a longer side. Said surface may be flat or curved in a convex way. To said proximal head end there is connected a first pen type grip handle part

denoted by 601 that is flattened having two wider sides parallel or substantially parallel to longer sides of the acoustic window and two narrower sides that are oriented in the direction of the narrower sides of the acoustic window 2.

[0054] The width of the two narrower sides, that is the distance between the two wider sides is such that said pencil type grip handle part 601 can be easily gripped between the fingers of the hand with said pen type grip and substantially it has a size corresponding to the thickness of a pen with a more or less large diameter.

[0055] In the central region of the two wider sides of the pen type grip handle part 601 there are provided two depressions or hollows 801 for easily tightening said part 601. These hollows allow to close the opposite fingers like pliers when holding the probe like a pen, thus overcoming a circumference with an arc of 180° formed by pen type grip opposite fingers.

[0056] The pen type grip handle tapered part 601 is connected by two opposite side hollows made in the wider side walls to an handle spheroidal part 101 to be held between the fingers that is composed of a spheroidal member having a greater diameter in the direction parallel to wider sides of the pen type grip handle part 601 and a smaller diameter in the direction parallel to narrower sides of said pen type grip handle part 601. Said spheroidal member on the side faced towards the end provided with the acoustic window 2 forms wall faces of recesses 701 in wider sides of the pen type grip handle part 601 and on the opposite side it forms a resting cap or dome that in its top region has the gripping extension 301 to be held between fingers with the annular groove 401 engaging the two adjacent gripping fingers delimited on one side by said cap or dome of the resting or gripping member 101 and on the other side by the radial enlargement 501.

[0057] In the particular embodiment the housing 1 has a longitudinal axis that coincides with a vector passing through the centre of the acoustic window and perpendicular to the surface tangential to said acoustic window in said centre such axis being coincident with the longitudinal axis of the gripping extension 401 to be held between the fingers and perpendicular to the greater and smaller diameter of the spheroid 101 in the equatorial plane thereof.

[0058] Figures 3 and 4 clearly show the advantage of gripping the housing between the fingers according to the present invention. In this example the skeletal structure of the hand is schematized by using an arrangement of articulated rods. Joints are indicated by circles. The greatest circle is the wrist. Figure 3 clearly shows the fact that by means of the gripping extension to be held between the fingers it is possible to relatively firmly and securely grip the probe even if the hand is in its substantial resting and stretched positions. In this case the probe is not subjected to any pressures and the grip is secure as regards the holding and the control of the probe when the hand and the probe are not stressed.

[0059] On the contrary figure 4 shows the holding between the fingers with the hand in its operating control condition wherein the probe is held not only by gripping it between the fingers, but also by tightening it or holding it like tongs along the resting and gripping cap or dome like surface 301. In this condition the thumb rests against the region of the handle spheroidal member under the equatorial line and connected to the pen type grip handle part 601. It is to be noted that the tongs-like or tightening grip occurs contemporaneously to the gripping between the fingers and however it is not a palmar grip. Moreover in this position tightening the holding between the fingers the spheroidal handle part 101 the joint of the wrist is not stressed i.e. the axis of the forearm and the one of the thumb are substantially aligned, thus reducing stresses to the carpal tunnel.

[0060] At the same time the possibility of resting the middle finger and/or other fingers of the hand on the cap or dome on the side of the spheroidal gripping part opposite to the acoustic window 2, on the distal side of the equatorial line of said spheroidal part allows to exert on the probe the necessary pushing pressure indicated by the arrow F1 in figure 4 and so to properly control the probe.

[0061] The following series of figures 5A to 5E and 6A to 6E clearly show the modes for gripping the housing and so the probe according to the present invention with reference to a probe of the convex type and to a probe of the linear type.

[0062] Figures 5A and 6A show the gripping condition by the holding between the fingers with the hand in the stretched and resting condition. Figure 5B and figure 6C show the condition when the housing is gripped between the fingers and the spheroid resting and gripping part 101 is tightened the wider faces of the housing and more precisely of the pen type grip handle part 601 or longer sides of the acoustic window 2 being oriented transversally to the longitudinal direction of fingers.

[0063] Figures 5C and 6B show the variant wherein the housing is gripped by tightening and holding between fingers the spheroid gripping and resting part 101 by using the wider faces of the housing and more precisely of the pen type grip handle part 601 or with the longer sides of the acoustic window 2 substantially oriented in the longitudinal direction of fingers.

[0064] Figures 5D and 5E and figures 6E and 6D show the housing gripped by the pen type grip with the probe in said two positions respectively with respect to the longitudinal axis of the hand respectively and that is in the two positions of the probe or housing corresponding to an orientation of the wider sides of the housing or of the flattened part 601 of the probe transversal to the axis of the forearm or parallel thereto respectively.

[0065] Figures 7 to 13 show probes of the convex type and of the linear type according to what has been previously described.

[0066] As it is clear from figures 7 to 13, the two housing parts 101 and 601 composing the spheroidal handle grip-

ping or resting part and the pen type grip handle part respectively, are advantageously made as being movably fastenable along a substantially equatorial separation plane of the spheroidal part 101. Such plane coincides with the line separating the walls of the two housing parts 101 and 601 denoted by 3 in figures 7 to 13.

[0067] The two housing parts 101 and 601 can be made of different materials and particularly the spheroidal gripping one can be made of a soft material and the pen type grip handle one can be made of a more rigid material.

[0068] The softer material can be also an outer layer covering a more rigid supporting layer. Similarly it is also possible for one part 101 or the other one 601 to have regions with covering inserts or layers made of soft material in locations contacting the fingers or other parts of the hand, such as for example hollows 801 or islets 901 in recesses 401.

[0069] Advantageously this characteristic allows to make housings for ultrasound probes and ultrasound probes such that the cap-like or dome-like part bearing the gripping extension 301 to be held between the fingers is in common to a series of probes which have as the probe housing the pen type grip handle part 601 and the spheroidal gripping part extending to the substantially equatorial separation surface.

[0070] In this case, such as shown in figures 12 to 13, in the housing space 4 of the housing there is the enclosed the array of electroacoustic transducers 5 placed at the acoustic window 2, a terminal board composed of a printed circuit 6 or it can be composed of simple conducting paths or it can also comprise an electronic circuit with corresponding electronic components and a connector 7 mounted on the printed circuit and connecting a control and communication cable (not shown) to the printed circuit and to transducers.

[0071] It is to be noted that in the case of the example of figures 11 to 13, the probe housing is composed of a part 1A that is always the same and it is both the terminal connecting the control and communication cable of the ultrasound machine to the ultrasound probe intended as the array of transducers and circuits associated thereto inside the probe, and a part of the spheroidal resting and gripping part 101 and more precisely the dome or cap-like part provided at the distal end of the probe housing and opposite to the acoustic window 2 and moreover it comprises the gripping extension 301 to be held between the fingers.

[0072] The other housing part 1B on the contrary becomes the real housing part of the probe firmly housing transducers and circuits associated thereto , moreover said housing part 1B being composed of the pen type grip handle part 601 and of the part of the spheroidal gripping and resting part 101 connected to said pen type grip handle part and that is interposed between it and the substantially equatorial plane or line of separation 3 A general machine comprises circuits controlling the ultrasound probe 1 and processing signals kept by said probe as images that are displayed on a screen or by other alternative displaying means. The probe 1 is connected to control and processing circuits by a control and processing cable. This cable is made as firmly connected or coupled to the ultrasound machine and particularly to control and processing circuits, while it ends with an housing part 1A with a connector part to which a probe can be connected and whose housing is composed of an housing part 1B with a connector.

[0073] From the above advantages of the present invention are clear consisting in a better condition for using the probe as regards the gripping thereof and consequences of an extended use on the health conditions of the muscle-skeletal structure of the hand and/or of the wrist of the user

Claims

1. Ergonomic housing for electroacoustic transducers, particularly for the ultrasound imaging, comprising at least an inner space (4) housing one or more electroacoustic transducers (5) and possible further eletric and/or electronic components (6/7),
which housing (1) has at least an acoustic window (2) at which the one or more electroacoustic transducers (5) are placed
and, at the end opposite to the one of the acustic window, at least an handle part (101) having a gripping and/or resting surface (201) that is rounded like a spherical or spheroidal cap or dome and that is ergonomically fitted for being gripped by an hand or a part thereof,

- the gripping and/or resting surface (201) is composed of an handle part like a spheric or spheroidal menber having a maximum outwardly projecting equatorial line beyond which said handle part (101) tapers connecting with a thinned handle part (601) having a pen type grip and ending by the end provided of the acoustic window (2), being the spheroidal handle part connected to the tapered handle part (601) having the pen type grip with two hollow recesses (701) at diametrically opposite sides and that in the gripping condition between the fingers condition, are a recess for gripping or housing the thumb of the hand, being said two opposite recesses (701) provided at the two side ends of the larger sides of the the pen type grip tapered handle part (601), while the two narrower sides of said the pen type grip tapered handle part are connected by a continuous flaring to the spheroidal handle part, **characterized in that**
- the gripping and/or resting surface (201) extends in the direction opposite to the end provided with the acoustic window (2) by a gripping extension to be held between the fingers (301),

said gripping extension (301) is connected to the gripping or resting surface (201) by at least two diametrically opposite recesses being shaped like a laid down U (401) for housing two adjacent fingers, being shaped such to be anatomically adapted to be engaged in the hollow between the fingers between two adjacent fingers of the hand, particularly between the forefinger and the middle finger or between the middle finger and the ring finger, such that it is possible to relatively firmly and securely grip the probe even if the hand is in its substantial resting and stretched position.

2. Housing according to claim 1 **characterized in that** the gripping extension (301) to be held between the fingers is composed of an elongated member like a pin, sleeve, bushing, tube or the like having a rounded shape such that said gripping extension (301) is anatomically fitted for the engagement in the space between the fingers between two adjacent fingers of the hand, particularly between the forefinger and the middle finger or between the middle finger and the ring finger.

