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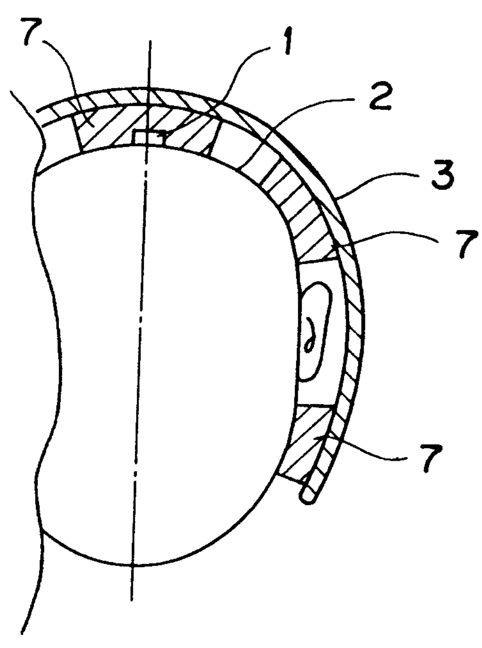
(54) **Speech transmitter.**

(57) A vibration pickup (1, 33) is mounted on a helmet (3), a headset (31), a hanger (40), a face mask (50, 51, 52), or the like which is put on a human head. The vibration pickup (1, 33) is held in or out of contact with a certain region of the human head for converting voice-induced mechanical vibration of the region into an electric signal. The vibration pickup (1, 33) may be held against the top, an upper or lower lateral side, or a cheek region of the human head.

FIG. 1



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BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates to a speech transmitter for use as a microphone with a radio transmitter in a noisy environment such as an automobile racing circuit, a construction site, or the like.

Description of the Prior Art:

In automobile racing, conversations between the drivers of racing automobiles and pit members or directors are usually transmitted and received typically through transceivers. The driver hears transmitted conversations with a small-size loudspeaker, a headset, or an earphone which is incorporated in a helmet that the driver wears to protect his head. The driver also transmits his speech, telling automobile conditions, driving conditions, and other conditions, through a microphone also incorporated in the helmet. The noise produced by a racing car while it is running has a very high level of up to 100 through 120 dB. While the helmet has a certain noise insulating capability as it covers the driver's ears, such a high racing noise level is excessive enough to make the helmet ineffective as a noise insulation. Conventional microphones are basically designed for use in low-noise environments. Since they are transducers for converting sound waves transmitted through air into electric signals, they cannot be used in noisy environments as the information that is picked up by the microphones is masked by the noise.

Therefore, the conventional microphones which are designed for picking up sound waves cannot effectively used to pick up user's speech in high-noise environments such as automobile racing circuits, construction sites, engine compartments on ships, or the like.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a speech transmitter which can reliably and clearly pick up the user's speech in noisy environments.

According to the present invention, there is provided a speech transmitter comprising an attachment adapted to be put on a human head, and a vibration pickup mounted on the attachment in a position for contact with a predetermined region of the human head, for converting mechanical vibration of the predetermined region into an electric signal.

The vibration pickup may be mounted on the attachment in a position for contact with a top region of the human head.

The speech transmitter may also include a vibration damper, the vibration pickup being mounted on the attachment through the vibration damper.

The speech transmitter may also include a base, the vibration pickup being mounted on the attachment through the base, the base having a surface area larger than the area of a vibration detection surface of the vibration pickup.

The attachment may include a cushioning pad having a series of spaced teeth, the vibration pickup being mounted on the attachment through the spaced teeth.

The speech transmitter includes leads electrically connected to the vibration pickup, the leads being of a spirally coiled pattern or a tortuous pattern.

The cushioning pad has a recess defined therein, the vibration pickup being positioned in the recess.

The attachment may comprise a helmet, the vibration pickup being mounted on an inner surface of the helmet.

According to the present invention, there is also provided a speech transmitter comprising an attachment adapted to be put on a human head, a magnetic member adapted to be attached to the human head in a first position, and a vibration pickup mounted on the attachment in a second position for facing the first position out of contact with the magnetic member, for converting a magnetic field generated by the magnetic member into an electric signal.

The vibration pickup may be mounted on the attachment in a position for contact with a lateral side region, such as a cheek, of the human head.

The attachment may comprise a headset having a support arm, the vibration pickup being mounted on a distal end of the support arm.

The attachment may comprise a hanger for engaging in a space between the human head and an auricle thereof, and a support arm joined at one end to the hanger, the vibration pickup being mounted on the opposite end of the support arm.

The attachment may comprise a face mask, the vibration pickup being attached to an inner surface of the face mask.

The speech transmitter may further include a vibratory plate adapted to be held against the predetermined region of the human head, the vibration pickup being mounted on the vibratory plate, a base plate supported on the attachment, and damping means coupled between the vibratory plate and the base plate, for dampening noise vibration transmitted from the attachment.

The above and other objects, features and advantages of the present invention will become more apparent from the following description when taken in conjunction with the accompanying drawings in which preferred embodiments of the present invention shown by way of illustrative example.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary cross-sectional view of a speech transmitter according to a first embodiment of the present invention;

FIG. 2 is a schematic view showing human head regions where a vibration pickup of the speech transmitter shown in FIG. 1 should be located;

FIG. 3 is a cross-sectional view showing how a helmet exerts a pressure;

FIG. 4 is an enlarged fragmentary cross-sectional view of a structure by which the vibration pickup is fixed to the helmet;

FIG. 5 is a cross-sectional view taken along line V - V of FIG. 4;

FIG. 6 is a fragmentary plan view of another structure by which the vibration pickup is fixed to the helmet;

FIG. 7 is an enlarged fragmentary cross-sectional view of still another structure by which the vibration pickup is fixed to the helmet;

FIG. 8 is an enlarged fragmentary cross-sectional view of a further structure by which the vibration pickup is fixed to the helmet;

FIG. 9 is a fragmentary plan view a pattern of leads from the vibration pickup;

FIG. 10 is a fragmentary plan view another pattern of leads from the vibration pickup;

FIG. 11 is a fragmentary cross-sectional view of another vibration pickup according to the present invention;

FIG. 12 is a side elevational view of a speech transmitter according to a second embodiment of the present invention;

FIG. 13 is a front elevational view showing a human head region where a vibration pickup of the speech transmitter shown in FIG. 12 should be located;

FIGS. 14A, 14B, and 14C are diagrams showing frequency characteristics of various human head regions;

FIG. 15 is a side elevational view of a speech transmitter according to a third embodiment of the present invention;

FIG. 16 is a side elevational view of the speech transmitter shown in FIG. 15 as it is placed on a human head;

FIGS. 17A, 17B, and 17C are front elevational views of different face masks;

FIG. 18 is an enlarged cross-sectional view of a vibration pickup of a speech transmitter according to a fourth embodiment of the present invention, the vibration pickup being used with one of the face masks shown in FIGS. 17A, 17B, and 17C;

FIG. 19 is a side elevational view of a helmet, showing a region of the helmet where a vibration pickup of a speech transmitter according to a fifth embodiment of the present invention is located;

FIG. 20 is an enlarged cross-sectional view of the vibration pickup shown in FIG. 19; and

FIG. 21 is an enlarged cross-sectional view of a speech transmitter according to a sixth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Like or corresponding parts are denoted by like or corresponding reference characters throughout views.

