Sept. 15, 1931. P. F. APFEL 1,823,228

AUDIPHONE

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FIG. 1.



FIG. 4.



FIG. 2.

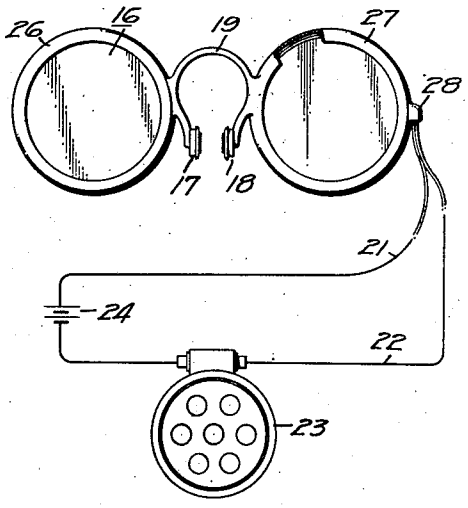


FIG. 5.

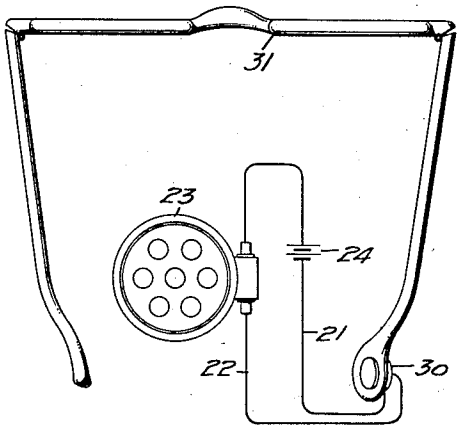


FIG. 6.

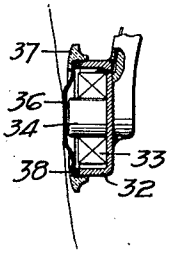
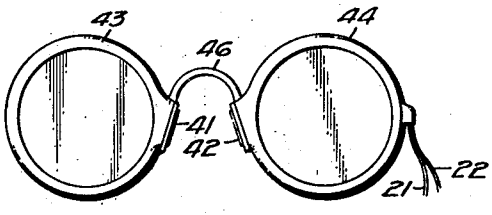


FIG. 3.



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FIG. 7.

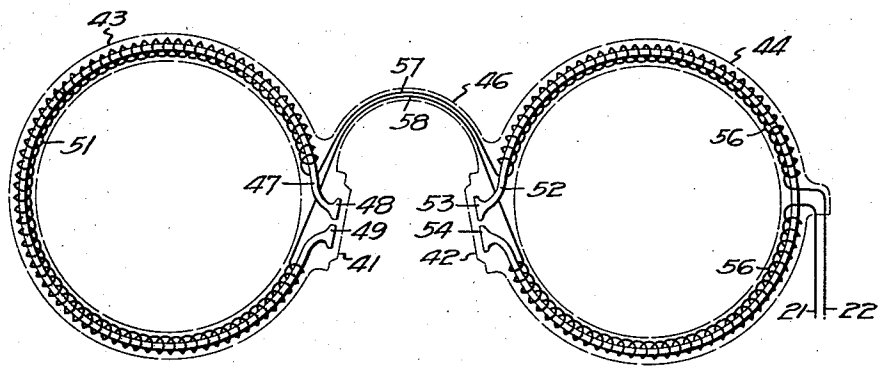


FIG. 8.

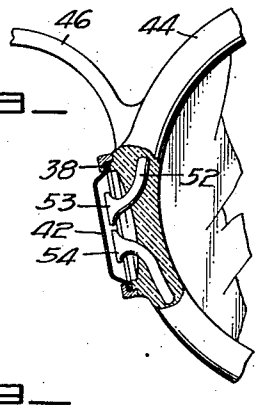
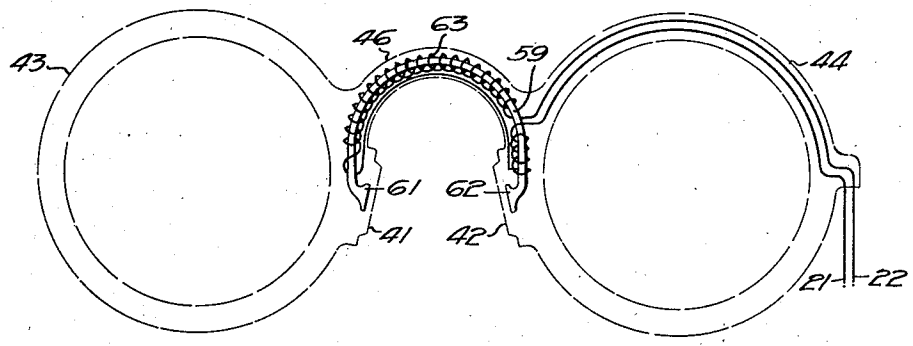


FIG. 9.



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UNITED STATES PATENT OFFICE

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AUDIPHONE

Application filed January 20, 1931. Serial No. 509,970.

This invention relates to telephonic devices for enabling deaf persons to hear, commonly known as audiphones.