3. Housing according to claim 2, **characterized in that** the two gripping recesses (401) have a bottom wall that is oriented in the axial direction of the gripping extension (301) and two side walls transversal or perpendicular to the axis of the gripping surface (101), one of said two side surfaces being composed of a region of the resting part (201) of the gripping surface (101) and the other side wall being provided at a distance anatomically adapted to sizes of fingers, especially to average sizes of fingers.

4. Housing according to one of claims 2 or 3, **characterized in that** the gripping extension (301) to be held between the fingers has an annular recess or an annular groove (401) having substantially a laid down U-shaped section, whose bottom surface is formed by a band of shell axial surface connected in a rounded way with the two side surfaces that are formed by surfaces transversal to the longitudinal axis of the extension and connected to said bottom surface, possibly only one or both in a rounded way, while one of said two side surfaces of the annular recess (401) is composed of the cap or dome-like resting part (201) of the gripping surface (101) and the other side surface is composed of the surface of a radial annular enlargement (501) provided at a certain distance from said cap or dome-like resting part (201) of the gripping surface (101)

5. Housing according to one or more of the preceding claims, **characterized in that** the gripping extension (301) to be held between the fingers has a rotation symmetrical shape.

6. Housing according to one or more of the preceding claims, **characterized in that** the gripping extension (301) to be held between the fingers has a not circular section shape, with a greater axis substantially oriented in the direction of fingers gripping it and/or in the antero-posterior direction of the hand and/or of the hollow between fingers and with a smaller axis oriented in the direction transversal to the longitudinal axis of fingers and/or to the antero-posterior direction of the hand.

7. Housing according to one or more of the preceding claims, **characterized in that** the gripping extension (301) to be held between the fingers constitutes a sleeve for the introduction of an electrical cable for connecting the transducer.

8. Housing according to one or more of the preceding claims, **characterized in that** the gripping extension (301) to be held between fingers has a longitudinal axis that coincides with the prolongation of a vector perpendicular to a surface tangential to the centre of the acoustic window (2).

9. Housing according to one or more of the preceding claims, **characterized in that** the acoustic window (2) is composed of a flat member.

10. Housing according to one or more of the preceding claims 1 to 8 , **characterized in that** the acoustic window (2) has a curved arrangement according to a sole axis of curvature or according to two or more axes of curvature the curvature being opposite to the one of the resting dome or cap (201) of the gripping surface (101).

11. Housing according to one or more of the preceding claims, **characterized in that** at an intermediate region of the housing between the gripping surface (101) and the acoustic window (2) the housing has two opposite recesses (701) having a rounded section shape.

12. Housing according to one or more of the preceding claims, **characterized in that** the handle part of the housing (1) forming the gripping surface (101) is composed of a spheroidal body flattened on two diametrically opposite sides such to have two different diameters at least in the equatorial plane and one of which is a greater diameter and the other one is a smaller diameter in the plane, the two opposite side recesses (701) provided at the intermediate region of the housing being made hollow in the direction of said greater axis,such that the spheroidal gripping surface (101) is gripped by being tightened by fingers of the hand in addition to holding between the fingers the gripping extension (301) to be held between fingers, fingers of the hand adhering to said spheroidal

gripping surface beyond the equatorial line thereof.

13. Housing according to one or more of the preceding claims, **characterized in that** it has two different thicknesses in the direction of each one of the two axes perpendicular one with respect to the other and enclosed in the plane perpendicular to the axis of the gripping extension (301) to be held between the fingers.

14. Housing according to one or more of the preceding claims, **characterized in that** it is shaped such to allow the gripping with the hand in the position like a pen type grip.

15. Housing according to one or more of the preceding claims, **characterized in that** in the part thereof between the spheroidal gripping surface (101) and the acoustic window (2), the housing has a flattened part (601) whose thickness substantially corresponds to the size of a pen or of a thick pen and however it has such a thickness to be gripped by the hand like a pen.

16. Housing according to claim 15, **characterized in that** in the two opposite faces of said pen type grip handle flattened part (601) and at the end of the two opposite fingers for example thumb and forefinger said surfaces have opposite depressions (801) for the positioning of said fingers.

17. Housing according to one or more of the preceding claims, **characterized in that** it comprises an acoustic window (2) provided on the head side of a pen type grip handle flattened part (601), which extends in the direction opposite to the acoustic window (2) with a spheroidal gripping handle (101) provided at the top opposite to the acoustic window of a gripping extension (301) to be held between the fingers.

18. Housing according to one or more of the preceding claims, **characterized in that** it is made of a first housing part (1A) and a second housing part (1B), which parts are harmonically completed one with the other and are separated along an intermediate separation plane (3) between a part shaped such to form at least a part of a pen type grip handle (601) and at least a part of a gripping handle shaped such to be held between the fingers.

19. Housing according to claim 18, **characterized in that** the first and second housing part (1A;1B) can be movably fastened one with the other.

20. Ultrasound probe comprising one or more electroacoustic transducers (5), that are connected to a communication cable, **characterized in that** said transducers (5)are housed in a space (4) of an housing (1) of said probe according to one or more of the preciding claims.

21. Ultrasound probe according to claim 20, **characterized in that** ergonomically shaped means (301) to be held between the fingers, i.e. in the hollow between two adjacent fingers of the hand are composed of a gripping extension to be held between the fingers.

22. Ultrasound probe according to claim 21, **characterized in that** the ergonomic housing for electroacoustic transducers, particularly for the ultrasound imaging, comprises at least an inner space (4) housing one or more electroacoustic transducers (5) and possible further eletric and/or electronic components (6/7),
which housing (1) has at least an acoustic window (2) at which the one or more electroacoustic transducers (5) are placed
and, at the end opposite to the one of the acustic window, at least an handle part (101) having a gripping and/or resting surface (201) that is rounded like a spherical or spheroidal cap or dome and that is ergonomically fitted for being gripped by an hand or a part thereof,

- the gripping and/or resting surface (201) is composed of an handle part like a spheric or spheroidal menber having a maximum outwardly projecting equatorial line beyond which said handle part (101) tapers connecting with a thinned handle part (601) having a pen type grip and ending by the end provided of the acoustic window (2), being the spheroidal handle part connected to the tapered handle part (601) having the pen type grip with two hollow recesses (701) at diametrically opposite sides and that in the gripping condition between the fingers condition, are a recess for gripping or housing the thumb of the hand, being said two opposite recesses (701) provided at the two side ends of the larger sides of the the pen type grip tapered handle part (601), while the two narrower sides of said the pen type grip tapered handle part are connected by a continuous flaring to the spheroidal handle part,
- the gripping and/or resting surface (201) extends in the direction opposite to the end provided with the acoustic window (2) by a gripping extension to be held between the fingers (301), said gripping extension (301) is connected to the gripping or resting surface (201) by at least two diametrically opposite recesses being shaped like a laid down U (401) for housing two adiacent fingers, being shaped such to be anatomically adapted to be engaged in the hollow between the fingers between two adjacent fingers of the hand, particularly between the fore-

finger and the middle finger or between the middle finger and the ring finger, such that it is possible to relatively firmly and securely grip the probe even if the hand is in its substantial resting and stretched position.

23. Housing according to one or more of the preceding claims 1 to 22, **characterized in that** the handle part and/or also the gripping extension to be held between the fingers are made of or are externally covered by a soft material.

Patentansprüche

1. Ergonomisches Gehäuse für einen elektroakustischen Wandler (5), insbesondere für die Ultraschallbilddarstellung, bestehend aus mindestens einem inneren Raum (4), einem Gehäuse (1), einem oder mehreren elektroakustischen Wandlern (5) und möglichen weiteren elektrischen und/oder elektronischen Komponenten (6, 7), wobei das Gehäuse (1) mindestens ein akustisches Fenster (2) aufweist, an dem der eine oder die mehreren elektroakustischen Wandler (5) angeordnet sind und an dem zu einem gegenüberliegenden Ende eines der akustischen Fenster (2) mindestens eine Bedieneinheit (101) vorgesehen ist, die eine Griff- und/oder Halteoberfläche (201) aufweist, die wie ein sphärischer oder sphäroidischer Deckel oder Dom ausgestaltet sind, der gerundet und der ergonomisch geformt ist, um diesen von einer Hand oder mit einem Teil von der Hand greifen zu können,

- wobei die Griff- und/oder Halteoberfläche (201) einen Handhabungsbereich aufweist, der wie ein sphärischer oder sphäroidischer Körper ausgestaltet ist, der eine maximale nach außen gerichtete äquatorische Ausdehnung aufweist, nach der sich der genannte Handhabungsbereich (101) verjüngt und mit einem verdünnten Handhabungsbereich (601) verbunden ist, der einen stiftähnlichen Griff aufweist und der bei dem Ende endet, das von dem akustischen Fenster (2) gebildet ist, wobei der sphäroidische Handhabungsbereich mit dem sich verjüngenden Handhabungsbereich (601) verbunden ist, der einen stiftähnlichen Griff und zwei gekrümmten Aussparungen (701) an den diametral gegenüberliegenden Seiten aufweist, und wobei im Griffzustand zwischen den Fingern eine Aussparung vorgesehen ist, um diese zu greifen oder den Daumen der Hand aufzunehmen, wobei die beiden gegenüberliegenden Aussparungen (701) zur Umfassung oder Aufnahme des Daumens der Hand dienen, wobei die beiden gegenüberliegenden Aussparungen (701) an den beiden Endseiten der größer bemessenen Seiten des stiftähnlichen Halters des sich verjüngenden Handhabungsbereiches (601) vorgesehen ist, wohingegen die beiden enger bemessenen Seiten des genannten stiftähnlichen Griffes des sich verjüngenden Handhabungsteils mittels einem kontinuierlichen Band mit dem sphäroidischen Handhabungsbereich verbunden sind,

dadurch gekennzeichnet,
dass die Griff- und/oder die Halteoberfläche (201) sich in Richtung gegenüberliegend zu dem Ende erstreckt, das von den akustischen Fenstern (2) gebildet ist, in dem eine Grifferweiterung vorgesehen ist, die zwischen den Fingern (301) angeformt ist, dass die genannte Grifferweiterung (301) mit der Griff- oder der Halteoberfläche (201) durch mindestens zwei diametral gegeriüberliegenden Aussparungen verbunden ist, die wie ein umgekehrtes U (401) geformt sind, um zwei benachbarte Finger aufzunehmen, dass die Aussparungen derart geformt sind, dass diese anatomisch angepasst sind, um zwischen den Raum zwischen den Fingern, insbesondere zwischen zwei benachbarten Fingern der Hand einzupassen, insbesondere zwischen dem Zeigefinger und dem Mittelfinger oder zwischen dem Mittelfinger und dem Ringfinger derart, dass es möglich ist, relativ fest und sicher die Sonde zu greifen, sogar wenn die Hand in ihrer im Wesentlichen Ruhestellung und ausgestreckten Position ist.