1ST EMBODIMENT:

FIG. 1 shows a speech transmitter according to a first embodiment of the present invention. The speech transmitter shown in FIG. 1 includes a vibration pickup 1 mounted in an attachment or helmet 3 which is put on a human head 2, the vibration pickup 1 being held in contact with the human head 3. The helmet 3 has inner cushioning pads 7 attached to the inner surface thereof for spacing the helmet shell apart from the human head 2 and protecting the human head 2. The inner cushioning pads 7 may be made of a lightweight foamed material such as foamed styrene.

The vibration pickup 1 comprises a transducer which converts mechanical vibration or voice sound vibration into an electric signal, and may be in the form of a piezoelectric transducer. In FIG. 1, the vibration pickup 1 is shown as being located on the top of the human head 2. When held in sufficient contact with the top of the human head 2, the vibration pickup 1 can detect a solid vibration or elastic wave that is propagated through the skull, the elastic wave being representative of speech. However, as shown in FIG. 2, it is preferable to located the vibration pickup 1 on the helmet 3 at a side portion thereof corresponding to an upper side region 4 or a lower side region 5 of the human head 2. Since the helmet 3 is structured to exert a lateral pressure to lateral sides of the human head 2, as shown in FIG. 3, when the helmet 3 is put on the human head 2, the vibration pickup 1 mounted on the side portion of the helmet 3 is pressed against the upper side region 4 or the lower side region 5 of the human head 2 for effectively picking up the elastic wave propagated through the skull.

The vibration pickup 1 may be fixed to the helmet 3 by a structure as shown in FIG. 4. In FIG. 4, one of the inner cushioning pads 7 has a recess 23 defined therein, and the vibration pickup 1 is positioned in the recess 23 in spaced relationship to the inner wall surfaces of the recess 23. A base 9 is attached to a vibration detection surface of the vibration pickup 1, the base 9 having a surface area larger than the area of the vibration detection surface. The base 9 is wider in area than the vibration detection surface because it allows more vibration to be transmitted to the vibration pickup 1, so that the vibration pickup 1 has an increased degree of vibration sensitivity. The base 9 is fixed to an edge surrounding the opening of the recess 23 by a vibration damper 8. Inasmuch as the vibration pickup 1 is spaced from the inner wall surfaces of the recess 23 and supported on the base 9 that is attached to the cushioning pad 7 through the damper 8, the vibration pickup 1 is acoustically isolated from the cushioning pad 7. The damper 8 should preferably be made of a material having a large internal loss such as urethane foam, foamed polymer, or the like.

As show in FIG. 5, the base 9 is held in contact through the damper 8 with a series of spaced teeth 12 of the cushioning pad 7. More specifically, the open end of the recess 23 has a circular pattern of spaced cutouts 11 defined between spaced teeth 12 of the cushioning pad 7. The base 9 is placed on the radially inner ends of the spaced teeth 12 through the damper 8. Therefore, the base 9 indirectly contacts the cushioning pad 7 through a relatively small surface area. As a result, any disturbing external noise which tends to be propagated through the cushioning pad 7 to the base 9 can be reduced.

FIG. 6 shows another structure by which the vibration pickup 1 is fixed to the helmet 3. In FIG. 6, a mesh-like springy member 12 is interposed between the edge surrounding the open end of the recess 23 in the cushioning pad 7 and the base 9 which supports the vibration pickup 1. The vibration pickup 1 is therefore supported in the recess 23 by the mesh-like springy member 12. External noise from the cushioning pad 7 can be dampened by the mesh-like springy member 12.

FIG. 7 shows still another structure by which the vibration pickup 1 is fixed to the helmet 3. In FIG. 7, a shield layer 13 which serves as an acoustic low-pass filter is held against the inner wall surfaces of the recess 23. The base 9 which supports the vibration pickup 1 is joined to the shield layer 13 through a damper 14 which may be made of urethane foam or the like. The shield layer 13 may be made of a heavy and hard material, such as lead, iron, or the like, which has a mechanical impedance much higher than that of the cushioning pad 7. The heavy and hard shield layer 13 less tends to be vibrated by unwanted external vibration, and hence serves as an acoustic low-pass filter. Noise vibration can therefore be rejected by the shield layer 13. As a result, only voice vibration that is propagated through the human head is effectively transmitted through the base 9 to the vibration pickup 1, which can thus converts the speech into an electric signal with a high signal-to-noise ratio.

A further structure by which the vibration pickup 1 is fixed to the helmet 3 is shown in FIG. 8. In FIG. 8, the base 9 is joined through a damper 17 to a vibration shield ring 16 which is mounted on another damper 15 fixed to the helmet 3. The base 9 is separate from the cushioning pad 7 so that the base 9 is acoustically isolated from the cushioning pad 7. The dampers 15, 17 may be made of urethane foam or the like. The vibration shield ring 16 may be made of a heavy and hard material such as lead, iron, or the like. The dampers 15, 17 and the vibration shield ring 16 are effective in preventing external noise from being transmitted from the helmet 3 to the vibration pickup 1.

FIG. 9 shows a pattern of leads 10 which extend from the vibration pickup 1 in the helmet 3. The leads 10 are spirally coiled around the vibration pickup 1. If the leads 10 were straight, they would tend to be vibrated by noise vibration applied to the helmet 3. The spirally coiled leads 10 are however more resistant to noise-induced vibration, i.e., are effective to dampen noise vibration applied to the helmet 3.

The leads 10 from the vibration pickup 1 may be placed in the helmet 3 in a tortuous pattern as shown in FIG. 10.

FIG. 11 shows another vibration pickup according to the present invention.

