

**INDUSTRY-UNIVERSITY
COOPERATION FOUNDATION
KYUNGPOOK NATIONAL UNIVERSITY**

Title (Name of Technology)

Trans-tympanic Transducer and Implantable Hearing Aid System Using the
Same

Executive Summary

Dr. Jin-Ho, Cho, a professor of Kyungpook University, has developed trans-tympanic membrane transducer and an implantable hearing aid system that are very interesting in terms of efficacy, safety and commercializing potential.

About 15% of the world population has mild to severe hearing loss, and a majority of people with hearing loss or hearing impaired people uses a hearing aid. However, every person wearing a hearing aid complains of inconvenience without exception. A large number of the hearing impaired people do not wear the hearing aid after he/she purchased it.

In this system, a miniature magnet is implanted perpendicularly in the little gap or hole incised purposely on the tympanic membrane and after the magnet is fixed through natural healing of the tympanic membrane. Then, AC magnetic field corresponding to sound signal is applied from a position adjacent to the magnet so as to vibrate the tympanic membrane, thereby remarkably improving sound qualities of a receiver, which would otherwise be limited to high frequency band in the prior art.

② Industry Sector: 1. Academic/Research (Medical device) 7. Medical device (Auditory aid equipment), 8. Non-profit org./Government (universities)

③ Therapeutic Target: 20. Sensory Organ (Hearing disorder)

④ Development phase: early stage

⑤ Type of business relationship sought (including licensing availability): development collaboration, or non-exclusive or exclusive licensing agreement

Key Technology Highlights

□ Vibration Efficiency of High Frequency Signals

one or a plurality of miniature magnet is implanted perpendicularly to the boundary of the tympanic membrane so as to extend through a portion of the tympanic membrane, and alternating magnetic field corresponding to sound signal is applied using the miniature magnet so as to vibrate the tympanic membrane, thereby increasing the vibration efficiency of high frequency signals.

□ Much Easier Operation and Less Damages of The Ossicle

It is much easier, in view of operation, to implant the magnet in the tympanic membrane than in the umbo. This also less damages the ossicle where many veins are present.

□ Preventing for Producing Strong Sound and Turning Up Volume of The Hearing Aid To The maximum

This, as an effect, can compensate for the hearing ability of people with moderate or moderate severe hearing loss and, in part, of people with severe hearing loss.

□ Application for A Totally- or Partially-Implantable Middle ear

The trans-tympanic membrane hearing aid system of the present invention is also applicable to a totally- or partially-implantable middle ear, which uses a floating mass transducer.

□ Protecting for The Tympanic Membrane From Risk Such As Noise

A differential magnet can be implanted on the tympanic membrane so as to protect the tympanic membrane from risk such as noise caused by a great external magnetic field.

■ IP Owner Summary

Industry-University Cooperation Foundation Kyungpook University

- TLO in Kyungpook University

■ Personal Description of Researcher

□ Name

Jin-Ho, Cho, Ph.D

□ Present Position

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Technology Overview

● Technology Platform

The core technology of Kyungpook University is to provide promising a trans-tympanic membrane transducer and an implantable hearing aid system using the same. More particularly, the trans-tympanic membrane transducer of the present invention can vibrate the tympanic membrane using a miniature magnetic member perpendicularly extending through a portion of the tympanic membrane and a coil implanted adjacent to the magnet to generate alternating magnetic field corresponding to sound signal, so as to remarkably improve sound qualities in high frequency bands, which are hardly achievable by a conventional air conduction hearing aid, and can also overcome difficulty, inconvenience and risk associated with a conventional operation that implants a miniature magnet on the surface of the tympanic membrane or on an auditory organ such as the ossicle in the middle ear.

Background and unmet needs: ReSound, a hearing aid manufacturer in USA, proposed another type of hearing aid in 2000. In this hearing aid, a thin dish of polymer having a magnet in the center thereof is attached, with a diameter less than 5mm, to the surface of the tympanic membrane by the side of the auditory ear canal, and the tympanic membrane is vibrated using an outside driving coil.

In this technique, however, the magnet has to be closely attached to various types of tympanic membranes of individuals. It is also troublesome to form a contact lens shaped round polymer membrane, customized to the curvature of the tympanic membrane, which is previously measured. Further, oil or like is periodically filled in order to continuously maintain the close attachment.

In order to satisfy these objects, implantable middle ears have been developed in recent years. However, this type of implantable middle ear is a hearing aid that is generally implanted in patients with moderate or severe hearing loss through an operation of two (2) hours or more.

