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(54) **Composite receiver tube for a hearing instrument**

(57) The compliance of a receiver tube for a hearing instrument may be enhanced by fabricating it as a composite assembly of a tube and a compliant insulator po-

sitioned between the tube and the receiver. The material of the insulator is selected such that it has a greater compliance than that of the tube.

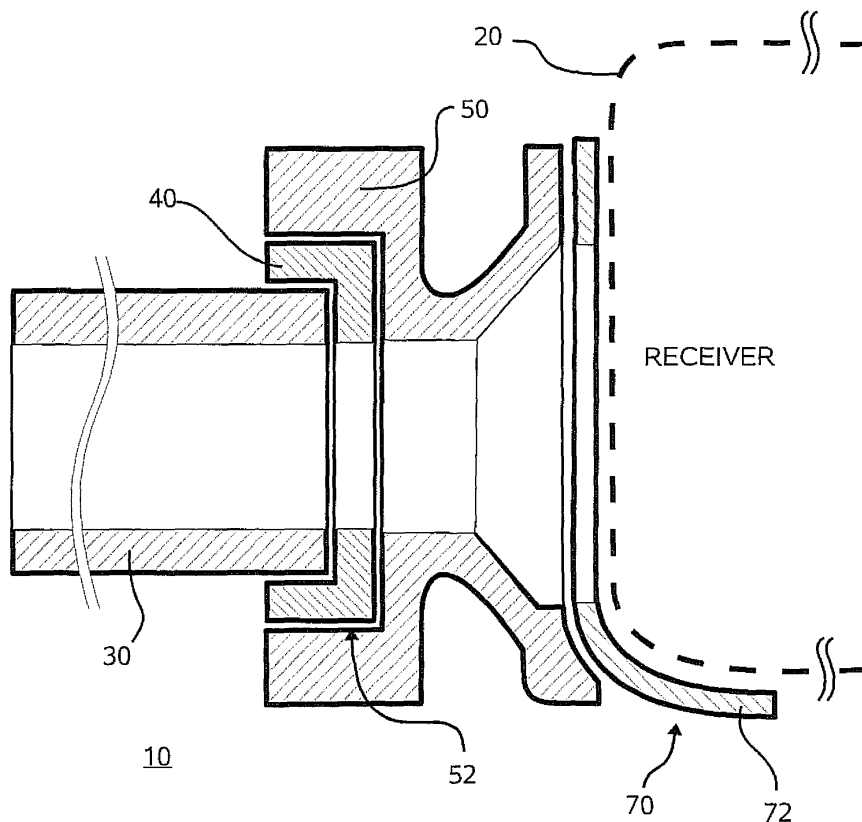


Fig. 1

Description

Cross-Reference to Related Applications

[0001] This application is related to and claims the benefit of commonly-owned U.S. Provisional Application for Patent, Serial No. 60/987,798, filed November 14, 2007, and is also related to commonly-owned U.S. Patent Applications no. 10/610,449, filed June 30, 2003, and titled "Feedback Reducing Receiver Mount and Assembly," and no. 10/945,704, filed September 21, 2004, and titled "Feedback Reducing Receiver Mount and Assembly," all incorporated herein by reference.

Background and Summary of the Invention

[0002] A receiver tube for a hearing instrument receiver, the component that generates the sound heard by the user of the hearing instrument, connects the output of the receiver with the outside of the shell, conveying the sound from the receiver to the user's inner ear. To accommodate a wax guard and provide a secure attachment for the receiver, the receiver tube may be configured as a composite of a tube, a cup, an insulator, and a flange that mates with the receiver. An insulator fashioned from a compliant material minimizes vibration that may be induced into the shell by the action of the receiver.

Brief Description of the Drawings

[0003]

Figure 1 is a cross-sectional view of a composite receiver tube;
 Figures 2 and 3 are drawings of an insulator for a composite receiver tube;
 Figures 4 and 5 are drawings of a flange for a composite receiver tube; and
 Figure 6 illustrates a composite receiver tube within a shell residing in the ear canal of the user.

Description of the Invention

[0004] A composite receiver tube 10 for a hearing instrument receiver 20, is shown in Figure 1, with the receiver 20 drawn partially in phantom. The composite receiver tube 10 in Figure 1 comprises four elements: a tube 30, a cup 40, an insulator 50, and a flange 70 that mates with the receiver 20. The cup 40 and the flange 70 help facilitate the manufacturing and assembly of the composite receiver tube, but may be omitted.