2. Gehäuse nach Anspruch 1,
dadurch gekennzeichnet,
dass die Griffervveiterung (301), die zwischen den Fingern zu halten ist, aus einem langgestreckten Körper, wie einer Stecknadel, einer Muffe, einem Gewindeanschluss, Röhre oder dergleichen, besteht, wobei der Körper eine gerundete Kontur, wie die genannte Griffervveiterung (301) aufweist und die anatomisch angepasst ist, um eine Verbindung zwischen dem Raum der Finger, insbesondere zwischen zwei benachbarten Fingern der Hand zu ermöglichen, insbesondere zwischen dem Vorfinger und dem Mittelfinger oder zwischen dem Mittelfinger und dem Ringfinger.

3. Gehäuse nach Anspruch 2,
dadurch gekennzeichnet,
dass die beiden Griffaussparungen (401) eine untere Wand aufweisen, die in die axiale Richtung der Griffeinrichtung (301) ausgerichtet ist und die zwei Seitenwände aufweist, die transversal oder senkrecht zu der Achse der Griffoberfläche (101) ausgerichtet ist, dass einer der genannten beiden Seitenoberflächen einen Bereich des Haltebereichs (201) der Griffoberfläche (101) aufweist und die andere Seitenwand in einer Entfernung angeordnet ist, die an die anatomischen Fingergrößen angepasst ist,

insbesondere zu Durchschnittsgrößen der Finger.

4. Gehäuse nach einem der Ansprüche 2 oder 3, **dadurch gekennzeichnet,** **dass** die Griffervveiterung (301), die zwischen den Fingern zu halten ist, eine ringförmige Aussparung oder eine ringförmige Höhlung (401) aufweist, die im Wesentlichen als umgekehrter U-förmiger Bereich gestaltet ist, dessen untere Oberfläche durch ein Hüllenband geformt ist, das sich von der axialen Oberfläche in eine gerundete Oberfläche erstreckt, die mit den beiden seitlichen Oberflächen verbunden ist, die durch Oberflächen gebildet sind, die transversal zu der Längsachse der Griffeerweiterung verlaufen und die mit der genannten unteren Oberfläche verbunden sind, dass möglicherweise lediglich eine oder beide in einer runden Art ausgestaltet sind, wohingegen einer der genannten beiden Seitenoberflächen der ringförmigen Aussparung (401) als kappen- oder domförmiger Haltekörper (201) ausgestalteten Griffoberfläche (101) ist und dass die andere Seitenoberfläche mit einer Oberfläche einer radialen ringförmigen Erweiterung (501) ausgestaltet ist, die einen bestimmten Abstand von dem genannten kappen- oder domförmigen Haltekörper (201) der Griffoberfläche (101) einnimmt.

5. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche, **dadurch gekennzeichnet,** **dass** die Grifferweiterung (301), die zwischen den Fingern zu halten ist, eine rotationssymmetrische Kontur aufweist.

6. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche, **dadurch gekennzeichnet,** **dass** die Grifferweiterung (301), die zwischen den Fingern zu halten ist, eine nicht kreisförmige Bereichskontur aufweist, die mit einer größeren Achse versehen ist, die im Wesentlichen in Richtung der Finger ausgerichtet ist, die diese greifen und/oder in der früheren - nachherigen Richtung der Hand ausgerichtet sind und/oder zu dem Hohlraum zwischen den Fingern ausgerichtet ist und mit einer kleineren Achse, die in die Richtung ausgerichtet ist, die transversal zu der Längsachse der Finger und/oder zu der früheren - nachherigen Richtung der Hand ausgerichtet sind.

7. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche, **dadurch gekennzeichnet,** **dass** die Griffeinrichtung (301), die zwischen den Fingern zu halten ist, eine Hülle aufweist, durch die ein elektrisches Kabel geführt ist, um den Wandler anzuschließen.

8. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche, **dadurch gekennzeichnet,** **dass** die Griffeinrichtung (301), die zwischen zwei Fingern zu halten ist, eine Längsachse aufweist, die fluchtend mit der Verlängerung eines Vektors liegt, der senkrecht zu einer Oberflächentangente bezüglich des Zentrums des akustischen Fensters (2) verläuft.

9. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche, **dadurch gekennzeichnet,** **dass** das akustische Fenster (2) aus einem flachen Teilbereich besteht.

10. Gehäuse nach einem oder mehreren der Ansprüche 1 bis 8, **dadurch gekennzeichnet,** **dass** das akustische Fenster (2) einen gekrümmten Bereich aufweist gemäß einer einzigen Achse der Krümmung oder gemäß zwei oder mehr Achsen der Krümmung, wobei die Krümmung gegenüberliegend zu dem einen Ruhedom oder Kappe (201) der Griffoberfläche (101) angeordnet ist.

11. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche, **dadurch gekennzeichnet,** **dass** an einem Zwischenbereich des Gehäuses zwischen der Griffoberfläche (10) und dem akustischen Fenster (2) das Gehäuse zwei gegenüberliegende Aussparungen (701) aufweist, die eine abgerundete Teilkontur aufweisen.

12. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche, **dadurch gekennzeichnet,** **dass** der Handhabungsbereich des Gehäuses (1), der die Griffoberfläche (10) bildet, aus einem sphäroidischen Körper gebildet ist, der an zwei diametral gegenüberliegenden Seiten derart abgeflacht ist, dass zwei verschiedene Durchmesser in der Ebene entstehen, zumindest in der äquatorialen Ebene, und dass einer dieser Durchmesser größer und der andere der Durchmesser kleiner in der Ebene ist, dass die beiden gegenüberliegenden seitlichen Aussparungen (701), die in dem Zwischenbereich des Gehäuses vorgesehen sind, einen Hohlraum aufweisen, der sich in Richtung der genannten größeren Achse erstreckt, derart, dass die sphäroidische Griffoberfläche (101) durch Zusammendrücken der Finger der Hand fest umgreifbar ist, zusätzlich zu der Halterung zwischen den Fingern der Grifferweiterung (301), die zwischen den Fingern zu halten ist, dass die Finger der Hand benachbart zu der genannten sphäroidischen Griffoberfläche über die äquatoriale Linie abstehen.

13. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche,
dadurch gekennzeichnet,
dass es zwei verschiedene Dicken aufweist, in die Richtung zu den beiden Achsen, die senkrecht bezüglich der anderen stehen und in der Ebene verlaufen, die senkrecht zu der Achse der Grifferweiterung (301) ausgerichtet ist, die zwischen den Fingern zu halten ist.

14. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche,
dadurch gekennzeichnet,
dass es derart ausgestaltet ist, um das Greifen mit der Hand in der Form wie ein stiftähnlicher Griff ermöglicht ist.

15. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche,
dadurch gekennzeichnet,
dass in dem Teilbereich zwischen der sphäroidischen Griffoberfläche (101) und dem akustischen Fenster (2) das Gehäuse einen abgeflachten Teilbereich (601) aufweist, dessen Dicke im Wesentlichen mit der Größe eines Stiftes oder eines dicken Stiftes korrespondiert, wobei jedoch es eine derartige Dicke aufweist, die geeignet ist von einer handähnlichen Stifthalterung umfasst zu werden.

16. Gehäuse nach Anspruch 15,
dadurch gekennzeichnet,
dass in den zwei gegenüberliegenden Stirnflächen des genannten stiftähnlichen Griffhandhabungsabgeflachtenbereich (601) und auf der anderen Seite der beiden gegenüberliegenden Finger, z.B. Daumen und Zeigefinger, die genannten Oberflächen gegenüberliegenden Vertiefungen (801) für die Positionierung für die genannten Finger aufweisen.

17. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche,
dadurch gekennzeichnet,
dass es ein akustisches Fenster (2) aufweist, dass auf der Kopfseite eines stiftähnlichen Griffhandhabungsabgeflachtenbereich (601) vorgesehen ist, dass in die Richtung gegenüberliegend zu dem akustischen Fenster (2) mit einer sphäroidischen Griffhalterung (101) ausgestattet ist, angeordnet ist, wobei dieses an der Spitze zu dem akustischen Fenster (2) der Grifferweiterung (301) vorgesehen ist, die zwischen den Fingern zu halten ist.

18. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche,
dadurch gekennzeichnet,
dass es aus einem ersten Gehäuseteil (1a) und aus einem zweiten Gehäuseteil (1 b) hergestellt ist, dass die Teile harmonisch zusammenfügbar sind und die vereinzelbar sind entlang einer Zwischentrennebene (3) zwischen einem derart geformten Teil, das zumindest ein Teil den stiftähnlichen Griffhalter (601) umfasst und zumindest zu einem Teil eines Griffhalters geformt ist derart, dass dieses zwischen den Fingern gehalten werden kann.

19. Gehäuse nach Anspruch 18,
dadurch gekennzeichnet,
dass das erste und zweite Gehäuseteil (1a, 1 b) lösbar miteinander verbunden werden können.

