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(54) **ACOUSTIC HEADSET**

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H04R 25/00 (2006.01)

(52) **U.S. Cl.**
USPC **381/151**; 381/378; 381/380

(58) **Field of Classification Search**
USPC 381/326, 151, 370–372, 375–380
See application file for complete search history.

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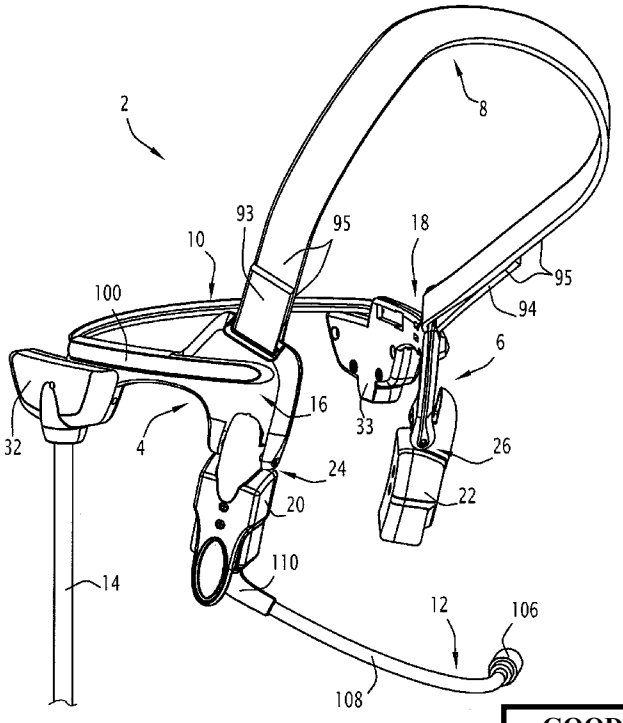
(57) **ABSTRACT**

This acoustic headset (**2**) comprises:
- two lateral acoustic modules (**4**, **6**) comprising a mechanical bone excitation transducer (**20**, **22**) which is capable of transmitting the sound signal to the auditory nerve by bone conduction,
- a flexible upper curved member (**8**) and a rigid rear curved member (**10**) for connecting the acoustic modules (**4**, **6**).

Each acoustic module (**4**, **6**) comprises:
- a plate (**16**, **18**) for lateral abutment against the sides of the skull,
- an articulation (**24**, **26**) between the abutment plate (**16**, **18**) and the transducer (**20**, **22**),
- a spring for return movement, in terms of rotation about the axis of articulation (**24**, **26**), of the transducer (**20**, **22**) relative to the plate (**16**, **18**) towards a rest position.