[0005] The tube 30, the cup 40, and the insulator 50 may have a circular cross section or a cross section of some other shape as desired. The flange 70 provides a physical or mounting interface between the insulator 50 and the receiver 20. As shown in Figures 1 and 4, the flange 70 may have an optional curved section 72 conforming to the receiver 20. The flange 70 may be secured

to the receiver 20 with an adhesive or by spot-welding, or a combination of the two.

[0006] The tube 30 may be fabricated from a synthetic material such as an elastomer or any other suitable material. One such elastomer is marketed by DuPont Dow Elastomers, L.L.C. under the trademark Viton. A Viton elastomer having a hardness rating of 50 on the Shore A scale will be suitable.

[0007] The tube 30 resides in the cup 40, which in turn resides in a recess 52 in the insulator 50. The cup 40 may be fabricated from a metal such as steel or any other suitable material. As depicted here, the cup 40 and the conforming recess 52 are cylindrical, but they could easily assume a different shape. The tube 30 may be secured to the cup 40 with an adhesive.

[0008] In addition to the recess 52 for the cup 40, the insulator 50 has a sound channel 54 (Figure 2). As illustrated in Figures 2 and 3, the insulator 50 has a flared section 56 that widens out towards the flange 70. The flared section 56 reduces the rigidity of the insulator 50 and increases the compliance of the insulator 50. The flared section 56 may assume a variety of shapes, including conical, hyperboloidal (technically, one half of a hyperboloid), and paraboloidal.

[0009] A facing 58 on the flared section 56 (Figures 2 and 3) provides a surface which mates with the flange 70. The facing 58 may have a curved surface 60 that conforms to the curved section 72 of the flange 70 (Figure 4), terminating in a lip 62. An opening 74 in the flange 70 (Figures 4 and 5) connects the sound channel 54 of the insulator 50 with the opening (not shown) of the receiver 20.

[0010] The insulator 50 may be fabricated in an injection-molding process, incorporating the cup 40 and the flange 70 during the process as appropriate. The insulator 50 may be made from a soft, rubberlike material such as a fluorosilicone having a hardness rating of 20-30 on the Shore A scale. Compared to the tube 30, the insulator 50 exhibits greater compliance. As noted above, the compliant effect of the insulator 50 is further enhanced by the flared section 56.

[0011] If desired, the inner-ear side 64 of the insulator 50 could be connected directly to tube 30 while the receiver side 66 of the insulator 50 could be affixed directly to the receiver 20, foregoing the cup 40 and the flange 70, respectively. Where the cup 40 is omitted, the recess 52 on the inner-ear side 64 of the insulator 50 may be sized to the outer dimensions of the tube 30.

[0012] The composite receiver tube 10 and the receiver 20 are shown within a shell 80 (shown in phantom), residing in the user's ear canal 90 in Figure 6. The tube 30 passes through the wall 82 of the shell 80. Optional mounting brackets 100, anchored within the shell 80 and attached to the insulator 50, and supporting the composite receiver tube 10 within the shell 80, are illustrated schematically. After the composite receiver tube 10 has been installed in the shell 80, the end 32 of the tube 30 protruding from the shell 80 is typically trimmed flush with

the outer surface 84 of the shell 80.

Claims

1. A composite receiver tube for conveying the output
of a hearing instrument receiver in a hearing instru-
ment comprising a shell, the shell comprising a wall,
to a user's inner ear, comprising:

a tube connected to the user's inner ear, the
tube passing through wall of the shell; and
an insulator, the insulator comprising

a surface for mating with the tube;
a surface for mating with the receiver; and
a sound channel connecting the tube with
the receiver.
2. A composite receiver tube as set forth in claim 1,
where the insulator comprises material exhibiting a
greater compliance than the compliance of the tube.
3. A composite receiver tube as set forth in claim 1,
where the insulator comprises a flared section posi-
tioned between the tube and the receiver.
4. A composite receiver tube as set forth in claim 3,
where the flared section comprises a conical, half-
hyperboloidal, or paraboloidal shape.
5. A composite receiver tube as set forth in claim 1,
further comprising a flange positioned between the
insulator and the receiver, where the flange compris-
es an opening connecting the sound channel of the
insulator with the receiver.
6. A composite receiver tube as set forth in claim 1,
where the insulator comprises a recess and further
comprising a cup positioned in the recess, where the
cup receives the tube.