Discovery and Achievements: A trans-tympanic membrane transducer and an implantable hearing aid system of Kyungpook University has been developed on the basis of ideas that the trans-tympanic membrane transducer vibrates the tympanic membrane using a miniature magnetic member perpendicularly extending through a portion of the tympanic membrane and a coil implanted adjacent to the magnet to generate alternating magnetic field corresponding to sound signal, so as to remarkably improve sound qualities in high frequency bands, which are hardly achievable by a conventional air conduction hearing aid.

This overcomes difficulty, inconvenience and risk associated with a conventional operation that implants a miniature magnet on the surface of the tympanic membrane or on an auditory organ such as the ossicle in the middle ear.

Hereinafter, a trans-tympanic membrane transducer and an implantable hearing aid system using the same will be described more as follows;

1. An implantable transducer comprising:

a pair of flange covers;

a magnetic member coupled between the flange covers; and

a casing member coupled between the flange covers with the magnetic member received therein the casing member,

wherein the transducer extends through a tympanic membrane when implanted.

2. An implantable hearing aid system comprising:

a transducer extending through a tympanic membrane,

wherein the transducer comprises a pair of flange covers; a magnetic member coupled between the flange covers; and a casing member coupled between the flange covers with the magnetic member received therein.

3. An implantable hearing aid system comprising:

a transducer extending through a tympanic membrane, wherein the transducer comprises a pair of flange covers, a magnetic member coupled between the flange covers, and a casing member coupled between the flange covers with the magnetic member received therein;

an insert unit disposed in an auditory ear canal and spaced apart from the transducer at a predetermined distance, so as to vibrate the transducer in response to signals supplied from outside; and

a hearing aid body connected to the insert unit through a conducting line so as to send the signals to the insert unit.

FIG. 1 is a perspective view of the trans-tympanic membrane transducer, which is perpendicularly implanted to a boundary portion of the tympanic membrane.

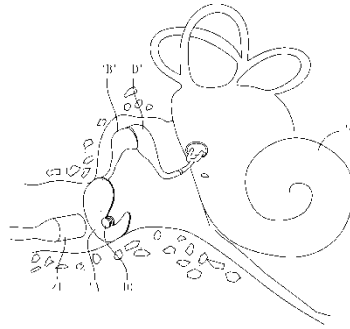
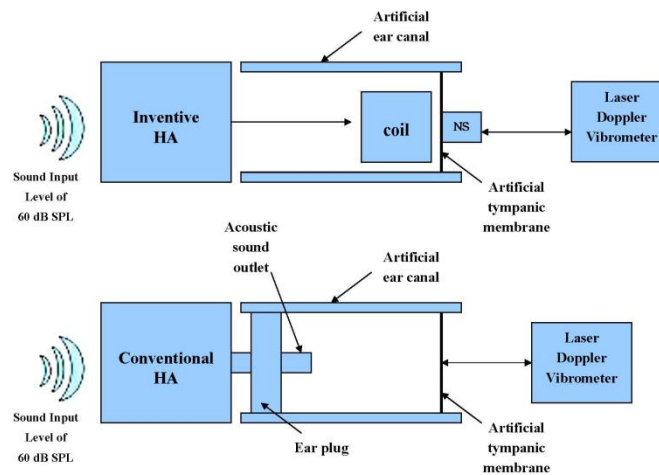


FIG. 2 illustrates comparative experiments using an implantable hearing aid system having a trans-tympanic membrane transducer of the technology and a conventional hearing aid.



Key Features and Advantages:

(1) Vibration Efficiency of High Frequency Signals

one or a plurality of miniature magnet is implanted perpendicularly to the boundary of the tympanic membrane so as to extend through a portion of the tympanic membrane, and alternating magnetic field corresponding to sound signal is applied using the miniature magnet so as to vibrate the tympanic membrane, thereby increasing the vibration efficiency of high frequency signals.

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(4) Application for A Totally- or Partially-Implantable Middle ear

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(5) Protecting for The Tympanic Membrane From Risk Such As Noise

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Patents and Publications

Kyungpook has filed application with United States of America(USA) and Korea regarding novel trans-tympanic membrane transducer and an implantable hearing aid system using the same.

TABLE. List of Patents for Novel Magnetic Resonance Imaging Contrast Agents

| Country | Appln. No. | Status | Description |
|---------|-------------|---------|--|
| Korea | 2007-002461 | Pending | Trans-Tympanic Membrane Transducer and An Implantable Hearing Aid System Using The Same |
| USA | 12/261,510 | Pending | Trans-Tympanic Membrane Transducer and An Implantable Hearing Aid System Using The Same |