10 Claims, 4 Drawing Sheets



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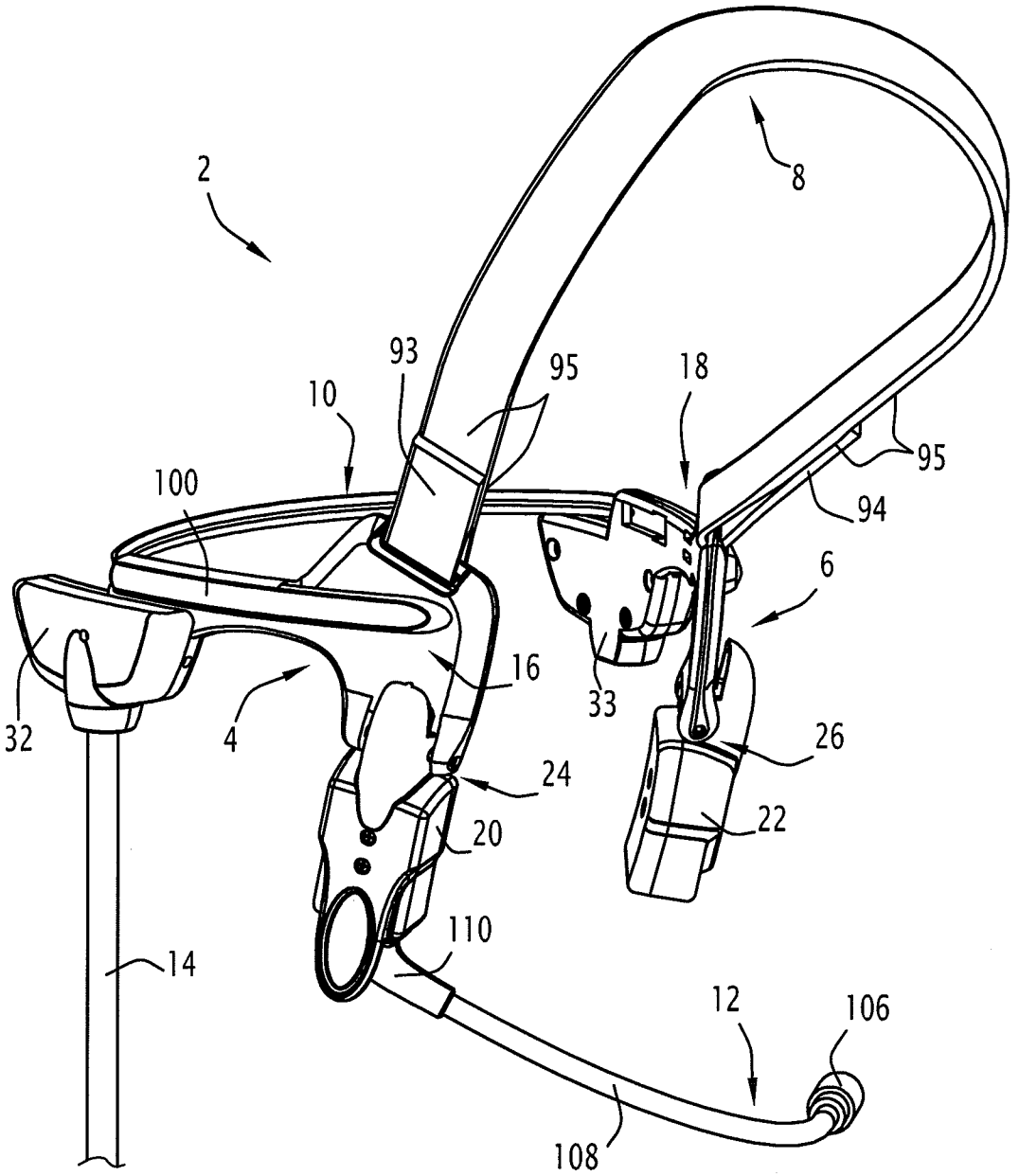