As shown in FIG. 11, the vibration pickup, generally designated by the reference numeral 24, comprises a magnetic sensor supported by a helmet at a portion corresponding to the upper side region 4 (see FIG. 2) or the lower side region 5 of the human head 2, for example. The vibration pickup 24 comprises a yoke 18 disposed in a damper 17 of urethane foam or the like that is fixedly mounted in the recess 23 in the inner cushioning pad 7 attached to the helmet. The vibration pickup 24 also has a center piece 9 disposed centrally in the yoke 18, and a pickup coil 20 wound around the center piece 9. The pickup coil 20 is electrically connected to the leads 10. The center piece 9 has a tip end positioned inwardly of the open end of the recess 23, i.e., the outer edges of the inner wall surfaces of the cushioning pad 7. The damper 17 has a distal end which is also spaced inwardly of the open end of the recess 23. Therefore, the vibration pickup 24 is held out of direct contact with the human head 2.

In use, a flat magnetic member 22 is applied to the head 2 at a position corresponding to the vibration pickup 24, and then the user wears the helmet on his head 3. With the helmet on the head 3, the magnetic member 22 and the vibration pickup 24 confront each other, but are spaced from each other. When the user utters voice sounds, the magnetic member 24 is vibrated by the elastic wave propagated through the skull, varying the intensity of a magnetic field generated by the magnetic member 22. The varying intensity of the magnetic field varies the amplitude of the voltage induced in the pickup coil 20, and the change in the voltage amplitude is transmitted over the leads 10. Since the voltage change corresponds to the elastic wave caused by the speech, the voice sounds uttered by the user can be detected indirectly as the voltage change transmitted over the leads 10.

The vibration pickup 24 supported in the helmet is held out of contact with the human head 2. Therefore, the helmet can be put on and taken off easily and is not required to be exactly positioned with respect to the head 2. The vibration pickup 24 in the form of a magnetic sensor can reliably and clearly picks up voice sounds as it is not adversely affected by noise vibration transmitted through the cushioning pad 7.

2ND EMBODIMENT:

FIG. 12 shows a speech transmitter according to a second embodiment of the present invention. As shown in FIG. 12, the speech transmitter includes a headset 31 placed on a human head 34, the headset 31 including a resilient support arm 32 extending toward a cheek 35. The speech transmitter also has a vibration pickup 33 mounted on an inner side of the support arm 32 which faces the cheek 35. The vibration pickup 33 can be held in contact with the cheek 35 under suitable pressure by the resilient support arm 32.

When the user wears the headset 31 on the head 34, as shown in FIG. 12, the vibration pickup 33 is automatically positioned on the cheek 35 for picking up voice sound vibration. The vibration pickup 33 comprises a transducer which converts mechanical vibration or voice sound vibration (solid vibration or elastic wave) into an electric signal, and may be in the form of a piezoelectric transducer. The electric signal produced by the vibration pickup 33 is sent to a radio transmitter (not shown). The headset 31 may also have a receiver such as an earphone to be located at an ear for reproducing transmitted voice sounds.

The vibration pickup 33 should preferably be located at the cheek 35, as shown in FIG. 12. More specifically, as shown in FIG. 13, the vibration pickup 3 should be positioned in a cheek region surrounded by a horizontal line *a* - *a* interconnecting points a, a beneath cheekbones, a horizontal line *b* - *b* interconnecting lower jawbone corners *b*, *b*, a vertical line passing through an end of the mouth, and another vertical line passing through a point *d* on a branchia where a chinbone is positioned closely to the face.

The vibration pickup 33 should preferably be located at the cheek 35 for the following reasons:

First, the vibratory level of voice sounds uttered by the user is relatively high at the cheek 35, and voice sounds uttered by the user and picked up at the cheek 35 are in such a frequency spectral range that they can clearly be recognized. Secondly, the cheek 35 is basically composed of muscles, and does not produce an uncomfortable sensation such as pain, excessive pressure, fatigue, or the like even when it is pressed by the vibration pickup 33 for a long period of time.

The first reason will be described in greater detail below. Speech sounds are produced by the vocal cord in a throat 37 when the vocal cord vibrates. The sound wave thus generated by the vocal cord is processed into words by the tongue and lips. If the vibration pickup 33 were held against the throat 37, since the throat 37 is remote from the lips, the speech sound picked up by the vibration pickup 33 would not be clear enough to be recognized as words. As shown in FIG. 14A, the vibration level of the speech sound produced by the vocal cord is relatively high, its components having frequencies of the speech sound that are higher than about 800 Hz, which is a threshold frequency for clearness, are very low in level. The sound produced by the vibration pickup 33 held against the throat 37 would be heard as indistinct mumbling sound, and could not be recognized clearly.

If the vibration pickup 33 were placed on the top 38 of the head 34, it would pick up high-frequency sound components which would make the sound clear as the frequency spectrum of the sound reaches about 2 KHz, as shown in FIG. 14B. However, the vibration level of the speech sound picked up by the vibration pickup 33 would be relatively low, and the signal-to-noise ratio of the signal produced by the vibration pickup 33 would be poor because of internal noise of the vibration pickup 33. The skull is a hemispherical shell and has a density P of 1.7 g/cm^3 and an acoustic impedance Pv of 6.0 g/cm^2/S. The muscles have a density P of 1.07 g/cm^3 and an acoustic impedance Pv of 1.7 g/cm^2/S. Therefore, the skull is harder and heavier than the muscles. This means that the skull is less liable to be vibrated by a vibration source such as the vocal cord. Consequently, the level of vibration that has been propagated through the skull is relatively low. Other cranial bones which might be available for bone conduction would be the forehead, the mastoid bone, and the nasal bone, but cannot be employed as the sound conducted through these cranial bones have a frequency spectrum and a vibration level as shown in FIG. 14B.

The muscles of the cheek 35 are closer to the tongue and lips which modulate the energy of the voice sound generated by the vocal cord into words, than the throat 37 and the top 38 of the head 34. The voice sound that is picked up from the cheek 35 has a high vibration level, and its sound pressure level at a frequency of about 1 KHz required for clearness is sufficiently high, as shown in FIG. 14C. Therefore, the cheek 35 is most suitable for picking up voice sounds that have been propagated from the vocal cord. The cheek 35 also has an appropriate internal loss for external disturbing noise, and is resistant to disturbance as its resonant frequency is lower than those of the cranial bones. In addition, the cheek 35 is soft enough to neatly and intimately contact the vibration pickup 33, and provides a wider sound pickup area than the cranial bones.