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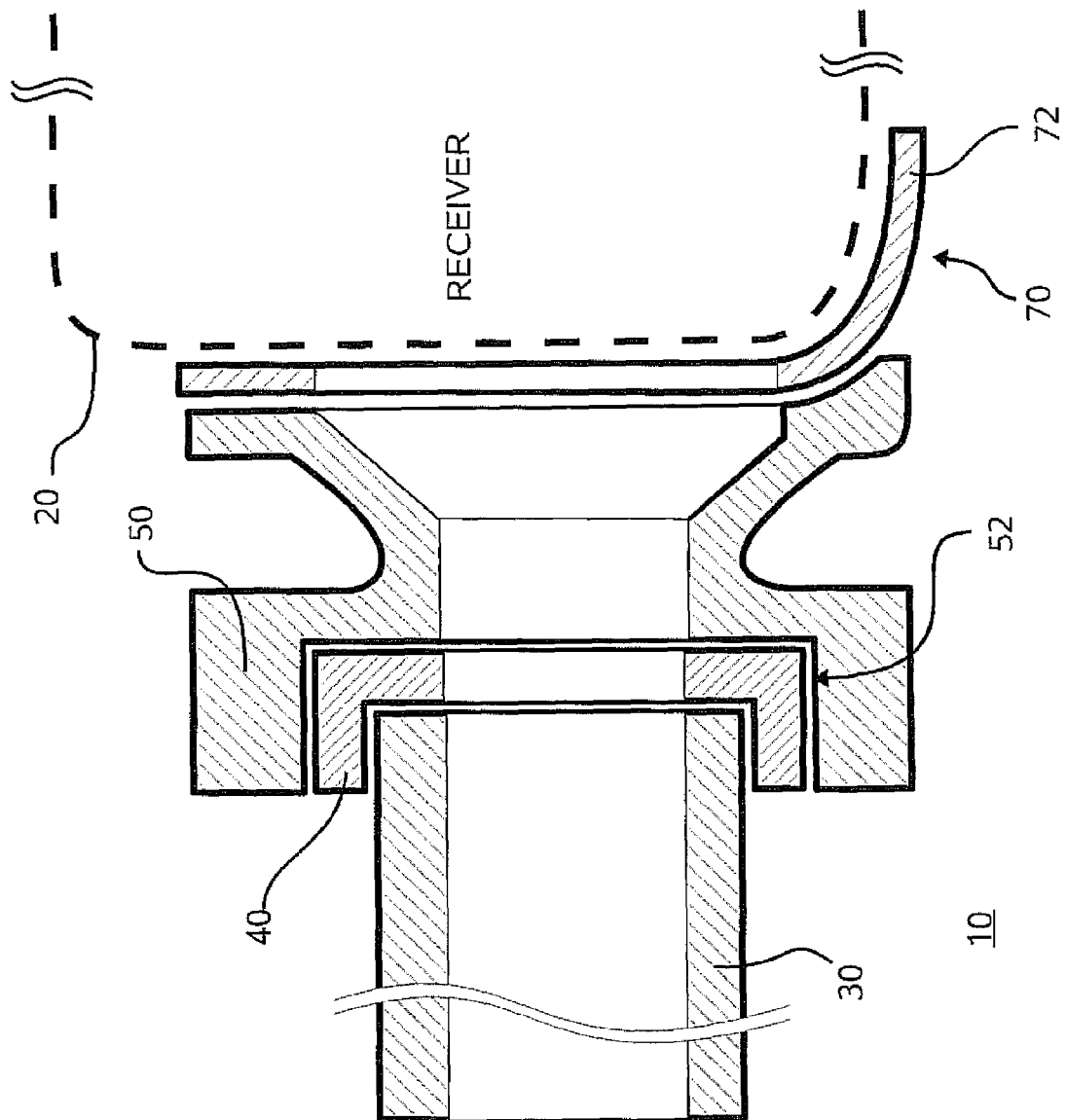