FIG.1

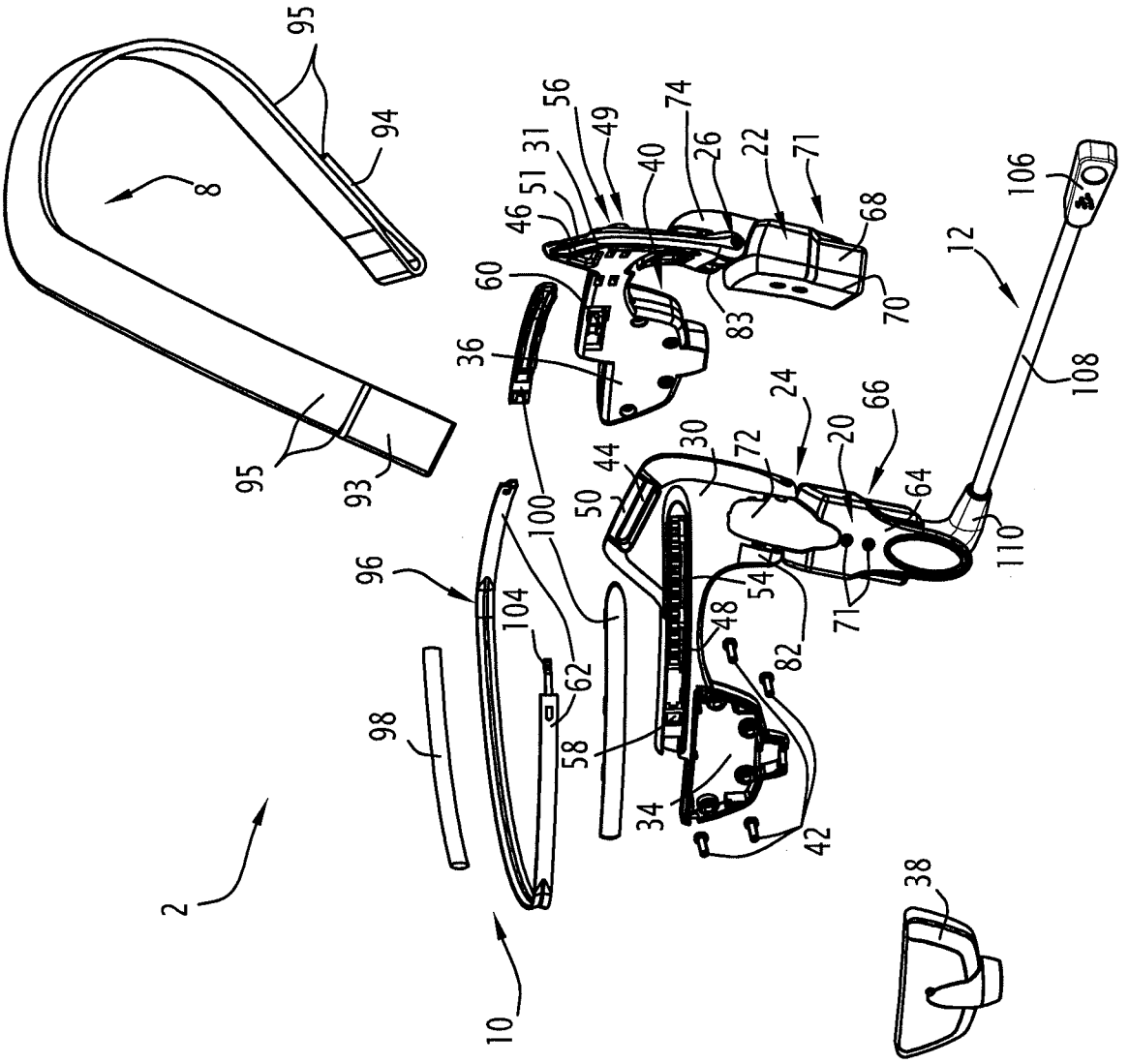
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FIG.2