20. Ultraschallsonde mit einem oder mehreren elektroakustischen Wandler (5), die an einem Kommunikationskabel angeschlossen sind,
dadurch gekennzeichnet,
dass die genannten Wandler (5) in einem Raum eines Gehäuses (1) der genannten Sonde gemäß einem oder mehreren der vorgenannten Ansprüche angeordnet sind.

21. Ultraschallsonde nach Anspruch 20,
dadurch gekennzeichnet,
dass ergonomisch geformte Mittel (301), die zwischen den Fingern, z.B. in einem Hohlraum zwischen zwei benachbarten Fingern einer Hand vorgesehen sind, die greifbar sind, und aus einer Grifferweiterung bestehen, die zwischen den Fingern zu halten ist.

22. Ultraschallsonde nach Anspruch 21,
dadurch gekennzeichnet,

- **dass**, das ergonomische Gehäuse für die elektroakustischen Wandler, insbesondere für die Ultraschallbildwiedergabe, mindestens einen inneren Raum (4) des Gehäuses, einen oder mehrere elektroakustische Wandler (5) und mögliche weitere elektrische und/oder elektrotechnische Komponenten (6, 7) aufweist,
- **dass** das Gehäuse (1) mindestens ein akustisches Fenster (2) aufweist, an dem eine oder mehrere elektroakustische Wandler (5) angebracht sind und an dem gegenüberliegenden Ende des akustischen Fensters mindestens ein Griffteil (101) vorgesehen ist, das einen Griff- und/oder eine Halteoberfläche (201) aufweist, die gerundet wie eine sphärische oder sphäroidische Kappe oder Dom geformt ist und die ergonomisch derart angepasst ist, dass diese von einer Hand oder einem Teil einer Hand umfassbar ist,
- **dass** die Griff- und/oder Halteoberfläche (201) aus einem Griffteil besteht, der wie ein sphärischer oder sphäroidischer Körper ausgestaltet ist, der eine axiale nach außen abstehende Äquatoriallinie aufweist, über die der genannte Griffteil (101) sich verjürigend verbunden ist mit

einem verdünnten Griffbereich (601), der einen stiftähnliche Greiff- und Haltekörper im Endbereich aufweist, das von dem akustischen Fenster (2) gebildet ist,

- **dass** das sphäroidische Griffteil, das mit dem sich verjüngenden Griffteil (601) verbunden ist, den stiftähnlichen Griff mit zwei hohlen Aussparungen (701) aufweist und zwar mit diametral gegenüberliegenden Seiten und dass in dem Greifzustand zwischen den Fingern eine Aussparung zum Einsetzen oder Aufnehmen des Daumens der Hand vorgesehen ist, dass die beiden gegenüberliegenden Aussparungen (701) an den beiden Endseiten der größeren Seiten des stiftähnlichen sich verjüngenden Griffhaltebereichs (601) vorgesehen sind, wohingegen die beiden engeren Seiten des genannten stiftähnlichen sich verjüngenden Griffhaltebereichs verbunden sind mit einem durchgehenden sich bis zu dem sphäroidische Handhabungsbereich erweiterten Körper,
- **dass** sich die Greif- und/oder Halteoberfläche (201) in Richtung gegenüberliegend zu dem Ende, das von dem akustischen Fenster (2) gebildet ist, durch eine Greifervveiterung erstreckt, die zwischen den Fingern (301) zu halten ist, dass die genannte Greiferweiterung (301 mit der Greif- oder Halteoberfläche (201) durch mindestens zwei diametral gegenüberliegende Aussparungen verbunden ist, die wie ein umgekehrtes U (401) geformt sind, um zwei benachbarte Finger aufzunehmen und die derart anatomisch geformt sind, dass diese angepasst sind, um den Zwischenraum zwischen zwei Fingern aufzunehmen, der zwischen zwei benachbarten Fingern der Hand vorhanden ist, insbesondere zwischen dem Zeigefinger und dem Mittelfinger oder zwischen dem Mittelfinger und dem Ringfinger derart, dass es möglich ist, die Sonde relativ fest und sicher zu greifen, sogar wenn die Hand im Wesentlichen in einer Ruhestellung und ausgestreckter Position ist.

23. Gehäuse nach einem oder mehreren der vorgenannten Ansprüche 1 bis 22,
dadurch gekennzeichnet,
dass der Handhabungsbereich und/oder auch die Grifferweiterung, die zwischen den Fingern zu halten ist, aus einem weichen Material oder aus einem weichen Überzugsmaterial hergestellt ist.

Revendications

1. Boîtier ergonomique pour transducteurs électro-acoustiques, en particulier pour l'imagerie par ultrasons, comprenant au moins un espace intérieur (4) logeant un ou plusieurs transducteurs électro-acoustiques (5) et d'éventuels autres composants électriques et/ou électroniques (6/7),
lequel boîtier (1) comporte au moins une fenêtre acoustique (2) à l'endroit de laquelle le ou les transducteurs électro-acoustiques (5) sont placés
et, à l'extrémité opposée à celle de la fenêtre acoustique, au moins une partie de manipulation (101) présentant une surface de préhension et/ou de repos (201) qui est arrondie, en forme de couvercle ou de dôme sphérique ou sphéroïdal, et qui est adaptée d'une manière ergonomique pour être saisie à l'aide d'une main ou d'une partie de celle-ci,

- la surface de préhension et/ou de repos (201) est constituée d'une partie de manipulation en forme d'élément sphérique ou sphéroïdal présentant une ligne équatoriale faisant saillie vers l'extérieur au maximum, au-delà de laquelle ladite partie de manipulation (101) converge en se raccordant à une partie de manipulation amincie (601) offrant une préhension du type stylo et se terminant par l'extrémité pourvue de la fenêtre acoustique (2), la partie de manipulation sphéroïdale étant raccordée à la partie de manipulation convergente (601) offrant la préhension du type stylo par deux évidements creux (701) situés sur des côtés diamétralement opposés et qui, dans la position de préhension, position entre les doigts, forment un évidement pour une préhension ou une réception du pouce de la main, lesdits deux évidements (701) opposés étant prévus aux deux extrémités latérales des plus grands côtés de la partie de manipulation convergente (601) à préhension du type stylo, tandis que les deux côtés plus étroits de ladite partie de manipulation convergente à préhension du type stylo sont raccordés par un évasement continu à la partie de manipulation sphéroïdale, **caractérisé en ce que**
- la surface de préhension et/ou de repos (201) s'étend dans la direction opposée à l'extrémité pourvue de la fenêtre acoustique (2) par un prolongement de préhension (301) à maintenir entre les doigts, ledit prolongement de préhension (301) est raccordé à la surface de préhension ou de repos (201) par au moins deux évidements (401) diamétralement opposés ayant une forme de U couché pour recevoir deux doigts adjacents, avec une conformation permettant une adaptation anatomique pour un engagement dans le creux entre les doigts, entre deux doigts adjacents de la main, en particulier entre l'index et le majeur ou entre le majeur et l'annulaire, de façon qu'il soit possible de saisir la sonde d'une manière relativement ferme et sure même si la main est dans sa position sensiblement de repos et en extension.

2. Boîtier suivant la revendication 1, **caractérisé en ce que** le prolongement de préhension (301) à maintenir entre les doigts est constitué d'un élément allongé en forme de tige, de manchon, de douille, de tube ou analogue, ayant une forme arrondie de façon telle que ledit prolongement de préhension (301) est adapté d'une manière anatomique pour l'engagement dans l'espace entre les doigts, entre deux doigts adjacents de la main, en particulier entre l'index et le majeur ou entre le majeur et l'annulaire.

3. Boîtier suivant la revendication 2, **caractérisé en ce que** les deux évidements de préhension (401) ont une paroi de fond qui est orientée suivant la direction axiale du prolongement de préhension (301) et deux parois latérales transversales ou perpendiculaires à l'axe de la surface de préhension (101), l'une desdites deux surfaces latérales étant constituée d'une zone de la partie de repos (201) de la surface de préhension (101) et l'autre paroi latérale étant prévue à une distance adaptée d'une manière anatomique à des tailles de doigts, en particulier à des tailles moyennes de doigts.

4. Boîtier suivant l'une des revendications 2 ou 3, **caractérisé en ce que** le prolongement de préhension (301) à maintenir entre les doigts comporte un évidement annulaire ou une gorge annulaire (401) ayant sensiblement une section en forme de U couché, dont une surface de fond est formée par une bande de surface axiale de douille raccordée d'une manière arrondie aux deux surfaces latérales qui sont formées par des surfaces transversales à l'axe longitudinal du prolongement et raccordées à ladite surface de fond, éventuellement seulement une seule ou les deux d'une manière arrondie, tandis que l'une desdites deux surfaces latérales de l'évidement annulaire (401) est constituée de la partie de repos (201) en forme de couvercle ou de dôme de la surface de préhension (101) et l'autre surface latérale est constituée de la surface d'un élargissement annulaire radial (501) prévu à une certaine distance de ladite partie de repos (201) en forme de couvercle ou de dôme de la surface de préhension (101).

5. Boîtier suivant une ou plusieurs des revendications précédentes, **caractérisé en ce que** le prolongement de préhension (301) à maintenir entre les doigts offre une forme à symétrie de révolution.

6. Boîtier suivant une ou plusieurs des revendications précédentes, **caractérisé en ce que** le prolongement de préhension (301) à maintenir entre les doigts offre une forme à section non circulaire, avec un plus grand axe sensiblement orienté suivant la direction de doigts le saisissant et/ou suivant la direction antéro-postérieure de la main et/ou du creux entre doigts et avec un plus petit axe orienté suivant la direction transversale à l'axe longitudinal de doigts et/ou à la direction antéro-postérieure de la main.