Fig. 1

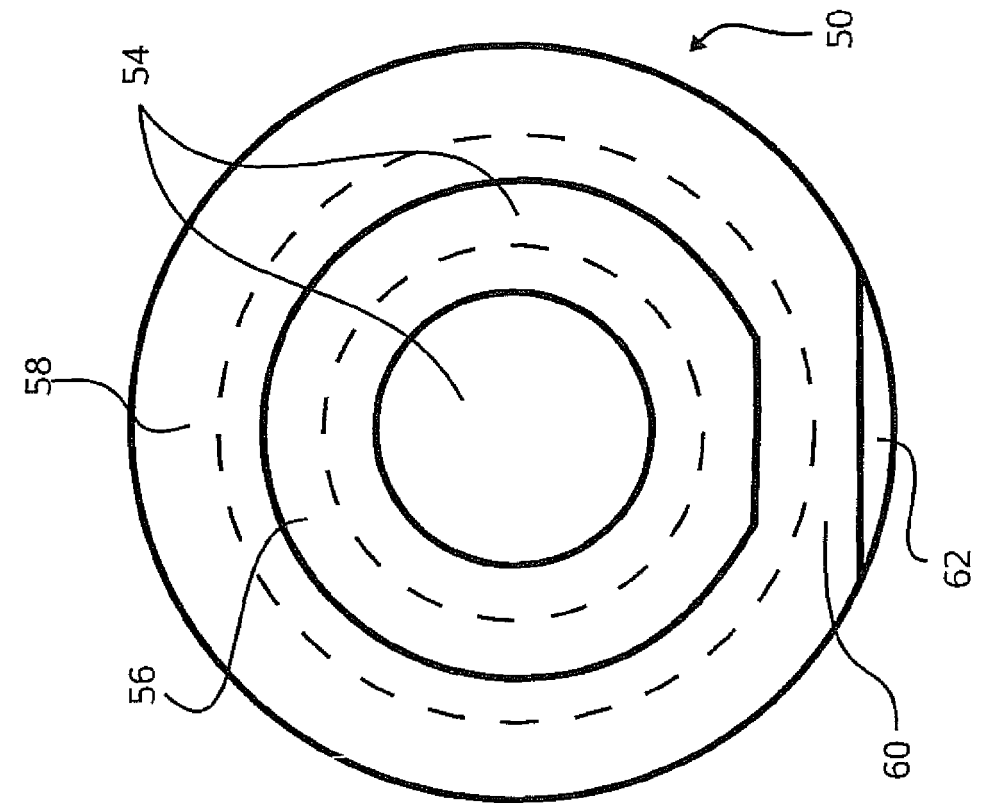


Fig. 3

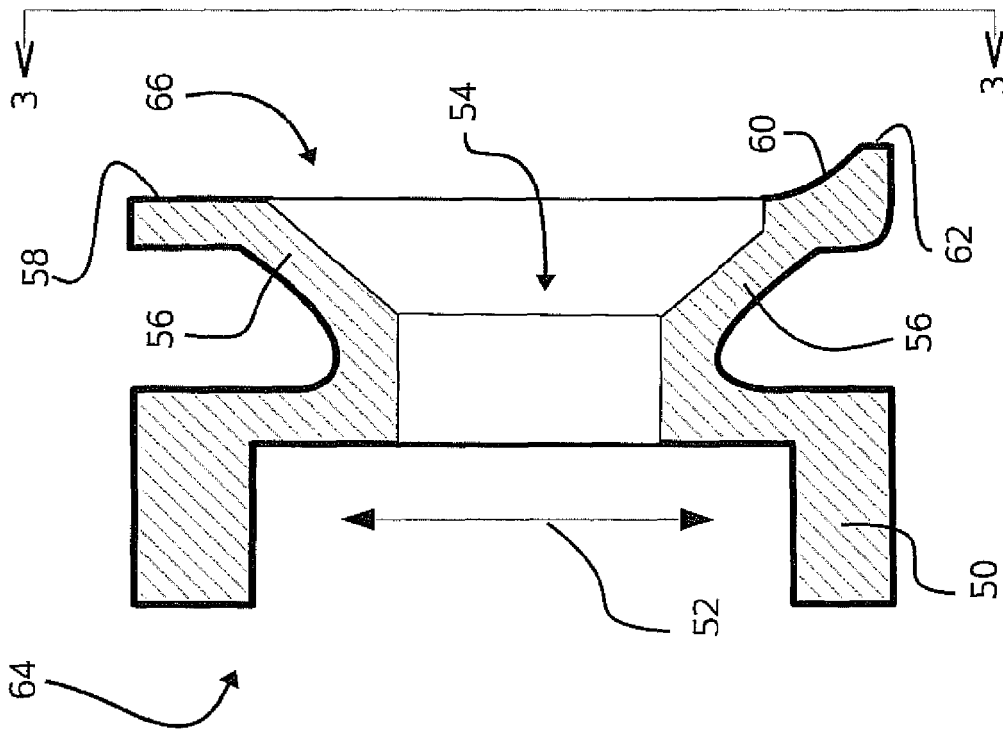