The second reason referred to above will be described in detail below. It is important that the surface, to be vibrated by the applied sound waves, of the vibration pickup 33 be held in contact in its entirety with the desired head region for efficient detection of the vibration. To meet this requirement, the vibration pickup 33 is pressed against the desired head region under a certain pressure (e.g., a light finger pressure). If the vibration pickup 33 were pressed against a head region where there is a bone beneath the skin for a long period of time, it would cause pain or discomfort to the user. If the vibration pickup 33 were pressed against the top 38 of the head 34 or the forehead, since hair would be present beneath the vibration pickup 33, it would cause an energy loss, lowering the vibration level especially in frequencies higher than 500 Hz. On the other hand, the cheek 35, which is mainly composed of muscles thicker than those of the other head regions, does not produce pain or discomfort even when it is pressed by the vibration pickup 33 under stronger pressure and/or for a long period of time. In the case where the vibration pickup 33 is incorporated in a helmet, the vibration pickup 33 may be located in a recess defined in an inner cushioning pad in the helmet, which inner cushioning pad is normally pressed against the cheek of the user to prevent the helmet from being positionally displaced or vibrated during usage. Therefore, the cheek is also a suitable region where the vibration pickup 33 is pressed when the vibration pickup 33 is incorporated in the helmet.

The vibration pickup 33 comprises a transducer which converts mechanical vibration or voice sound vibration into an electric signal, and may be in the form of a piezoelectric transducer. The vibration pickup 33 may also be a dynamic or magnetic transducer. In practice, the vibration pickup 33 should be of a weight of about 5 g or less and have an area in the range from 1 to 5 cm^2 for contact with the cheek 35.

The speech transmitter according to the second embodiment is capable of automatically positioning the vibration pickup 33 properly with respect to the cheek 35 of the user immediately when the user wears the headset 31. The speech transmitter is also capable of clearly and reliably picking up voice sounds transmitted to the cheek 5 without external noise.

3RD EMBODIMENT:

FIGS. 15 and 16 illustrate a speech transmitter according to a third embodiment of the present invention.

The speech transmitter shown in FIGS. 15 and 16 is essentially in the form of a headset. The speech transmitter includes a substantially U-shaped hanger 40 for engaging in a space between a human head 44 and an auricle 43 of the user. The speech transmitter also includes a support arm 41 extending from one end of the hanger 40. When in use, the hanger 40 extends along the auricle 43, and the support arm 41 is positioned forwardly of the hanger 40 on a side of the face of the user. The support arm 41 is made of a material which is flexible enough for a finger to be able to change the shape of the support arm 11, and which is also plastic enough to retain its shape after it is changed. Preferably, the support arm 41 may be in the form of a hollow pipe with leads 42 extending therethrough. Specifically, the support arm 41 may be composed of a lead rod having a diameter ranging from 2 to 3 mm and covered with a tube of soft vinyl with the leads 42 extending therethrough. A vibration pickup 33, which is identical to the vibration pickup 33 shown in FIG. 12, is mounted on the tip end of the support arm 41. The leads 42 are electrically connected to the vibration pickup 33.

In use, as shown in FIG. 16, the hanger 40 is placed around the auricle 43, and the support arm 41 is bent to position the vibration pickup 43 on a cheek 35 of the user and press the vibration pickup 43 against the cheek 45 under a suitable pressure. When the user speaks, the voice sound is converted by the vibration pickup 43 into an electric signal, which is then transmitted over the leads 42.

4TH EMBODIMENT:

Generally, racing car drivers use a face mask to protect their heads from fire or high temperature in case of car accidents. Various types of face masks are known in the art. FIG. 17A shows a face mask 50 with two openings for exposing both eyes respectively therethrough. FIG. 17B shows a face mask 51 having one oblong opening for exposing both eyes therethrough. FIG. 17C illustrates a face mask 52 large enough to expose the face of the user therethrough. These face masks 50, 51, 52 are made of a heat- or fire-resistant material such as aramid fibers.

As shown in FIG. 18, a vibration pickup 33, which is identical to the vibration pickup 33 shown in FIG. 12, is detachably attached to an inner surface of the face mask 50 (which may be the face mask 51 or 52) by a Velcro tape 55 at a position corresponding to the cheek 35 of the driver. If the face mask 50 is intended for repeated use, since the cheek 35 of the driver is of a fixed position, the vibration pickup 33 may be fixed to the face mask 50.

When the driver wears the face mask 50, the vibration pickup 33 is automatically positioned with respect to the cheek 35 of the driver. When the driver then wears a helmet, the vibration pickup 33 is pressed against the cheek 35 by an inner cushioning pad 54 attached to the inner side of a helmet shell 53.

5TH EMBODIMENT:

FIGS. 19 and 20 show a speech transmitter according to a fifth embodiment of the present invention.

The speech transmitter is combined with a helmet to be worn typically by a car driver. The helmet has a helmet shell 63 with an inner cushioning pad 64 attached to the inner side thereof. The speech transmitter includes a vibration pickup 33, which is identical to the vibration pickup 33 shown in FIG. 12, fixedly or detachably attached to an inner surface of the cushioning pad 64 at a position corresponding to a cheek 35 of the driver. If the vibration pickup 33 is detachably attached to the cushioning pad 64, it may be joined by a Velcro tape.

When the driver wears the helmet, the vibration pickup 33 is automatically positioned with respect to the cheek 35 of the driver, and pressed against the cheek 35 by the cushioning pad 64.

6TH EMBODIMENT:

FIG. 21 shows a speech transmitter according to a sixth embodiment of the present invention.

The speech transmitter shown in FIG. 21 includes a vibration pickup 33, which is identical to the vibration pickup 33 shown in FIG. 12, mounted on a vibratory plate 69 to be held in contact with a cheek 35 of the user. The vibratory plate 69 is spaced from and coupled to a base plate 67 by a plurality of dampers 68. The vibration pickup 33 is disposed in the space between the base plate 67 and the vibratory plate 69. The base plate 67 is attached to an inner surface of an inner cushioning pad 64 of a helmet. The base plate 67, which is typically made of a metal such as lead or the like, serves to block unwanted external noise vibration which would otherwise be applied through the cushioning pad 64 to the vibration pickup 33. The dampers 28 are preferably made of a material having a large internal loss and a large acoustic impedance, e.g., a cushioning material such as butyl rubber or the like. These dampers 28 are also effective to prevent external noise vibration from being transmitted from the cushioning pad 64 to the vibration pickup 33. Therefore, the vibration pickup 33 can pick up voice sounds clearly and produce a corresponding electric signal with a high signal-to-noise ratio.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

Claims

1. A speech transmitter comprising:

   an attachment (3) adapted to be put on a human head; and

   a vibration pickup (1) mounted on said attachment (13) in a position for contact with a predetermined region of the human head, for converting mechanical vibration of said predetermined region into an electric signal.