7. Boîtier suivant une ou plusieurs des revendications précédentes, **caractérisé en ce que** le prolongement de préhension (301) à maintenir entre les doigts constitue un manchon pour l'introduction d'un câble électrique servant à la connexion du transducteur

8. Boîtier suivant une ou plusieurs des revendications précédentes, **caractérisé en ce que** le prolongement de préhension (301) à maintenir entre les doigts présente un axe longitudinal qui coïncide avec le prolongement d'un vecteur perpendiculaire à une surface tangentielle à la ligne centrale de la fenêtre acoustique (2).

9. Boîtier suivant une ou plusieurs des revendications précédentes, **caractérisé en ce que** la fenêtre acoustique (2) est constituée d'une pièce plate.

10. Boîtier suivant une ou plusieurs des revendications 1 à 8 précédentes, **caractérisé en ce que** la fenêtre acoustique (2) présente un agencement courbe suivant un axe unique de courbure ou suivant deux axes de courbure ou plus, la courbure étant opposée à celle du dôme ou couvercle de la partie de repos (201) de la surface de préhension (101).

11. Boîtier suivant une ou plusieurs des revendications précédentes, **caractérisé en ce que**, à l'endroit d'une zone intermédiaire du boîtier située entre la surface de préhension (101) et la fenêtre acoustique (2), le boîtier présente deux évidements (701) opposés offrant une forme à section arrondie.

12. Boîtier suivant une ou plusieurs des revendications précédentes, **caractérisé en ce que** la partie de manipulation du boîtier (1) formant la surface de préhension (101) est constituée d'un corps sphéroïdal aplati sur deux côtés diamétralement opposés, de façon à présenter deux diamètres différents au moins dans le plan équatorial et dont l'un est un plus grand diamètre et l'autre est un plus petit diamètre dans le plan, les deux évidements latéraux opposés (701) prévus à l'endroit de la zone intermédiaire du boîtier étant réalisés en creux suivant la direction dudit plus grand axe, de façon telle que la surface de préhension (101) sphéroïdale est saisie en étant serrée par des doigts de la main en plus de maintenir entre les doigts le prolongement de préhension (301) à maintenir entre des doigts, des doigts de la main étant au contact de ladite surface de préhension sphéroïdale au-delà de la ligne équatoriale de celle-ci.

13. Boîtier suivant une ou plusieurs des revendications précédentes, **caractérisé en ce qu'**il présente deux épaisseurs différentes suivant la direction de chacun des deux axes perpendiculaires l' un vis-à-vis de l'autre et contenus dans le plan perpendiculaire à l'axe du prolongement de préhension (301) à maintenir entre les doigts.

14. Boîtier suivant une ou plusieurs des revendications précédentes, **caractérisé en ce qu'**il est conformé de façon à permettre la préhension à l'aide de la main dans la position analogue à une préhension du type stylo.

15. Boîtier suivant une ou plusieurs des revendications précédentes, **caractérisé en ce que**, dans la partie de celui-ci située entre la surface de préhension (101) sphéroïdale et la fenêtre acoustique (2), le boîtier comporte une partie aplatie (601) dont l'épaisseur correspond sensiblement à la taille d'un stylo ou à celle d'un stylo épais et cependant il présente une épaisseur lui permettant d'être saisi à l'aide de la main à la façon d'un stylo.

16. Boîtier suivant la revendication 15, **caractérisé en ce que**, dans les deux faces opposées de ladite partie aplatie de manipulation (601) à préhension du type stylo et à l'extrémité des deux doigts opposés, par exemple le pouce et l'index, lesdites surfaces comportent des parties en retrait (801) opposées pour le positionnement desdits doigts.

17. Boîtier suivant une ou plusieurs des revendications précédentes, **caractérisé en ce qu'**il comprend une fenêtre acoustique (2) prévue sur le côté frontal d'une partie aplatie de manipulation (601) à préhension du type stylo, lequel s'étend dans la direction opposée à la fenêtre acoustique (2) par une partie de manipulation par préhension (101) sphéroïdale prévue au sommet opposé à la fenêtre acoustique d'un prolongement de préhension (301) à maintenir entre les doigts.

18. Boîtier suivant une ou plusieurs des revendications précédentes, **caractérisé en ce qu'**il est constitué d'une première partie de boîtier (1A) et d'une seconde partie de boîtier (1B), lesquelles parties se complètent entre elles d'une manière harmonieuse et sont séparées le long d'un plan de séparation intermédiaire (3) entre une partie conformée de façon à former au moins une partie d'une partie de manipulation (601) à préhension du type stylo et au moins une partie d'une partie de manipulation par préhension conformée de façon à être maintenue entre les doigts.

19. Boîtier suivant la revendication 18, **caractérisé en ce que** la première et la seconde parties de boîtier (1A ; 1B) peuvent être rendues solidaires l'une de l'autre d'une manière amovible.

20. Sonde à ultrasons comprenant un ou plusieurs transducteurs électro-acoustiques (5), qui sont connectés à un câble de communication, **caractérisée en ce que** lesdits transducteurs (5) sont logés dans un espace (4) d'un boîtier (1) de la dite sonde conforme à une ou plusieurs des revendications précédentes.

21. Sonde à ultrasons suivant la revendication 20, **caractérisée en ce que** des moyens (301) conformés d'une manière ergonomique à maintenir entre les doigts, à savoir dans le creux entre deux doigts adjacents de la main, sont constitués d'un prolongement de préhension à maintenir entre les doigts.

22. Sonde à ultrasons suivant la revendication 21, **caractérisée en ce que** le boîtier ergonomique pour transducteurs électro-acoustiques, en particulier pour l'imagerie par ultrasons, comprend au moins un espace intérieur (4) logeant un ou plusieurs transducteurs électro-acoustiques (5) et d'éventuels autres composants électriques et/ou électroniques (6/7),
lequel boîtier (1) comporte au moins une fenêtre acoustique (2) à l'endroit de laquelle le ou les transducteurs électro-acoustiques (5) sont placés
et, à l'extrémité opposée à celle de la fenêtre acoustique, au moins une partie de manipulation (101) présentant une surface de préhension et/ou de repos (201) qui est arrondie, en forme de couvercle ou de dôme sphérique ou sphéroïdal, et qui est adaptée d'une manière ergonomique pour être saisie à l'aide d'une main ou d'une partie de celle-ci,

- la surface de préhension et/ou de repos (201) est constituée d'une partie de manipulation en forme d'élément sphérique ou sphéroïdal présentant une ligne équatoriale faisant saillie vers l'extérieur au maximum, au-delà de laquelle ladite partie de manipulation (101) converge en se raccordant à une partie de manipulation amincie (601) offrant une préhension du type stylo et se terminant par l'extrémité pourvue de la fenêtre acoustique (2), la partie de manipulation sphéroïdale étant raccordée à la partie de manipulation convergente (601) offrant la préhension du type stylo par deux évidements creux (701) situés sur des côtés diamétralement opposés et qui, dans la position de préhension, position entre les doigts, forment un évidement pour une préhension ou une réception du pouce de la main, lesdits deux évidements (701) opposés étant prévus aux deux extrémités latérales des plus grands côtés de la partie de manipulation convergente (601) à préhension du type stylo, tandis que les deux côtés plus étroits

de ladite partie de manipulation convergente à préhension du type stylo sont raccordés par un évasement continu à la partie de manipulation sphéroïdale,

- la surface de préhension et/ou de repos (201) s'étend dans la direction opposée à l'extrémité pourvue de la fenêtre acoustique (2) par un prolongement de préhension (301) à maintenir entre les doigts, ledit prolongement de préhension (301) est raccordé à la surface de préhension ou de repos (201) par au moins deux évidements (401) diamétralement opposés ayant une forme de U couché pour recevoir deux doigts adjacents, avec une conformation permettant une adaptation anatomique pour un engagement dans le creux entre les doigts, entre deux doigts adjacents de la main, en particulier entre l'index et le majeur ou entre le majeur et l'annulaire, de façon qu'il soit possible de saisir la sonde d'une manière relativement ferme et sure même si la main est dans sa position sensiblement de repos et en extension.

23. Boîtier suivant une ou plusieurs des revendications 1 à 22 précédentes, **caractérisé en ce que** la partie de manipulation et/ou également le prolongement de préhension à maintenir entre les doigts sont réalisés en une matière souple ou sont recouverts extérieurement d'une telle matière souple.

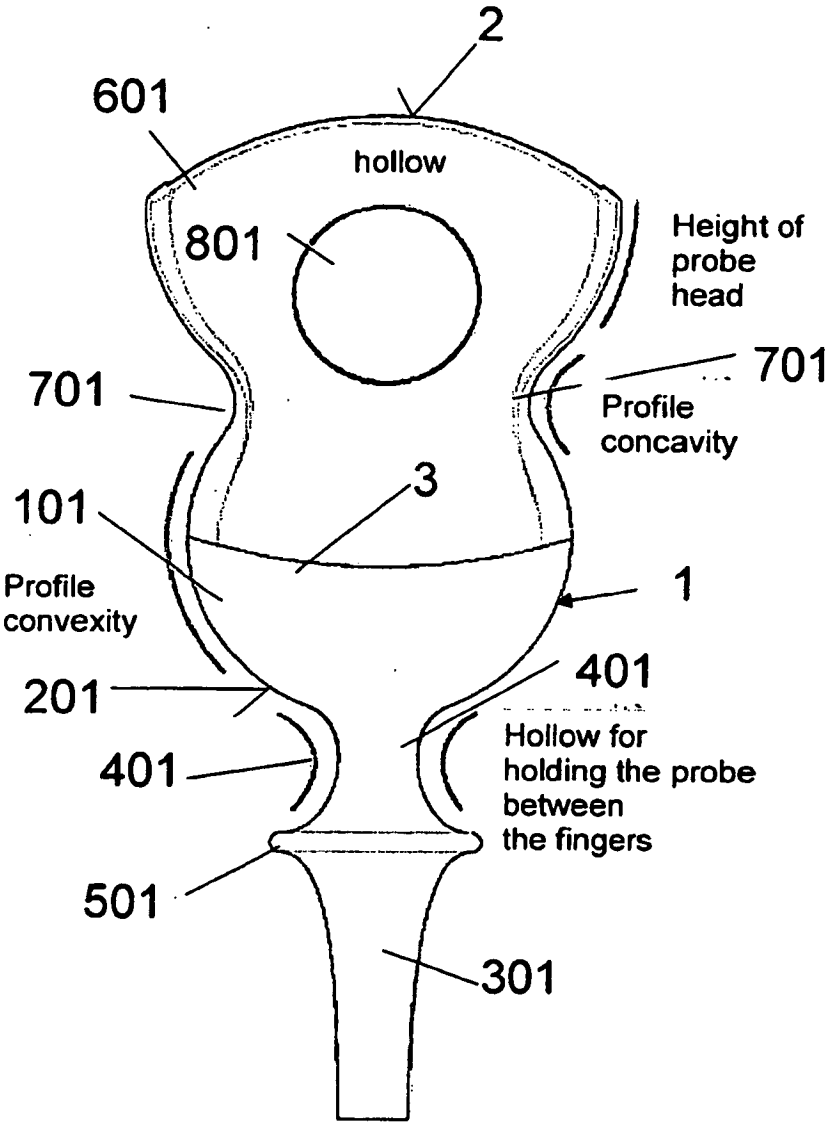

2
601
hollow
801
Height of probe head
701
701
Profile concavity
3
101
Profile convexity
1
401
201
401
Hollow for holding the probe between the fingers
501
301