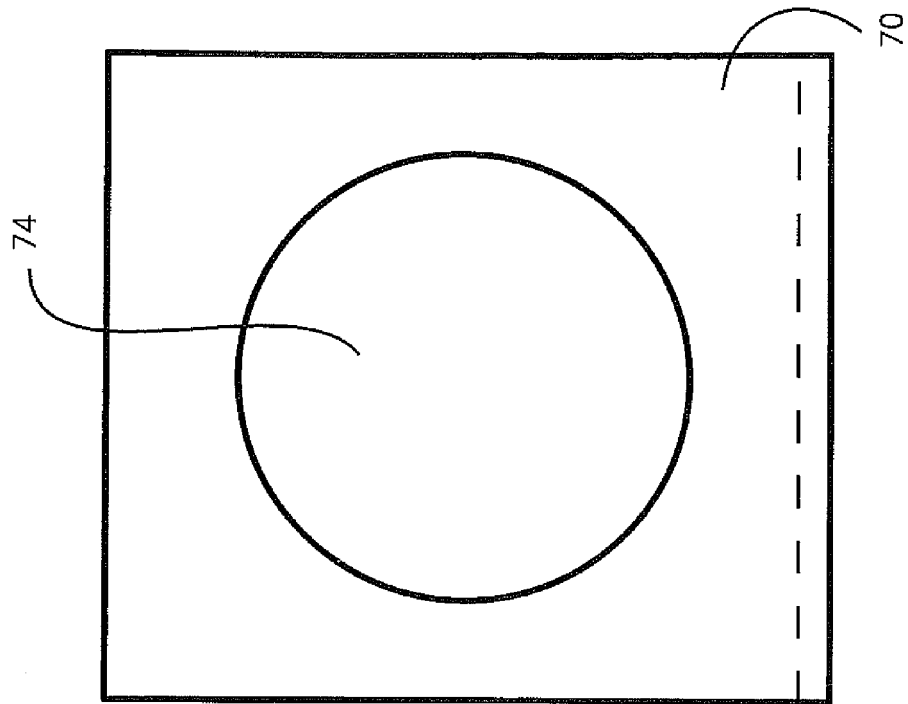
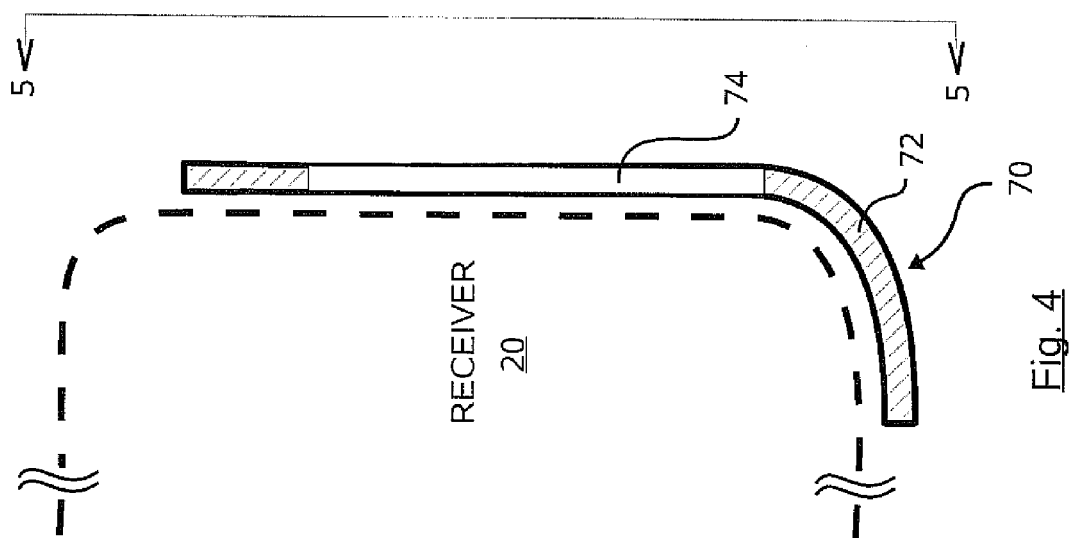