Frequently, deafness is not accompanied by impairment of the auditory nerve and is due solely to defects in the ear structure. If sound vibrations can be made to act on the auditory nerve in such cases, hearing will be possible. I have found that if a vibrating member be placed in contact with one or more bones of the head, such as the mastoid temporal bone or the nasal bone, the vibrations will be effectively transmitted through the bones of the head to the auditory nerve. Prior devices for aiding the hearing have been awkward and cumbersome in appearance and for this reason have been a source of great inconvenience to users. The parts of my device which are exposed to view can have the appearance of a pair of eye-glasses or can be combined with a pair of eye-glasses, thus eliminating the disadvantages in appearance of devices heretofore known.

It is one object of my invention to provide a novel device for transmitting sound through the bones of the head to the auditory nerve.

Another object is to provide a device of this character which can be supported by the frame of a pair of eye-glasses in such a manner that its presence will not be noticed without close scrutiny.

These and other objects and advantages are attained in the embodiments of the invention illustrated in the accompanying drawings, in which:

Fig. 1 illustrates the appearance of one embodiment of my invention when in use, the device shown being in the form of pince-nez eye-glasses.

Fig. 2 is a front view of the device shown in Fig. 1, illustrating also the manner in which the device can be connected to a suitable microphone.

Fig. 3 is a modification of the pince-nez type of the device.

Fig. 4 illustrates a modification of my invention as applied to a pair of bow type eye-glasses.

Fig. 5 is a top view of the device illustrated in Fig. 4, together with a microphone.

Fig. 6 is a detail cross sectional view of the receiving mechanism of the device shown in Figs. 4 and 5.

Fig. 7 is a diagrammatical view of the modification shown in Fig. 3.

Fig. 8 is a detail view, partly in section, of the vibratory member of the modification shown in Fig. 3.

Fig. 9 is a front view of a modification having electromagnetic means mounted in the nose bridge of a pair of eye-glasses.

In its preferred form the invention comprises a vibratory member disposed adjacent to or in intimate contact with one of the bones of the head and electromagnetic means for vibrating said member in accordance with sound waves. Preferably, the vibratory member is mounted on a pair of eye-glasses in such a position that it is practically unnoticeable, parts of the device being disposed within the bows, rims, or nose bridge of the eye-glasses.

Referring now to the drawings, and first to Figs. 1 and 2 thereof, I have shown an audiphone associated with a pair of eye-glasses 16 of the pince-nez type. A pair of miniature receiving devices 17 and 18 are mounted on nose bridge 19 of eye-glasses 16 and are preferably so disposed that the vibratory member of each receiver bears against the nasal bone of the wearer.

Electrical conductors 21 and 22 are employed for connecting receivers 17 and 18 in an electrical circuit with a microphone 23, or other suitable sound pick-up device, and a source of current, such as a battery 24, can also be included in the circuit. The rims 26 and 27 of the eye-glasses can be made of moldable material and conductors 21 and 22 leading to the receiver can be embedded therein. If desired, however, the rims can instead be made hollow or have a groove therein to form a conduit for the conductors. Nose bridge 19 of the eye-glasses can be formed in any desired manner and is preferably provided with a groove or is made hollow to hide the parts of the conductors extending between receivers 17 and 18. Microphone 23 is adapted

to be secured in the usual manner on the chest of the user and the visible portions of conductors 21 and 22 extending to the microphone are preferably covered by a suitable ribbon and can enter the eye-glasses near one end 28.

In the operation of the device illustrated in Figs. 1 and 2, sound waves impinging on microphone 23 set up corresponding current variations in conductors 21 and 22 which cause the vibratory members of receivers 17 and 18 to vibrate in accordance therewith in a manner well known in the art. These vibrations are impressed on the nasal bone of the wearer and are transmitted from this bone through other bones of the head to the auditory nerve. Where the hearing of a person is only partially impaired, some sound will also reach the auditory nerve through the ears, thus reinforcing the sound from the audiphone. Prior devices of this character commonly employed a receiver which was placed over or in the ear, thereby obstructing passage of all sounds through the ear except that from the receiver. With my device the sound passages of the ear are left unobstructed and the sounds from the audiphone are added to the sounds received naturally, rather than being substituted therefor.

It is not necessary that the receiving device of the audiphone be placed adjacent the nasal bone and, if desired, this part of the device can be located in a position where it bears against some other bone of the head. For example, in Figs. 4 and 5 I have shown a receiver 30 mounted on one of the bows of a pair of eye-glasses 31 in such a position that it abuts against the mastoid temporal bone directly behind the ear. This arrangement is particularly suitable for women, since the receiver can be effectively hidden by the hair. It is to be understood that a receiver of this type can be placed on the ends of either one or both bows of the eye-glasses, as may be desired.