2. A speech transmitter according to claim 1, wherein said vibration pickup (1) is mounted on said attachment in a position for contact with a top region of the human head.

3. A speech transmitter according to claim 1, further including a vibration damper (8), said vibration pickup being mounted on said attachment through said vibration damper (8).

4. A speech transmitter according to claim 1, further including a base (9), said vibration pickup (1) being mounted on said attachment through said base, said base (9) having a surface area larger than the area of a vibration detection surface of said vibration pickup (1).

5. A speech transmitter according to claim 1, wherein said attachment includes a cushioning pad (7) having a series of spaced teeth (12), said vibration pickup (1) being mounted on said attachment through said spaced teeth.

6. A speech transmitter according to claim 1, further includes leads (10) electrically connected to said vibration pickup (1), said leads (10) being of a spirally coiled pattern.

7. A speech transmitter according to claim 1, further includes leads (10) electrically connected to said vibration pickup (1), said leads being of a tortuous pattern.

8. A speech transmitter according to claim 1, wherein said attachment includes a cushioning pad (7), further including a vibration damper (14) attached to said cushioning pad (7), and a base (9) mounted on said vibration damper (14), said vibration pickup (1) being supported on said base.

9. A speech transmitter according to claim 8, wherein said cushioning pad (7) has a recess defined therein, said vibration pickup (1) being positioned in said recess.

10. A speech transmitter according to claim 1, wherein said attachment comprises a helmet (3), said vibration pickup (1) being mounted on an inner surface of said helmet.

11. A speech transmitter comprising:

    an attachment adapted to be put on a human head;

a magnetic member (22) adapted to be attached to the human head in a first position; and

a vibration pickup (24) mounted on said attachment in a second position for facing said first position out of contact with said magnetic member (22), for converting a magnetic field generated by said magnetic member into an electric signal.

12. A speech transmitter according to claim 1, wherein said vibration pickup (1) is mounted on said attachment in a position for contact with a lateral side region of the human head.

13. A speech transmitter according to claim 12, wherein said lateral side region is a cheek.

14. A speech transmitter according to claim 1, wherein said attachment comprises a headset (31) having a support arm (31), said vibration pickup (33) being mounted on a distal end of said support arm.

15. A speech transmitter according to claim 1, wherein said attachment comprises a hanger (40) for engaging in a space between the human head and an auricle (43) thereof, and a support arm (41) Joined at one end to said hanger (40), said vibration pickup (33) being mounted on the opposite end of said support arm.

16. A speech transmitter according to claim 1, wherein said attachment comprises a face mask (50, 51, 52), said vibration pickup (33) being attached to an inner surface of said face mask.

17. A speech transmitter according to claim 1, further including a vibratory plate (67) adapted to be held against said predetermined region of the human head, said vibration pickup (33) being mounted on said vibratory plate (67), a base plate (69) supported on said attachment, and damping means (68) coupled between said vibratory plate (67) and said base plate (69), for dampening noise vibration transmitted from said attachment.

FIG. 1

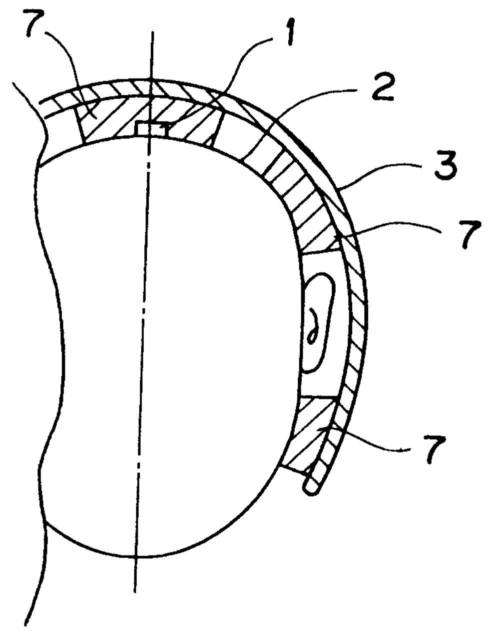
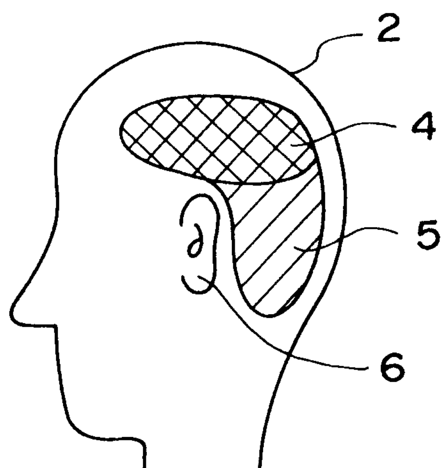
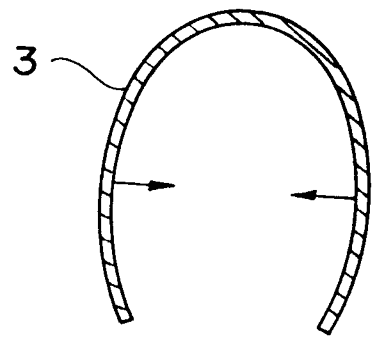