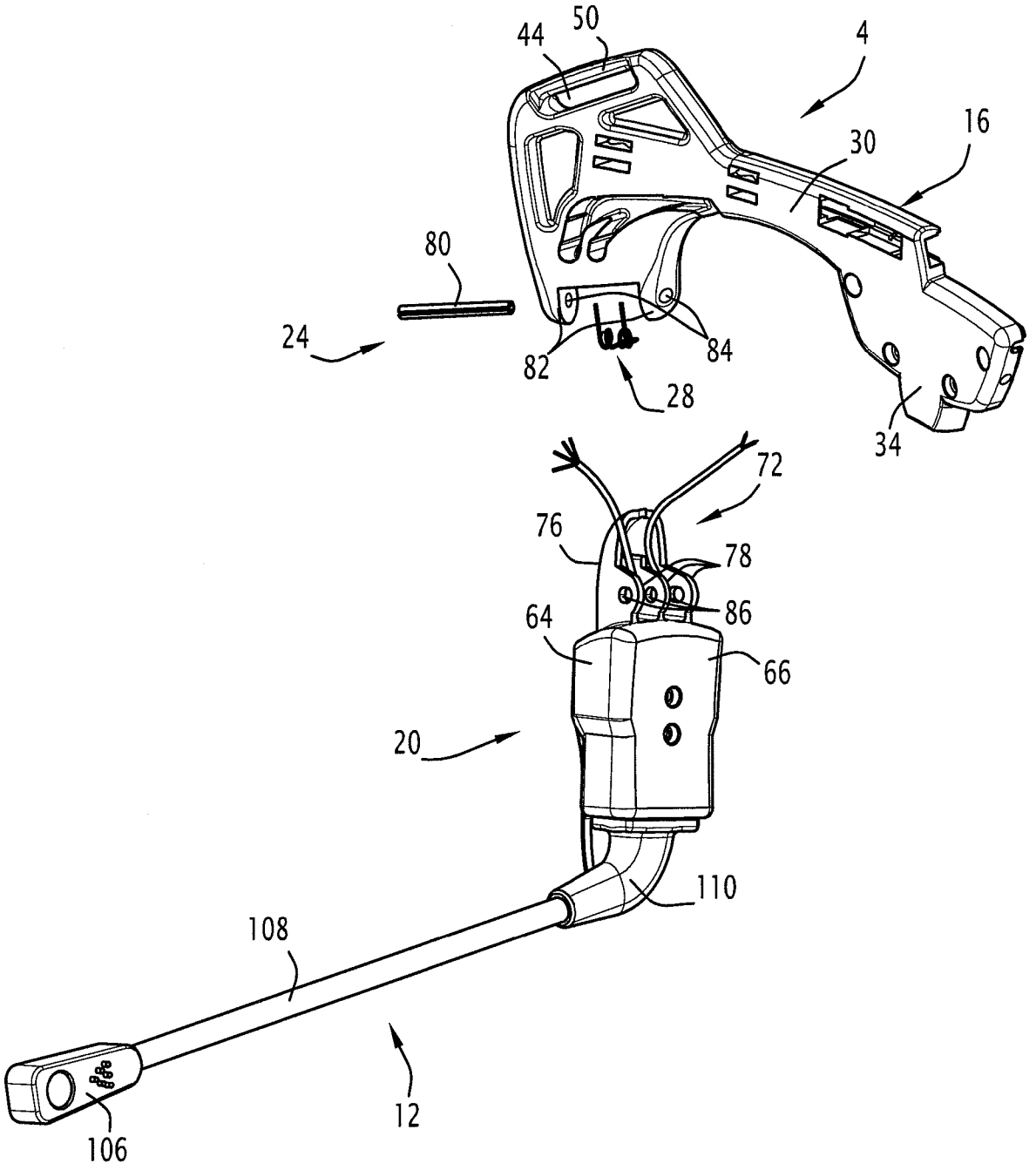

FIG.3

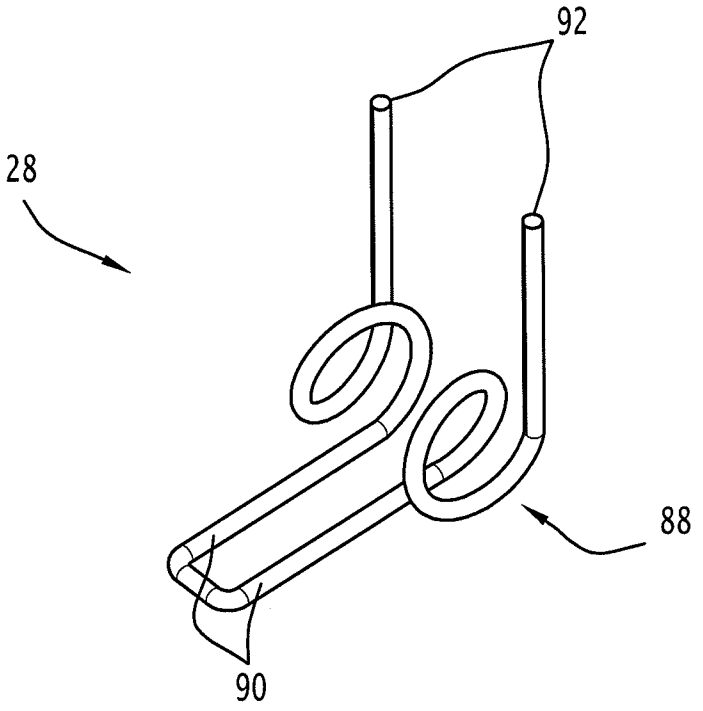

FIG.4

ACOUSTIC HEADSET

The present invention relates to an acoustic headset comprising:

- two lateral acoustic modules comprising a mechanical bone excitation transducer which is capable of transmitting the sound signal to the auditory nerve by bone conduction,
- at least one curved member for connecting the acoustic modules.

The invention also relates to a piece of head gear for infantrymen comprising a heavy helmet and an acoustic headset of this type.