Fig. 1

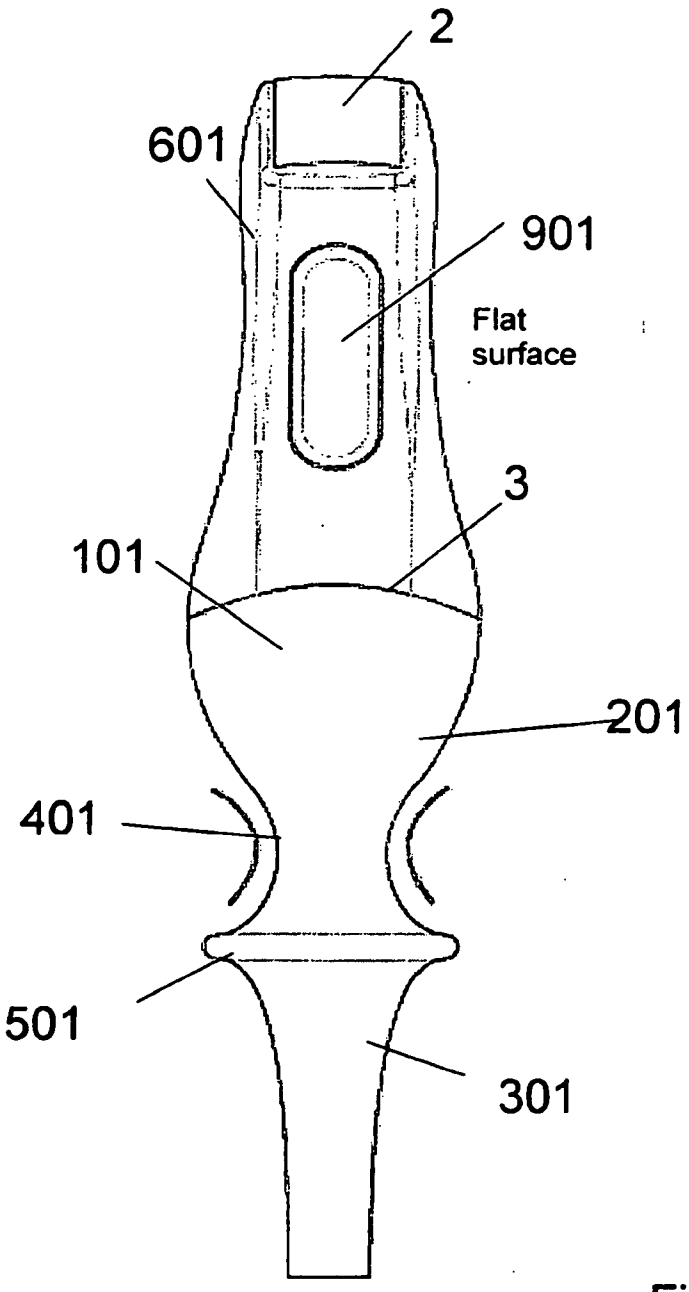


Fig. 2

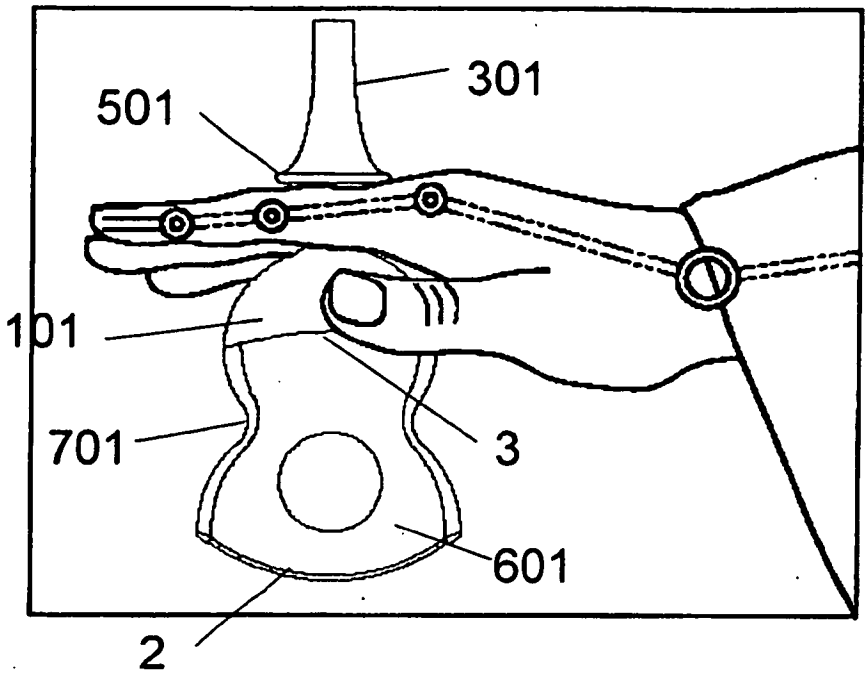


Fig. 3

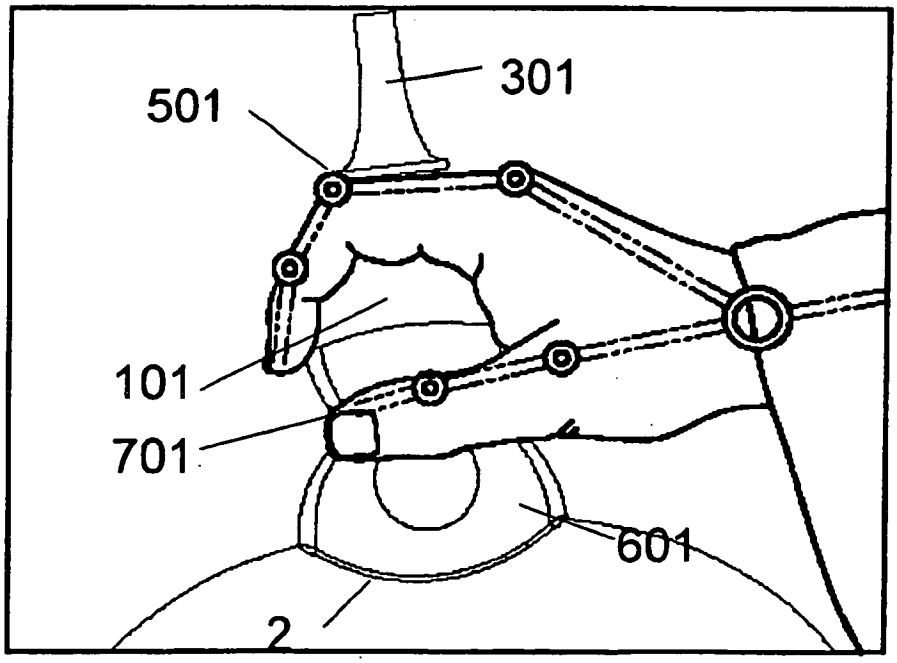


Fig. 4

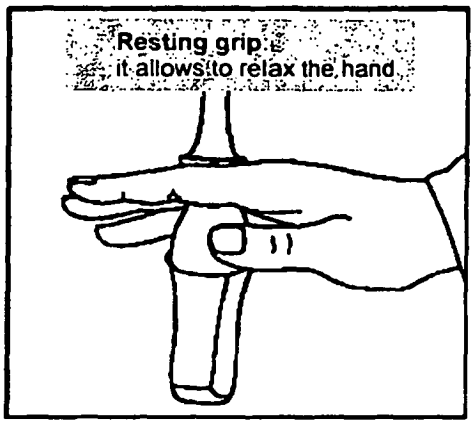


Fig. 5A

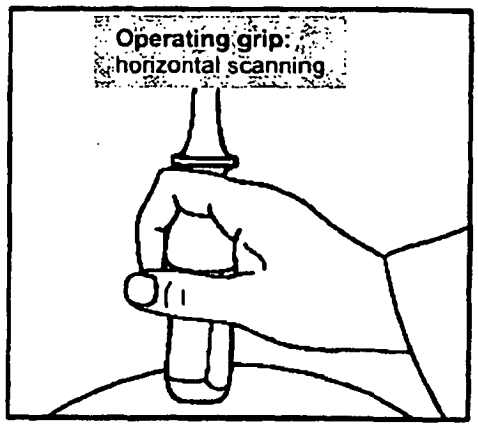


Fig. 5B

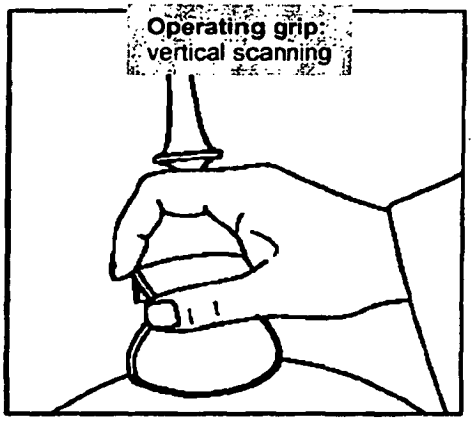


Fig. 5C

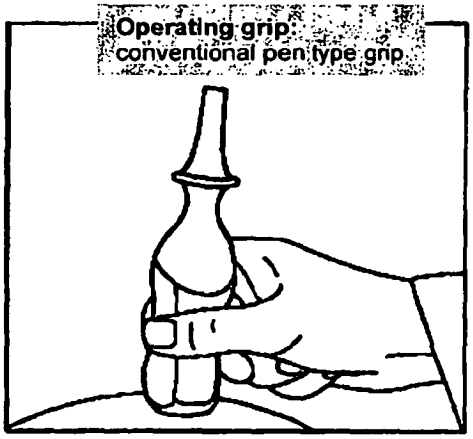