FIG. 2



F I G. 3



F I G. 4

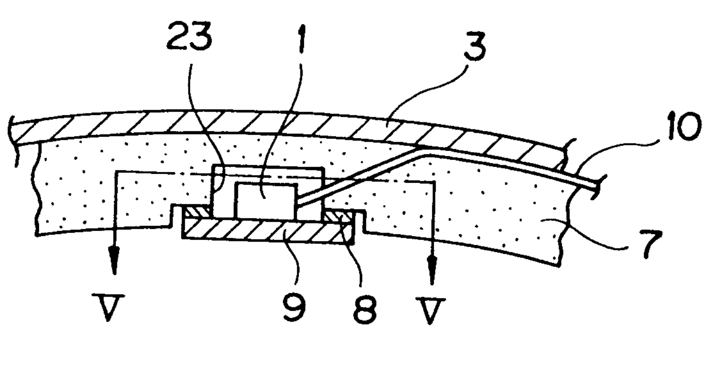


FIG. 5

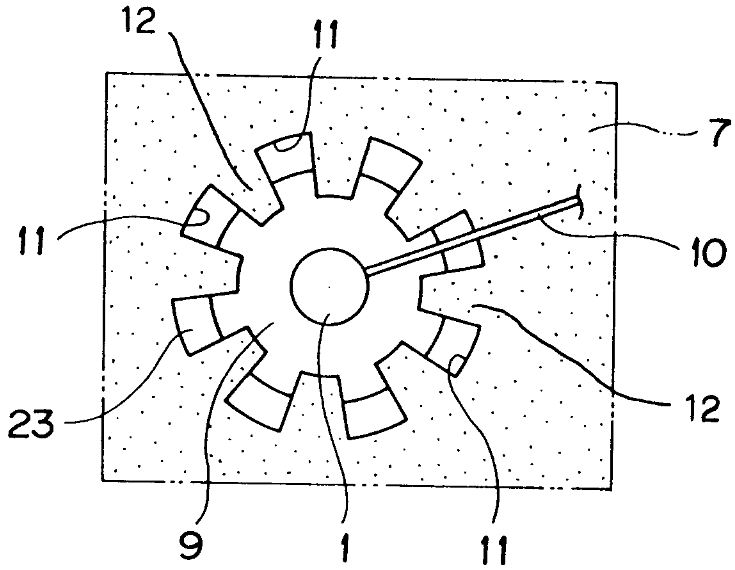


FIG. 6

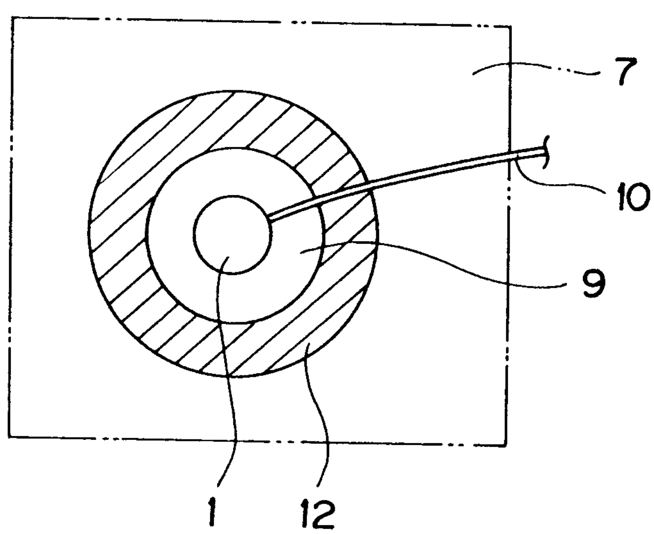


FIG. 7

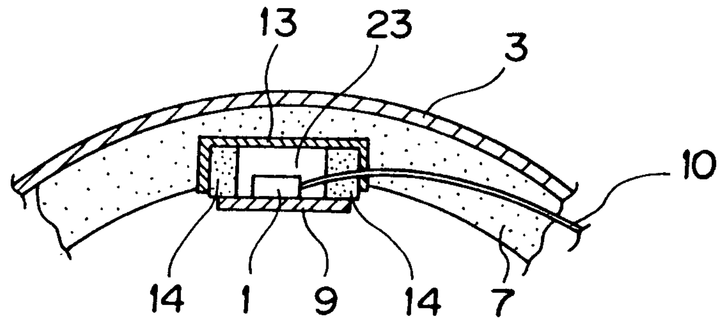


FIG. 8

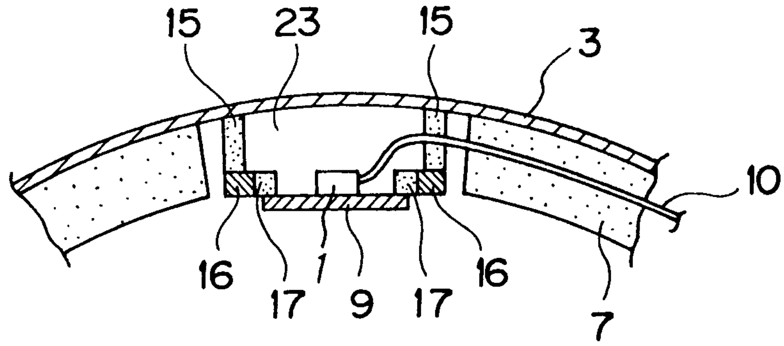


FIG. 9

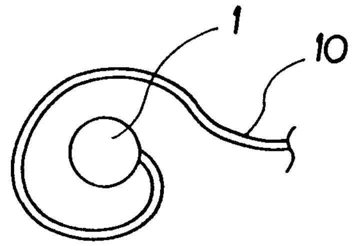


FIG. 10

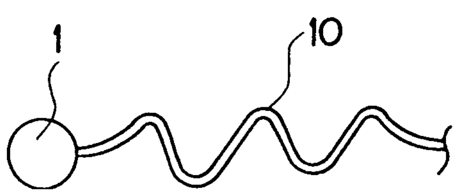


FIG.11

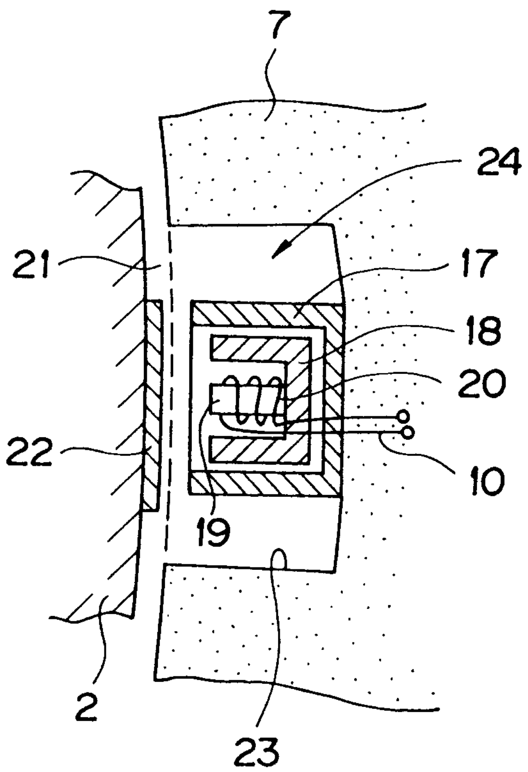


FIG.12

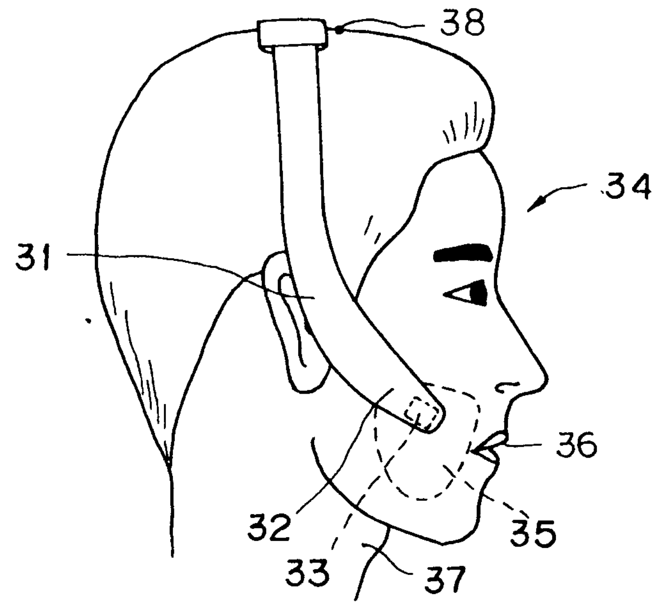


FIG.13

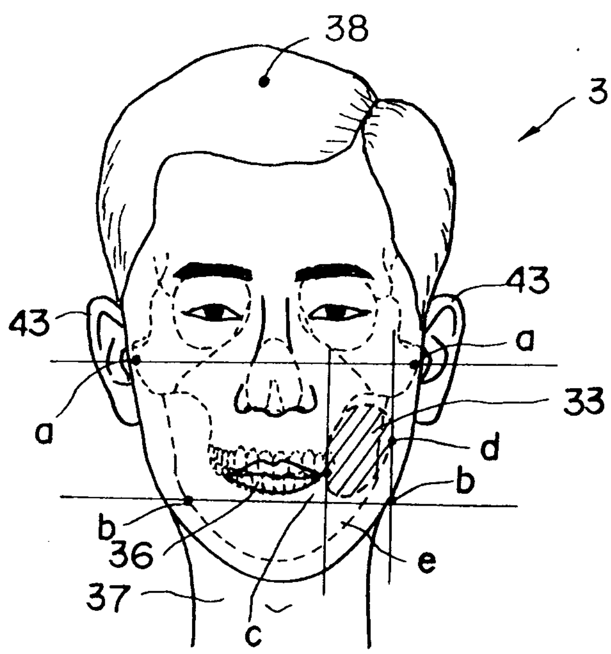


FIG.14A

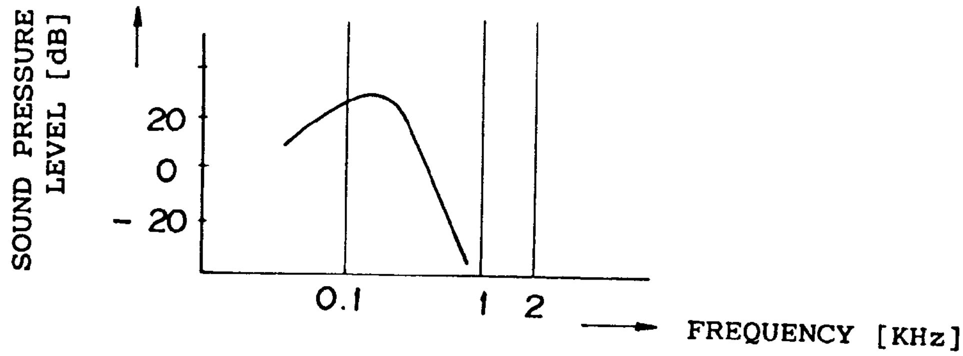