An acoustic headset of the prior art comprises two lateral acoustic modules and a curved member for connecting the two acoustic modules. Each lateral acoustic module comprises a mechanical bone excitation transducer which is capable of converting an electrical signal into a vibrating wave which represents the sound signal and of transmitting the sound signal to the auditory nerve by means of bone conduction.

In order best to transmit the sound signal by bone conduction, the transducer must have the majority of the internal surface thereof in contact with a corresponding lateral side of the skull of the user, in particular with the temporal bone of the skull.

When the user positions the headset on his head, he begins by positioning the curved member for connecting the acoustic modules, then he adjusts the position of each module.

However, taking into consideration the shape of the human skull and the fact that the transducer is fixed in position in the module, only a small portion of the internal surface of the transducer is often in contact with the temporal bone, bringing about impairment of the auditory portion of the headset.

An ergonomic shape of the acoustic module does not allow that problem to be solved because each human skull has a specific shape.

Therefore, an object of the invention is to allow provision of a large contact surface-area between the transducers and the temporal bones of the skull in order to achieve good auditory quality and comfortable wearing of the headset.

Thus, the invention relates to an acoustic headset as described above, characterised in that each acoustic module comprises:

- a plate for lateral abutment against the sides of the skull,
- an articulation between the abutment plate and the transducer,
- a spring for return movement, in terms of rotation about the axis of articulation, of the transducer relative to the plate towards a rest position.

According to other embodiments, the acoustic headset comprises one or more of the following features taken in isolation or in accordance with any technically possible combination:

- the maximum angle of rotation of the articulation about the axis thereof is a minimum of 60°,
- the return movement applied by each spring of a module is directed from that module towards the other module,
- the transducer has at least one additional degree of freedom in terms of rotation about an axis which is angularly displaced from the axis of articulation,
- the articulation comprises an articulation shaft which connects the transducer to the plate, and the component among the plate and the transducer which is capable of rotating about the shaft for articulation comprises through-holes for the shaft, the holes having a diameter greater than the diameter of the shaft,

- the acoustic headset comprises an upper curved member which is for connecting the acoustic modules and which is capable of moving into abutment against the upper portion of the head and a rear curved member which is for connecting the acoustic modules and which is capable of moving into abutment against the rear of the head,
- each curved member has an adjustable length,
- the acoustic headset comprises an electroacoustic microphone which is connected to an acoustic module, in particular to the transducer of the acoustic module,
- the acoustic headset is capable, owing to its dimensions, of being used with a heavy helmet for infantrymen or with a nuclear bacteriological chemical mask.

The invention also relates to a piece of head gear for infantrymen comprising a heavy helmet and an acoustic headset of this type.

The invention and its advantages will be better understood from a reading of the following description which is given purely by way of example and with reference to the appended drawings, in which:

FIG. **1** is a general perspective view of the acoustic headset according to the invention,

FIG. **2** is an exploded perspective view of the acoustic headset according to the invention,

FIG. **3** is an exploded perspective view of an acoustic module for the right ear according to the invention and

FIG. **4** is a perspective view of a return spring according to the invention.

In FIG. **1**, an acoustic headset **2** comprises two lateral acoustic modules **4**, **6**, an upper curved member **8** and a rear curved member **10** for connecting the acoustic modules **4**, **6**. The headset **2** further comprises a microphone **12** which is connected to the acoustic module **4** and a headset wire **14**.

Each acoustic module **4**, **6** comprises a plate **16**, **18** for lateral abutment against the sides of the skull and a mechanical bone excitation transducer **20**, **22**. An articulation **24**, **26** is provided between the abutment plate **16**, **18** and the transducer **20**, **22**. A spring **28**, which is visible in FIGS. **3** and **4**, is provided for each articulation and is capable of ensuring return movement, in terms of rotation about the axis of articulation **24**, **26**, of the transducer **20**, **22** relative to the plate **16**, **18** towards a rest position.

