Aug. 28, 1934. A. VON SUCHORZYNSKI 1,971,630

ELECTRIC HEARING APPARATUS FOR THE DEAF

Filed Dec. 4, 1931

Fig. 1.

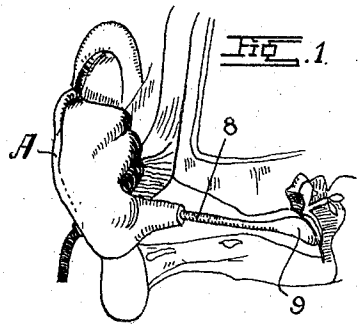


Fig. 2.

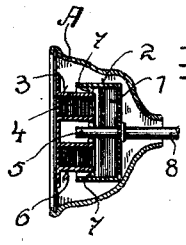


Fig. 3.

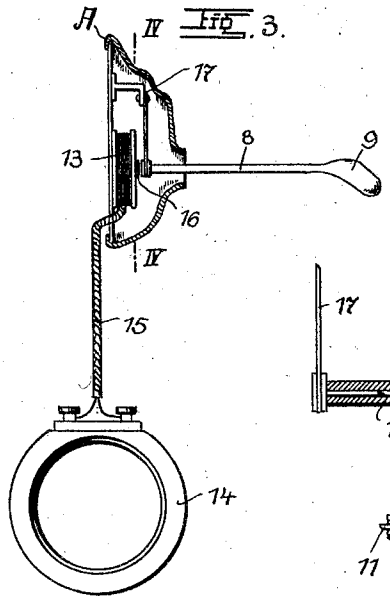


Fig. 4.

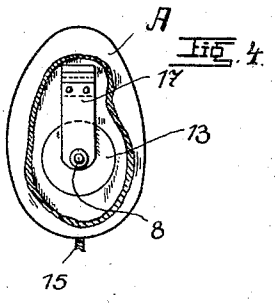


Fig. 5.

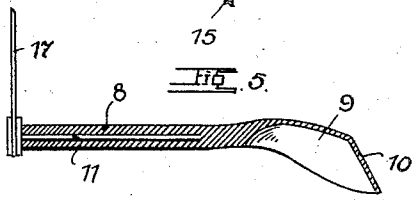
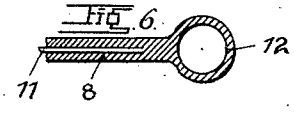


Fig. 6.



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Patented Aug. 28, 1934 1,971,630

UNITED STATES PATENT OFFICE

1,971,630

ELECTRIC HEARING APPARATUS FOR THE DEAF

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Application December 4, 1931, Serial No. 578,963
In Germany February 17, 1931

5 Claims. (Cl. 179—107)

All known electric hearing apparatuses transmit the sound waves like a telephone through the air in the ear passage on to the tympanum of a deaf person. In most cases sclerose, that is cartilaginification or calcination of the joints of the auditory ossicles is the cause of the deafness. The auditory ossicles have more or less lost their normal capability of vibrating, so that speech and musical sounds are more or less indistinctly heard by the deaf person. Greater intensity of sound of the known electrical hearing apparatuses cannot overcome this objection, and consequently many deaf persons have no appreciable advantage from these hearing apparatuses.

The present invention overcomes this objection in that the air in the auditory passage does not serve as sound transmitter, but instead of same an elastic thin element is fitted in the space of the auditory passage in direct contact with the tympanum and with the auditory ossicles and transmits the vibrations of the electric apparatus. These vibrations are first transformed into sound waves by the tympanum, conducted through the chain of the auditory ossicles to the labyrinth and only then perceived as sound by the auditory nerves. At the same time an automatic permanent massage takes place so that the joints of the auditory ossicles are gradually loosened and rendered more movable. As soon as this has been attained, the distinguishing sharpness of speech and music will increase, and the deaf person will hear more distinctly.

As is known, the vibrations of a struck tuning fork, the handle of which is held on the head bones or on good teeth of a deaf person, are easily perceived as tone by the auditory nerves of this person. This proceeding is called a molecular sound transmission through the bone mass of the head to the hearing nerves of the labyrinth. It is easily apparent that a vibrating elastic body can transmit the sound waves more strongly and better by means of contact with the tympanum and the auditory ossicles than in the contact with the head bones. A contact with the cartilageous labyrinth wall, in the event of the auditory bones being lacking and with tympanum removed by operation, would, nearer the hearing nerves, be considerably more effective than through the head bones.

Two pot-shaped magnets are preferably employed as magnet, which are slipped the one over the other with their coils, the smaller magnet serving as armature, which is elastically mounted by means of rubber rings in recesses in the edge as close as possible to the larger pot-shaped magnet. The two magnets are situated with their like poles opposite, so that in the case of like directed electric currents the magnets mutually repel one another, whereby the electric vibrations of the armature without diaphragm with the thin rod moved thereon become effective corresponding to the sound reception of the microphone.