Fig. 5D

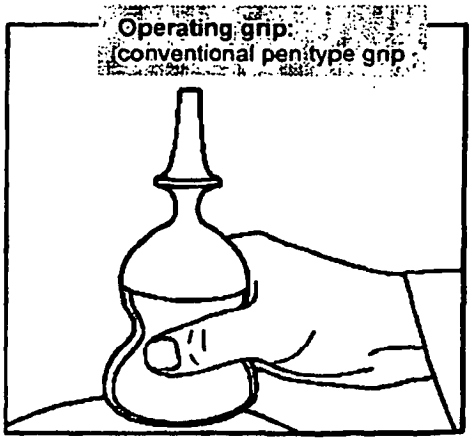


Fig. 5E

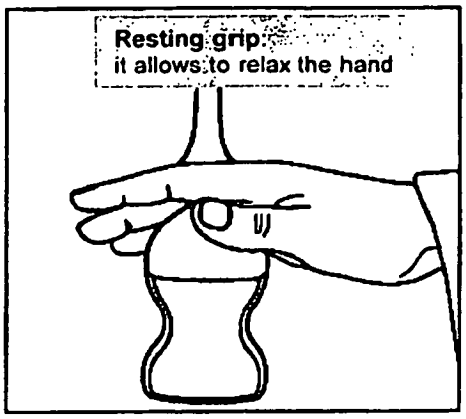


Fig. 6A

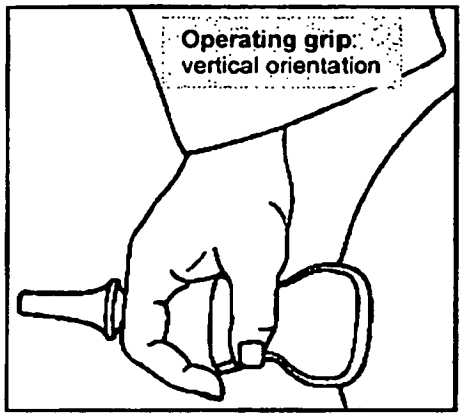


Fig. 6B

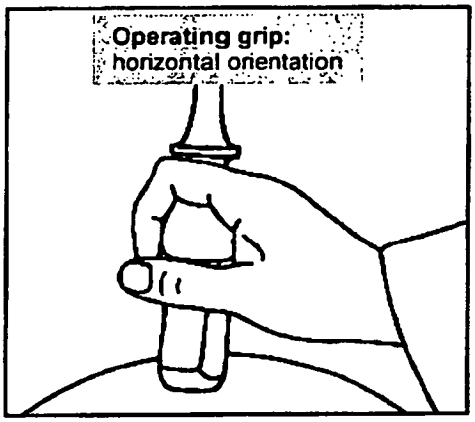


Fig. 6C

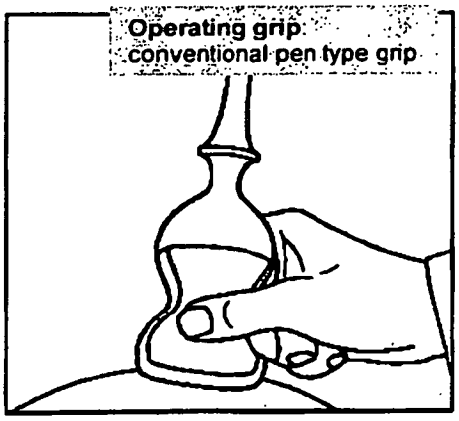


Fig. 6D

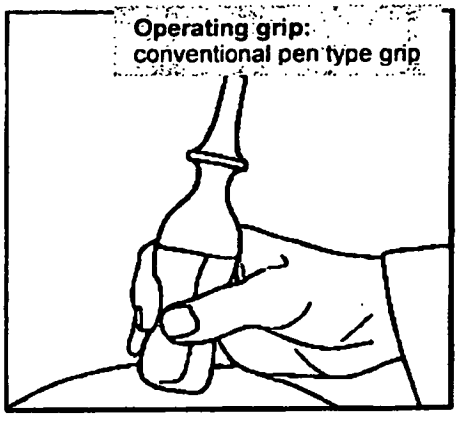
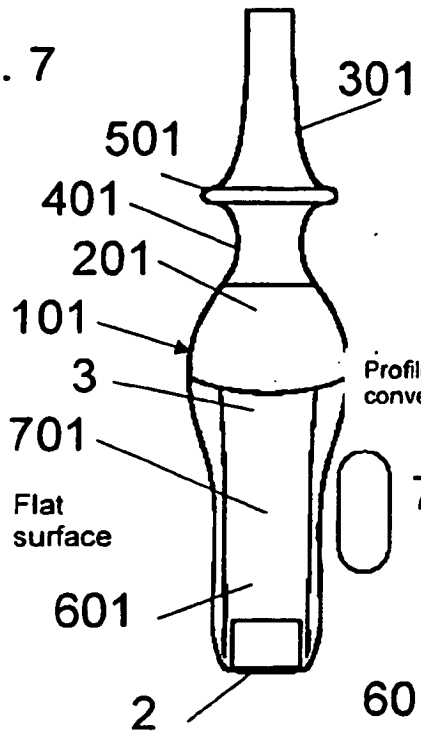