Each plate **16**, **18** of FIGS. **1** and **2** comprises an abutment plate **30**, **31** which is capable of moving into abutment against the skull above an ear. A through-opening for the ear is provided in the lower portion of each plate **30**, **31**. Each plate **16**, **18** comprises, in the rear portion of the plate **30**, **31**, a housing **32**, **33** which comprises a first half-shell **34**, **36** and a second half-shell **38**, **40** which is fixed to the first half-shell **34**, **36** via fixing means **42**, such as screws **42** having countersunk heads.

The first half-shell **34**, **36** and the second half-shell **38**, **40** together delimit a trapezoidal caisson-like structure which has a closed cross-section and which is capable of receiving in particular the wire **14** of the headset.

The abutment plate **30**, **31** comprises an oblong opening **44**, **46** which receives an end of the upper curved member **8**. The rear curved member **10** comprises a guiding conduit **48**, **49** which is provided in the abutment plate **30**, **31** and which has an elongate shape in the main direction of the abutment plate **30**, **31**.

The oblong opening **44**, **46** is particularly near an upper edge of the abutment plate **30**, **31**, the material remaining between the opening **44**, **46** and the upper edge forming a rod **50**, **51**.

Each guiding conduit **48**, **49** comprises, in its recess, at one end and over a portion of the length thereof, a rack **54**, **56**

which comprises reliefs which are spaced apart in such a manner that the longitudinal section of the rack **54**, **56** is of saw-tooth-like shape and, at the other end, a through-hole **58**, **60** for a rod **62** of the rear curved member **10**.

The main abutment plate **30**, **31** and the half-shells **34**, **36**, **38**, **40** of the housings **32**, **33** are, for example, of plastics material and injection-moulded.

Each mechanical bone excitation transducer **20**, **22** is capable of converting an electrical signal into a vibrating wave which represents the sound signal and of transmitting the sound signal to the auditory nerve by bone conduction. The transducer **20**, **22** comprises an element (not illustrated) which is capable of transmitting vibrating waves from the electrical signals received and two half-shells **64**, **66**, **68**, **70** which protect the transmitting element which is not illustrated.

The half-shells **64** and **66**, **68** and **70** are connected, for example, via fixing means **71**, such as screws **71** having countersunk heads. The half-shells **64**, **66**, **68**, **70** are, for example, of plastics material and injection-moulded.

The half-shells **64** and **68** which are located at the outer sides of the headset **2** each comprise an integral lug **72**, **74** for connection to the plate **16**, **18**. The lugs **72**, **74** have a U-like cross-section which is open towards the inner side of the headset and comprise a web **76** and at least two flanges **78** which extend towards the inner side of the headset from the web **76** and perpendicularly relative thereto. Each lug **72**, **74** has, for example, three flanges **78**.

In FIGS. **2** and **3**, the articulation **24**, **26** comprises an articulation shaft **80** which connects the transducer **20**, **22** to the abutment plate **16**, **18**. The plate **16**, **18** has a cover **82**, **83**, in which there is received the lug **72**, **74**, through-holes **84** for the articulation shaft **80** being provided in the cover **82**, **83**. The flanges **78** of the lug **72**, **74** of the transducer **20**, **22** have through-holes **86** for the shaft **80**.

The transducer **20**, **22** is capable of moving in rotation relative to the plate **16**, **18** between two extreme positions. The first position of the transducer **20**, **22** which is also referred to as the rest position corresponds to a position perpendicular to the plate **16**, **18** towards the inner side of the headset **2**. The second position of the transducer **20**, **22** corresponds to a position which is substantially in continuation of the plate **16**, **18**.

The maximum angle of rotation of the articulation **24**, **26** about its axis is a minimum of 60° and is particularly 90°.

The transducer **20**, **22** is capable of rotating about the articulation shaft **80**. The through-holes **86** have a diameter greater than the diameter of the shaft **80** so that the transducer **20**, **22** has at least one additional degree of freedom in terms of rotation about an axis which is angularly displaced, for example, by 5°, from the axis of articulation **24**, **26**.

The return spring **28** of FIG. **4** comprises a central helical winding **88** and ends **90**, **92** which extend in two directions and which are perpendicular to each other when the spring is in a rest position.