Several embodiments of the invention are illustrated by way of example in the accompanying drawing in which:—

Fig. 1 shows the hearing apparatus inserted in the ear, the hearing apparatus being in side elevation and the ear in section.

Fig. 2 shows the hearing apparatus in a central vertical section, a pot-shaped magnet being used.

Fig. 3 is a longitudinal central section of a simpler form of magnet.

Fig. 4 is a section on line IV—IV of Fig. 3.

Fig. 5 is a longitudinal section, showing a special construction of the rod.

Fig. 6 is a longitudinal section of a special form of construction of the portion of the rod bearing against the tympanum.

In the drawing the apparatus has a cap A adapted to the shape of the shell of the ear, so that it is tightly held in the ear. In this cap a pot-shaped magnet is arranged, the coil 1 of which acts as armature, the pot 2 being slipped over the pot 3 of a magnet coil 4. A bolt 5 of the armature coil 1 projects into a sleeve 6 of the magnet coil and between the pot 2 and the pot 3, rubber rings 7 being also provided between the sleeve 6 and the bolt 5 in corresponding grooves in the mutually shiftable parts so that the shiftable parts are elastically mounted the one relative to the other. The like poles of the two magnets 1 and 4 are directed the one towards the other so that in the event of like directed electric currents the magnets must repel one another with double force. A rod 8 leading to the tympanum is fixed on the armature magnet 1. This resilient rod 8 terminates, in the construction illustrated in Figs. 1 to 5, in a spoon 9, the raised portion of which is constructed as a conical point 10, the conicity of the spoon being smaller than the conicity of the natural tympanum. A rubber rod is preferably used as resilient rod, and according to the form of construction illustrated in Figs. 5 and 6 a steel wire is embedded in the rubber rod 8. This steel wire makes it possible, to give to the rubber rod 8 any desired curvature and angular position adapted to the auditory passage in a simple manner, the rod 8 then retaining this position.

This steel wire 11 only extends so far towards the spoon 9 that the elasticity of the spoon is ensured at the bend.

In the form of construction illustrated in Fig. 6, the rubber rod 8 terminates in a spherical hollow body 12. This construction enables an effective contact of the rubber rod with the long labyrinth wall, in the event of the tympanum and the auditory bones being lacking.

In the form of construction illustrated in Fig. 3 a simple electromagnet 13 is arranged in the cap and is brought into conductive connection with a microphone 14, by means of a cable 15, and an armature 17 is resiliently suspended in front of the core 16 of the electromagnet 13, on which armature the resilient rod 8 is fixed.

In all the different constructions of the resilient rod 8 and its bearing element 9, 12, the rod is fixed on the armature 1 or 17 so that the oscillations of the armature, caused by the current impulses occurring in the electromagnets, are transmitted to the tympanum and the auditory bones in their full extent through the intermediary of the rod 8.

I claim:—

1. An electric hearing apparatus for the deaf, comprising in combination a telephone, consisting of a magnet and a shiftable armature, and a thin resilient rod fixed on said armature adapted to be inserted into the space of the auditory passage up to the tympanum and to contact with this latter, to transmit the movements of said armature to the auditory members of the ear, and a rubber packing between said armature and said magnet adapted to resiliently support said armature on said magnet and to resiliently limit the amplitude of oscillation of said armature.

2. An electric hearing apparatus, comprising in combination a small pot having an external annular groove, a large pot loosely slipped over said small pot and having an internal annular groove, two coils one in each of said pots adapted to mutually attract and repulse each other to impart oscillating movements to said large pot, a thin resilient rod on said large pot adapted to be inserted in the space of the auditory passage up to the tympanum and to contact with this latter to impart the oscillating movements of said large pot thereto, and a rubber ring arranged in the annular grooves in said pots adapted to resiliently connect said two pots.

3. An electric hearing apparatus as specified in claim 1, comprising in combination with the resilient rod, a small spoon-shaped body terminating in a conical point of smaller conicity than the conicity of the natural tympanum to obtain a good contact with the tympanum.

4. In an electric hearing apparatus as specified in claim 1 the resilient rod comprising in combination a thin bendable steel wire adapted to be bent to the shape of the ear passage, and a rubber case surrounding said wire and adapted to form a resilient contact with the auditory member of the ear.

5. In an electric hearing apparatus as specified in claim 1, the rod comprising in combination a bendable wire adapted to be bent to the shape of the ear passage, a rubber case surrounding said wire, and a hollow spherical extension on the end of said case adapted to form a resilient bearing against the auditory members of the ear.

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