Fig. 6E

Fig. 7



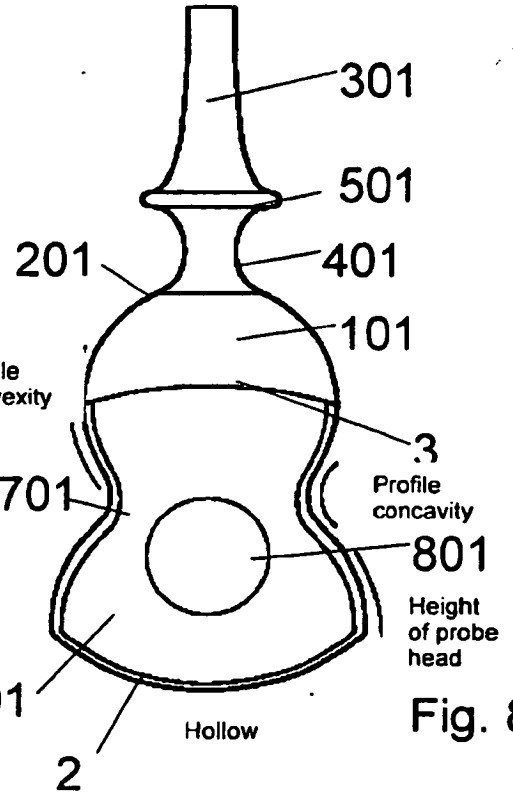


Fig. 8

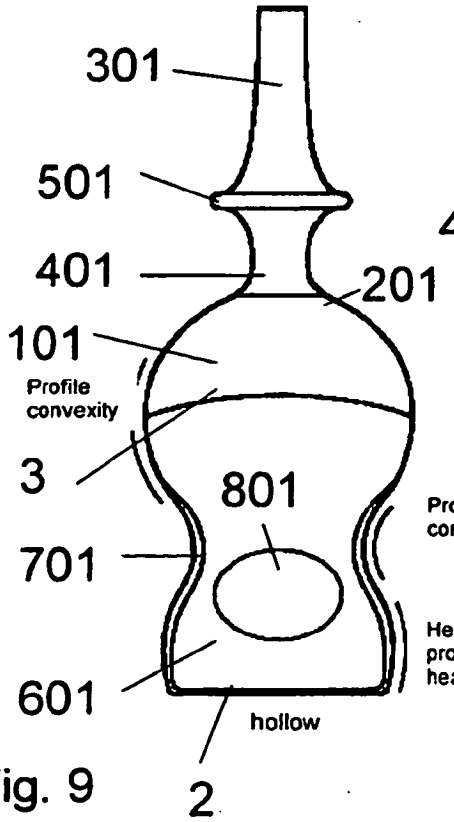


Fig. 9

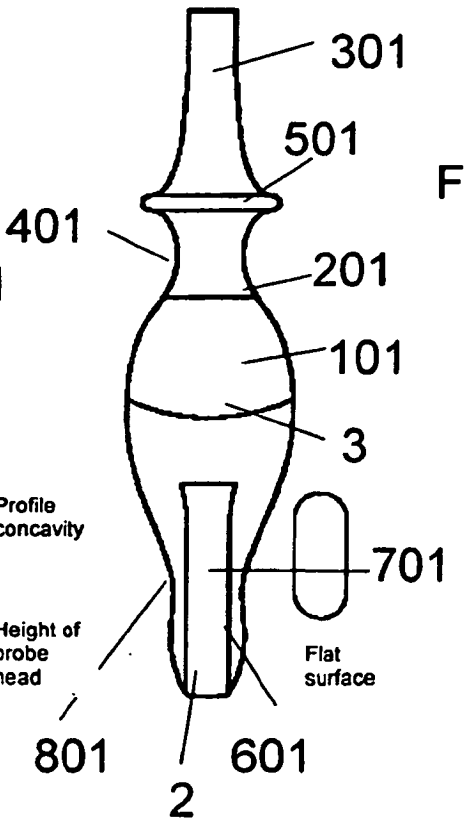


Fig. 10

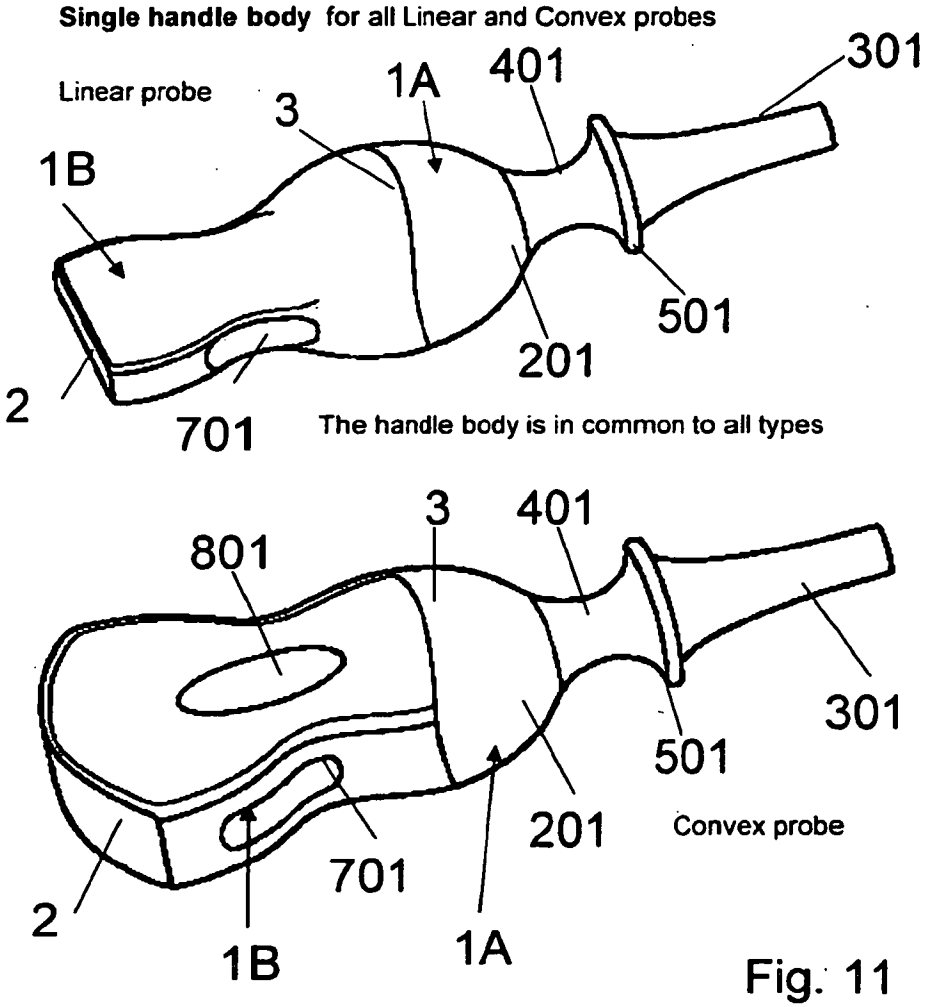

Single handle body for all Linear and Convex probes
Linear probe
3
1A
401
301
1B
501
201
2
701
The handle body is in common to all types
3
401
801
301
501
201
Convex probe
701
2
1B
1A

Fig. 11

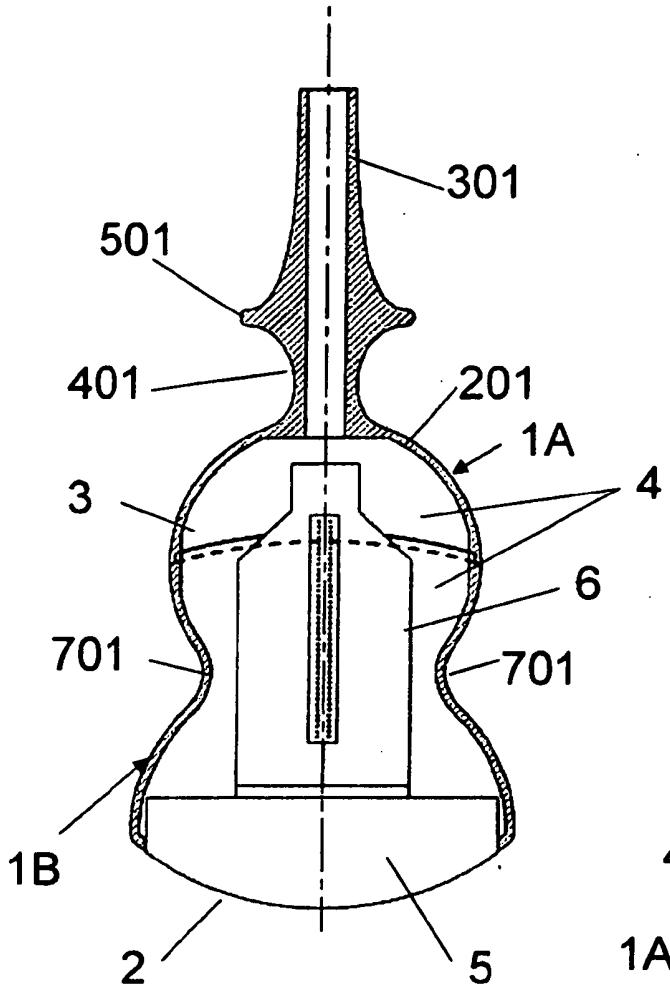

301
501
401
201
1A
3
4
6
701
701
1B
2
5

Fig. 12

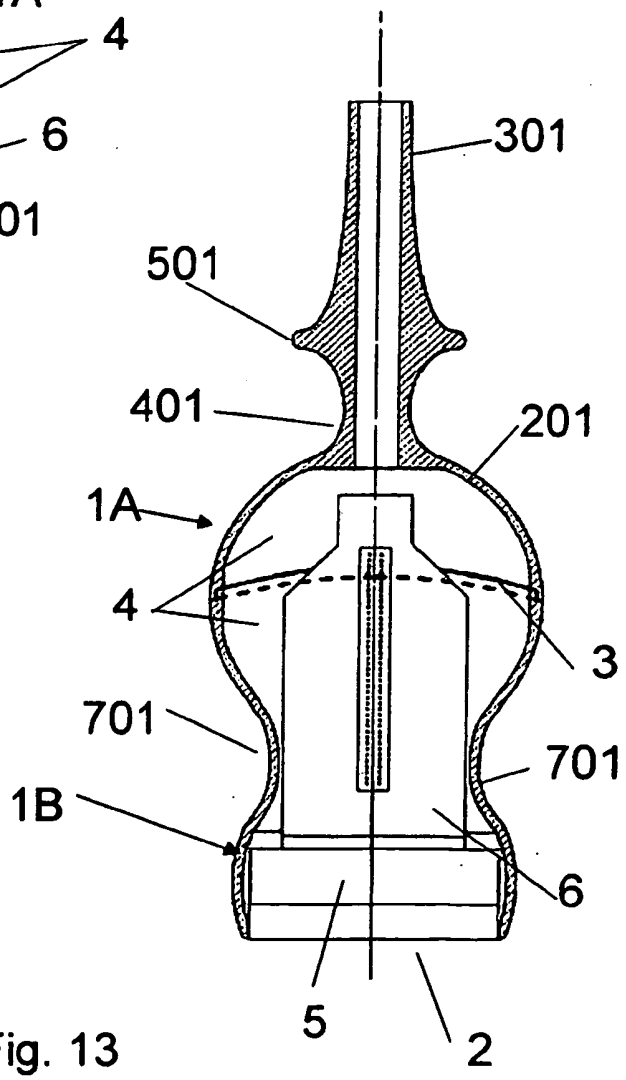

301
501
401
201
1A
4
3
701
701
1B
6
5
2

Fig. 13

REFERENCES CITED IN THE DESCRIPTION

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- US 4898177 A **[0016]**

专利名称(译)	用于电声换能器的人体工学外壳和具有所述外壳的超声探头		
公开(公告)号	EP1935343B1	公开(公告)日	2011-10-26
申请号	EP2006425843	申请日	2006-12-18
[标]申请(专利权)人(译)	百胜集团		
申请(专利权)人(译)	ESAOTE S.P.A.		
当前申请(专利权)人(译)	ESAOTE S.P.A.		
[标]发明人	FURIA ROBERTO REZZONICO FABIO		
发明人	FURIA, ROBERTO REZZONICO, FABIO		
IPC分类号	A61B8/00		
CPC分类号	A61B8/00 A61B8/4411 A61B8/4455		
其他公开文献	EP1935343A1		
外部链接	Espacenet		

摘要(译)

用于电声换能器的人体工学外壳，特别是用于超声成像，包括至少一个内部空间（4），其容纳一个或多个电声换能器（5）和可能的其他电子和/或电子部件（6/7），该外壳（1）具有至少一个声窗（2），一个或多个电声换能器（5）放置在该声窗上，并且至少一个把手部分（101）由相对的夹持表面构成，该夹持表面具有符合人体工程学的形状，以便用手抓握或者本发明的一部分，其特征在于，抓握表面具有这样的形状或轮廓（301），其符合人体工程学以便通过将其插入手的两个相邻手指之间的空腔中，即通过将其保持在手指之间而被抓握。本发明还涉及一种具有所述类型的壳体的探头和一种与所述探头组合的超声波机器。

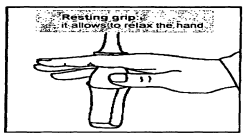

Fig. 5A

Fig. 5B

Fig. 5C

Fig. 5D

Fig. 5E