Fig. 2



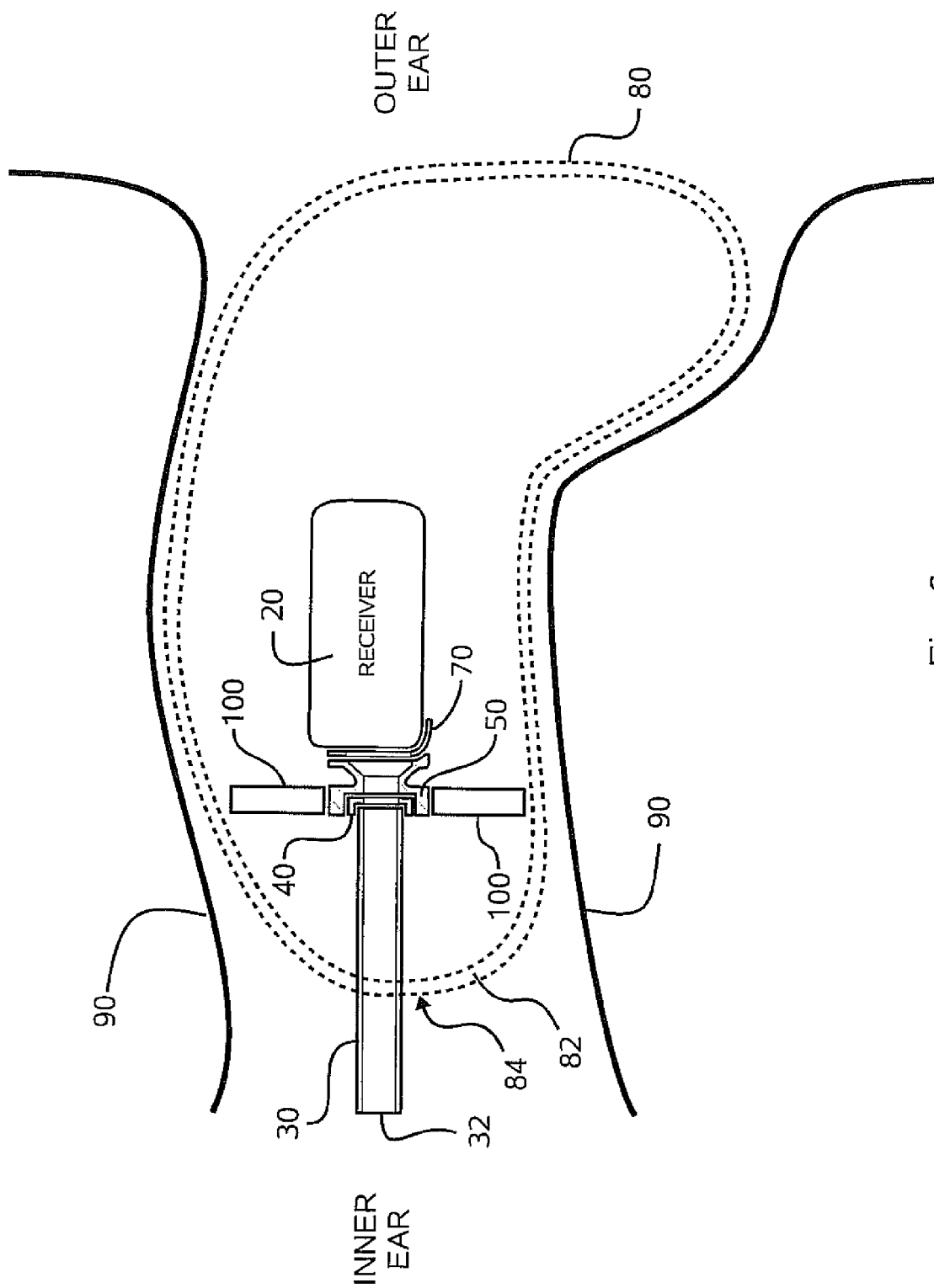


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 98779807 P [0001]
- US 61044903 A [0001]
- US 10945704 B [0001]