The ends **90** of the spring **28** are fixed to the transducer **20**, **22** and the ends **92** which are fixed to the abutment plate **16**, **18**, the articulation shaft **80** extending inside the winding **88**, so that the return movement applied by the spring **28**, when the spring **28** is not in a rest position, is directed from one module **4**, **6** towards the other module **4**, **6**.

The spring **28** is, for example, constructed by a metal rod being deformed.

The upper curved member **8**, which is also referred to as the head-band **8**, has an adjustable length and is capable of being positioned on the upper portion of the head.

The upper curved member **8** is thin and is constructed from a flexible material. The thickness of the upper curved member **8** is, for example, less than 2 mm.

The upper curved member **8** is, for example, a band **8** whose ends **93**, **94** are folded over and fixed to the body of the band **8** via fixing means **95**, such as complementary connection strips **95** having hooks and loops.

The end **93** engages, at the inner side of the acoustic module **4**, in the oblong opening **44** and extends at the outer side of the module **4** in order to be fixed to the body of the band **8** via the means **95** so that the band **8** forms a retention loop around the rod **50**, thereby connecting the upper curved member **8** to the module **4**.

The other end **94** of the band **8** extends through the hole **46** of the acoustic module **6** in order to be fixed to the body of the band **8** via the means **95** and to form a retention loop around the rod **51**, thereby connecting the upper curved member **8** to the module **6**.

The rear curved member **10**, which is constructed from a rigid material, is a curved member for mechanically retaining the two modules **4**, **6**.

The rear curved member **10** comprises, for example, a main body **96** which is of elongate and curved shape and whose ends are constituted by the rods **62**. A comfort foam **98** surrounds the main body **96**. The rear curved member **10** comprises the guiding conduits **48**, **49** and covers **100** for protecting the rod **62** and the ends **104** of the rod **62**, the covers covering the conduits **48**, **49**.

The main body **96** and the rod **62** are, for example, metal plates which have a width of less than 1 cm and a thickness of less than 2 mm.

The rear curved member **10** has an adjustable length owing to the rod **62** sliding in the guiding conduits **48**, **49**. The rear curved member **10** which is also referred to as the nape-band **10**, is capable of being positioned under the otic bone behind the head, near the nape of the neck.

Each end **104** of the rod **62** is curved in accordance with a V shape and engages in the holes **58**, **60**, then slides in the guiding conduits **48**, **49**, before becoming engaged in the reliefs of the rack **54**, **56**. The lateral fixing of the rod **62** is brought about by the edges of the holes **58**, **60** and the longitudinal fixing of the rod **62** is brought about by the engagement of the V-like ends **104** in the reliefs of the rack **54**, **56**.

The electroacoustic microphone **12** comprises an analogue sensor **106** which is for sensing the acoustic sound waves and which is connected to a hollow and deformable rod **108** which receives the electric cables at the centre thereof and which is capable of being curved in different directions, and a hollow elbow piece **110** for fixing the rod **108** to the acoustic module **4**.

In this manner, a user of the headset **2** begins by approximately adjusting the length of the head-band **8** using the fixing means **94**, then the length of the nape-band **10**, by sliding the rod **62** in the guiding conduits **48**, **49** in one direction or the other.

Subsequently, the user moves the transducer **20**, **22** away from the plate **16**, **18** from the rest position, by means of rotation about the articulation **24**, **26**, and the sensor **106** of the microphone **12** if the rod **108** were to be folded towards the inner side of the headset **2**.

The user positions the headset **2** on his head by positioning the band **8** on the upper portion of his skull, the rear curved member **10** behind his head near his nape and the plates **16**, **18** for lateral abutment against the sides of his skull, the plate **16** above the right ear and the plate **18** above the left ear. The opening provided in the lower portion of the abutment plates

30, 31 brings about good ergonomy of the plate 16, 18 in relation to the upper portion of the external ear.

After positioning the headset 2 on his head, the user adjusts the upper curved member 8 on his head, then the rear curved member 10 on his nape, by adjusting the length of the curved member 8 using the fixing means 95 and the length of the curved member 10 by sliding the rod 62 in the guiding conduits 48, 49.