In Fig. 6 I have shown in detail one form of receiving device which is suitable for use in the embodiments illustrated in Figs. 2 and 5. Disposed within a casing 32 is an electromagnet comprising a coil 33 and a core 34 of magnetic material. Preferably core 34 is permanently magnetized. Disposed adjacent the electromagnet is a diaphragm 36 which can be held in place by a flanged annular ring 37 having a threaded engagement with casing 32. If desired, diaphragm 36 can be dished outwardly as shown, in order to make more intimate contact with the surface against which its rests. Diaphragm 36 is adapted to be vibrated in accordance with the sound waves in a manner well understood in the art. For enabling greater movement of diaphragm 36 an annular resilient member 38, of soft rubber or the like, can be disposed between the peripheral edge of diaphragm 36 and casing 32 on one or both sides of the diaphragm.

In Fig. 3 I have shown a modification in which a pair of diaphragms 41 and 42 of magnetized material are adapted to be actuated by an electromagnet or a plurality of electromagnets hidden within the frame of a pair of eye-glasses. The electromagnets can be disposed within the rims 43 and 44 of the eye-glasses or within the nose bridge 46.

Fig. 7 illustrates one construction of the device when the rims of the eye-glasses are employed to house the electromagnets. Rims 43 and 44 of the eye-glasses can be molded about the electromagnets which preferably have a shape corresponding to that of the rims. For actuating diaphragm 41 I have shown an electromagnet provided with a core 47 of generally circular shape having enlarged ends 48 and 49 which constitute the pole pieces of the magnet and about core 47 a coil 51 is wound having a relatively large number of turns.

The electromagnet for vibrating diaphragm 42 is of similar construction and comprises a core 52 having poles 53 and 54 and about which is wound a coil 56. Preferably, coils 51 and 56 of the respective electromagnets are connected in series by conductors 57 and 58 extending through the nose bridge of the eye-glasses. By this construction the receiving apparatus of the audiphone simulates the appearance of a pair of ordinary eye-glasses. The weight of the device is relatively small and is well distributed, thereby eliminating the annoying discomfort of prior devices of this nature which usually are provided with a receiver which is adapted to be placed over or within the ear.

When it is desired to employ the nose bridge of a pair of eye-glasses for housing the electromagnetic means, the device can have a construction similar to that illustrated in Fig. 9. The core 59 of the electromagnet is approximately horse-shoe shaped and the poles 61 and 62 thereof can each be disposed adjacent one of the diaphragms 41 or 42. The coil 63 of the electromagnet can be embedded in the nose bridge when the same is made of moldable material, or if desired, the nose bridge can be made tubular and the electromagnet can be encased therein. Conductors 21 and 22 can be embedded or encased in one or both of the rims of the eye-glasses and extend to the microphone of the device as heretofore described.

It is to be understood that any suitable microphone or other pick-up device can be employed with the audiphone, and if desired, suitable amplifying means can be utilized for amplifying the sounds to be received.

While I have shown and described certain preferred embodiments of my invention, I do not wish to be limited thereto, since the invention as defined in the appended claims can be embodied in a plurality of other forms.

I claim:

1. In an audiphone of the character described, a frame adapted to be worn before the eyes, a vibratory member mounted on said frame and an electromagnet for vibrating said member, said electromagnet being disposed within said frame.

2. In an audiphone of the character described, a frame adapted to be worn before the eyes, a vibratory member mounted on said frame, said member adapted to abut against one of the bones of the wearer's head, and electromagnetic means for vibrating said member in accordance with sound waves, said electromagnet means being disposed within said frame.

3. In an audiphone of the character described, a frame adapted to be worn before the eyes, a vibratory member mounted on said frame adapted to abut against the wearer's nasal bone and electromagnetic means for vibrating said member, said electromagnetic means being secured to said frame.

4. In an audiphone of the character described, a frame adapted to be worn before the eyes, said frame having a pair of rims and a nose bridge, a vibratory member mounted on said frame adapted to abut against the wearer's nasal bone, and electromagnetic means for vibrating said member, said electromagnetic means being disposed within said nose bridge.

5. In an audiphone of the character described, a frame adapted to be worn before the eyes, said frame having a pair of rims and a nose bridge, a vibratory member mounted on said frame adapted to abut against the wearer's nasal bone, electromagnetic means for vibrating said member, said electromagnetic means being disposed on said nose bridge, and electrical conductors for said electromagnet means, said conductors being encased within one of the rims of said frame.

6. In an audiphone of the character described, a frame adapted to be worn before the eyes, said frame having a pair of rims and a nose bridge, a vibratory member mounted on said frame adapted to abut against the wearer's nasal bone, electromagnetic means for vibrating said member, said electromagnet means being disposed within one of the rims of said frame.

7. In an audiphone of the character described, a frame adapted to be worn before the eyes of a wearer having bows extending to points behind the ears, a vibratory member adapted to abut against the wearer's mastoid temporal bone and electromagnetic means for vibrating said member, said electromagnetic means being mounted on one of the bows of said frame.

8. In an audiphone of the character described, a frame adapted to be worn before the eyes provided with rims and suitable for a pair of eye-glasses, a pair of vibratory members mounted on said frame, said members adapted to abut against the sides of the wearer's nasal bone, an electromagnet for vibrating each of said vibratory members, each of said electromagnets being mounted in one of the rims of said frame.

In testimony whereof, I have hereunto set my hand.

PHILIP F. APFEL.