FIG.14B

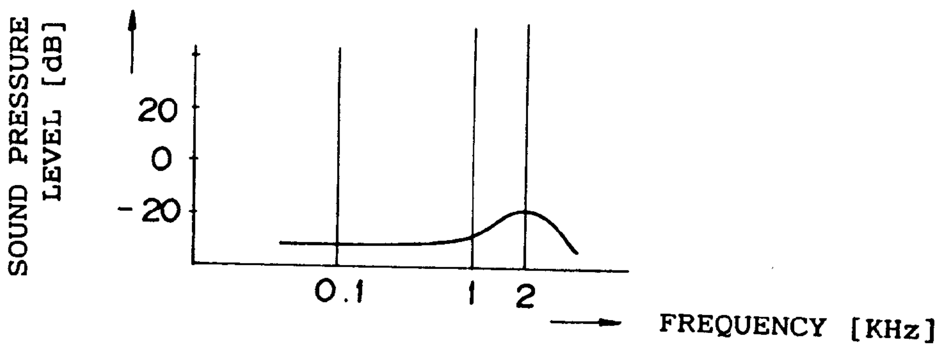


FIG.14C

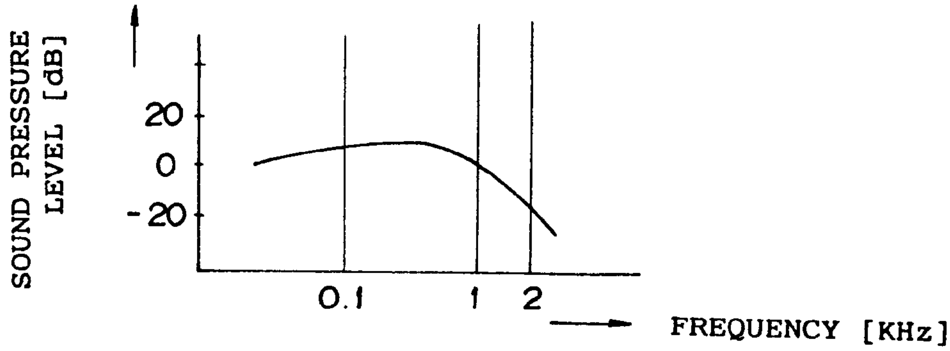


FIG.15

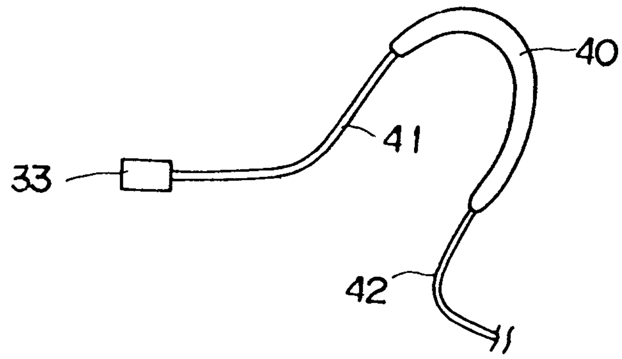


FIG.16

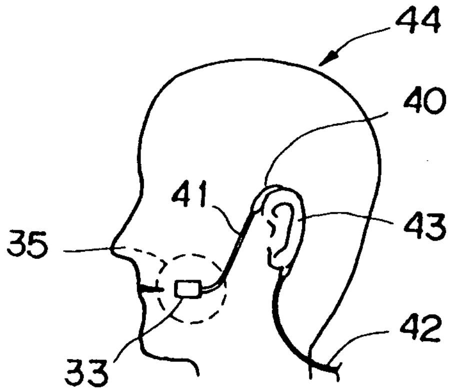


FIG.17A

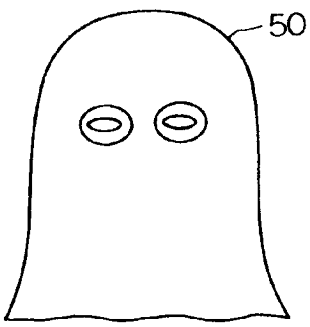


FIG.17B

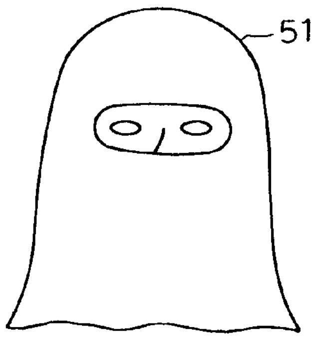


FIG.17C

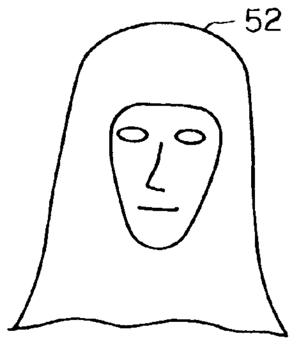


FIG.18

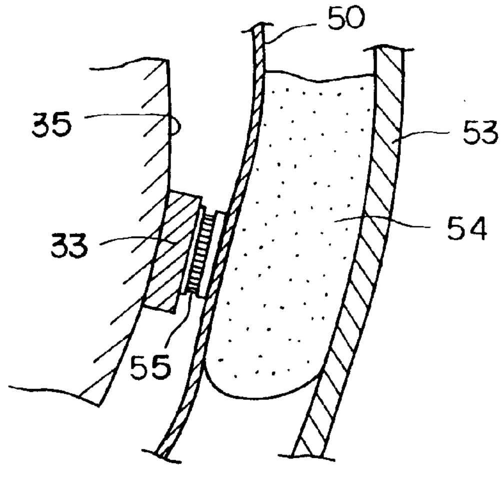


FIG. 19

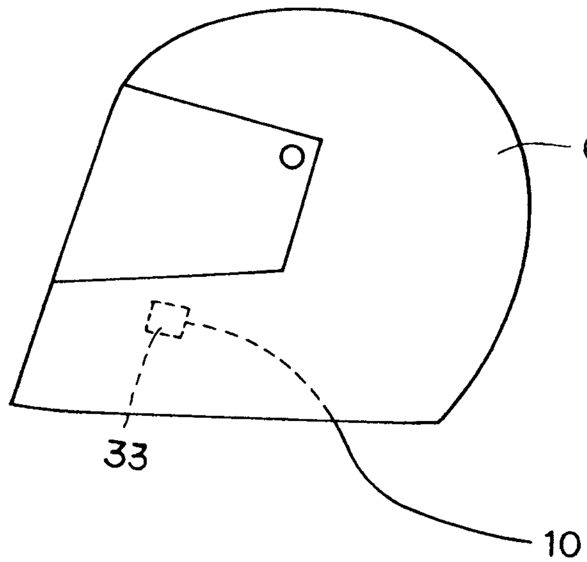


FIG. 20

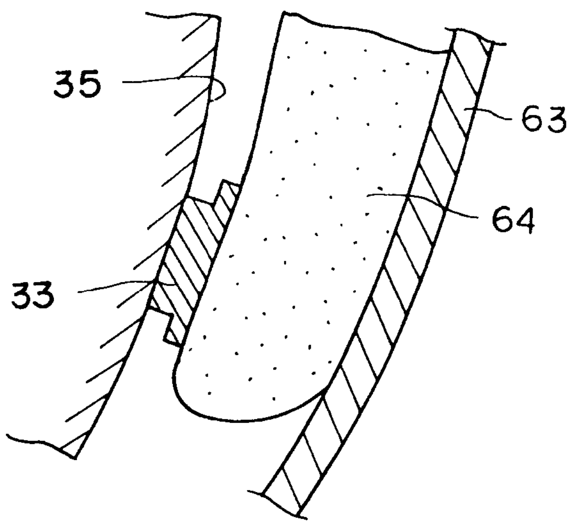
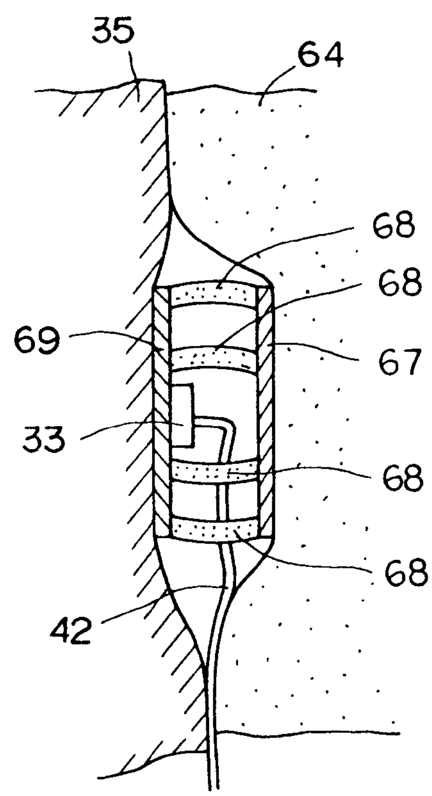


FIG. 21



European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92305078.5

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
P,X	CH - A - 679 965 (PEIKER) * Totality * --	1,3	H 04 R 1/46
A	US - A - 4 520 238 (IKEDA) * Abstract; column 1, lines 5-63; fig. 1; claim 1 * --	1	
A	DE - A - 3 023 155 (TELEMIT) * Page 5, line 1 - page 10, line 14; claim 1 * ----	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

H 04 R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	30-09-1992	GRÖSSING

CATEGORY OF CITED DOCUMENTS

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