Once the length of the curved members 8, 10 is adjusted, the articulations 24, 26 and the spring 28 allow the transducers 20, 22 to be kept in contact with the right and left temporal bones of the skull. The adjustment of the position of the mechanical bone excitation transducers 20, 22 on the temples is carried out naturally and automatically owing to the additional degree of freedom in terms of rotation about the axis which is angularly displaced from the axis of articulation 24, 26.

The adjustment of the transducers 20, 22 which is carried out in this manner allows a good level of reception to be obtained and the headset 2 to be worn comfortably.

Finally, the user adjusts the position of the sensor 106 of the microphone 12 in relation to his mouth by bending the rod 108.

After removal, the headset 2 can be readily put away because the transducers 20, 22 are automatically moved, under the action of the spring, towards the interior and into the plane of the headset.

The upper curved member 8 allows, owing to its small thickness and its flexible material, a heavy helmet to be worn without discomfort on top of the head. The rear curved member 10, since it is positioned under the otic bone behind the head, also allows all heavy combat helmets to be worn.

The mechanical fixing of the two modules 4, 6 is brought about by the rear curved member 10 whilst the upper curved member 8 serves to fix the arrangement in position on top of the head.

According to another embodiment, the abutment plate 16, 18 is capable of rotating about the articulation shaft 80 and the through-holes 84 have a diameter greater than the diameter of the shaft 80.

According to other embodiments, the headset 2 is capable of being used with motorcyclists' helmets, crash helmets for motor vehicle drivers, headsets for armored vehicles, firemen's helmets, helmets for agents of the security services, helmets for building sites, aircraft pilots' helmets.

According to other embodiments, the headset 2 is a headset for switchboard operators.

The invention claimed is:

1. Acoustic headset (2) comprising:

two lateral acoustic modules (4, 6) comprising a mechanical bone excitation transducer (20, 22) which is capable of transmitting the sound signal to the auditory nerve by bone conduction,

at least one curved member (8, 10) for connecting the acoustic modules (4, 6), characterised in that each acoustic module (4, 6) comprises:

a plate (16, 18) for lateral abutment against the sides of the skull,

an articulation (24, 26) between the abutment plate (16, 18) and the transducer (20, 22),

a spring (28) for return movement, in terms of rotation about the axis of articulation (24, 26), of the transducer (20, 22) relative to the plate (16, 18) towards a rest position.

2. Acoustic headset (2) according to claim 1, characterised in that the maximum angle of rotation of the articulation (24, 26) about the axis thereof is a minimum of 60°.

3. Acoustic headset (2) according to claim 1, characterised in that the return movement applied by each spring (28) of a module (4, 6) is directed from the module (4, 6) towards the other module (4, 6).

4. Acoustic headset (2) according to claim 1, characterised in that the transducer (20, 22) has at least one additional degree of freedom in terms of rotation about an axis which is angularly displaced from the axis of articulation (24, 26).

5. Acoustic headset (2) according to claim 4, characterised in that the articulation (24, 26) comprises a shaft (80) for articulation (24, 26) which connects the transducer (20, 22) to the plate (16, 18), and in that the component among the plate (16, 18) and the transducer (20, 22) which is capable of rotating about the shaft (80) for articulation (24, 26) comprises through-holes (86) for the shaft (80), the holes (86) having a diameter greater than the diameter of the shaft (80).

6. Acoustic headset (2) according to claim 1, characterised in that it comprises an upper curved member (8) which is for connecting the acoustic modules (4, 6) and which is capable of moving into abutment against the upper portion of the head and a rear curved member (10) which is for connecting the acoustic modules (4, 6) and which is capable of moving into abutment against the rear of the head.

7. Acoustic headset (2) according to claim 1, characterised in that the or each curved member (8, 10) has an adjustable length.

8. Acoustic headset (2) according to claim 1, characterised in that it comprises an electroacoustic microphone (12) which is connected to an acoustic module (4, 6), in particular to the transducer (20, 22) of the acoustic module (4, 6).

9. Acoustic headset (2) according to claim 1, characterised in that it is, owing to its dimensions, capable of being used with a heavy helmet for infantrymen or with a nuclear bacteriological chemical mask.

10. Piece of head gear for infantrymen comprising a heavy helmet and an acoustic headset (2) of the type according to claim 1.

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