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F. J. FALTICO
HEARING AID DEVICE

2,390,243

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Fig. 1.

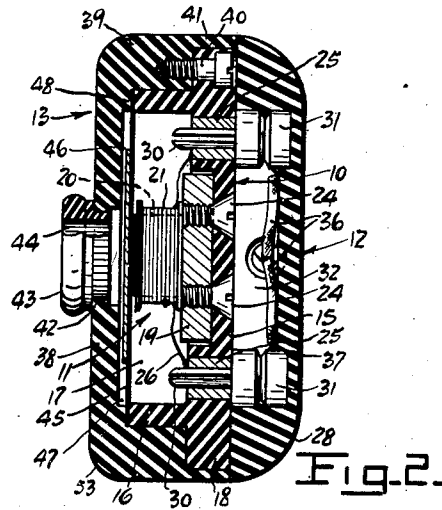
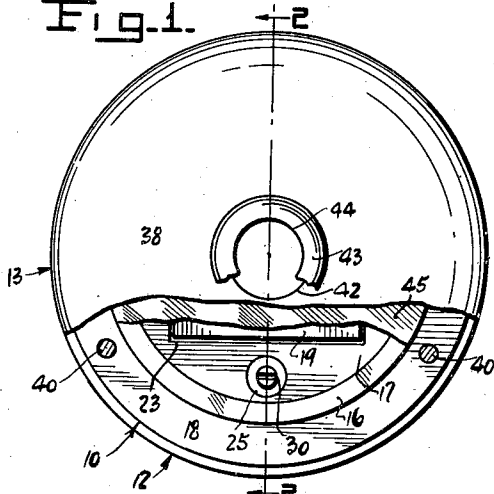


Fig. 2.

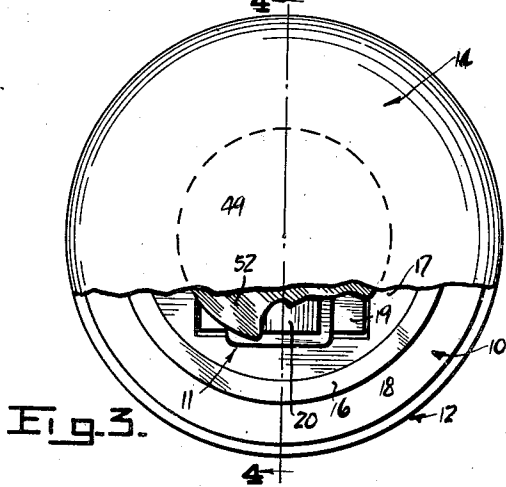


Fig. 3.

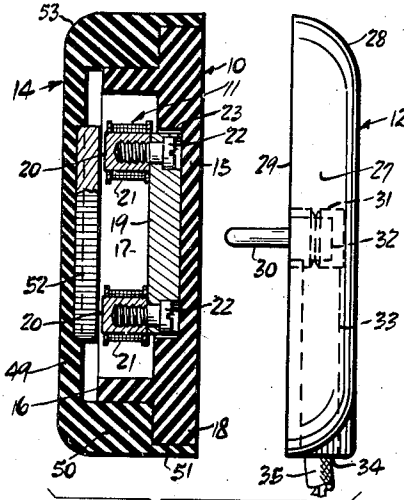


Fig. 4.

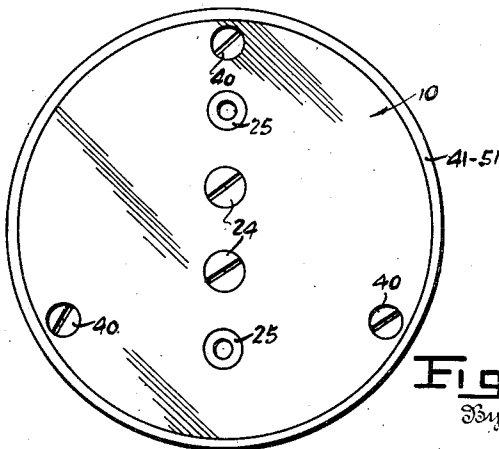


Fig. 5.

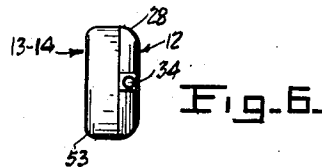


Fig. 6.

Inventor
FRANK J. FALTICO

Carlson & Hayler
Attorneys

UNITED STATES PATENT OFFICE

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HEARING AID DEVICE

Frank J. Faltico, Minneapolis, Minn., assignor to
The Malco Company Incorporated, Minne-
apolis, Minn., a corporation of Minnesota

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4 Claims. (Cl. 179-107)

This invention relates generally to improve-
ments in devices for use by the hard of hearing
and more particularly to what may be termed a
combination bone conduction or air conduction
receiver or phone for hearing aids.

As is well known in the art there are two rec-
ognized methods of transferring sound wave
vibrations to the inner ear. Where an impaired
middle ear is the difficulty bone conduction is
used, a vibrating member, vibrated at audible
frequencies by an electromagnetic translating or
motor device, being held against a hearing in-
ducing bone of the head, such as the mastoid
bone immediately behind the ear. By reaction
principles the bone structure of the head is thus
employed as a vibratory structure to conduct the
audible frequencies to the inner ear. When cir-
cumstances permit, however, the more common
air conduction principles may be employed where-
in a diaphragm, vibrated by a similar electro-
magnetic translator device, is caused to impel
vibrations in the air through the ear canal to
the inner ear.

Inasmuch as the condition of each hard of
hearing patient will thus dictate which type of
receiver or phone to use, it is evident that a sin-
gle basic unit capable of being adapted with but
minor change to either bone or air conduction
use would be of extreme advantage to the dis-
tributor or fitter since he would then be required
to keep on hand only a comparatively small stock
of basic units and a suitable larger number of
the simpler and less expensive interchangeable
parts in order to be able to meet all needs.

It is the primary object of my invention, there-
fore, to provide a device of this nature embodying
a basic or foundation unit carrying the vibratory
translating mechanism and capable of being
used with either of two types of covers or caps,
one of which will make the unit ready for oper-
ation as a bone conduction audiphone or receiver
while the other will make the unit equally use-
ful as an air conduction receiver. The inter-
changeable parts are simple and inexpensive and
require no delicate changes or alterations of the
basic or foundation unit to be applied thereto.

Another object is to provide a device of this
nature in simple, compact, light and durable
form having numerous novel features of con-
struction and arrangement facilitating manu-
facture and maintenance.

These and other more detailed and specific
objects will be disclosed in the course of the
following specification, reference being had to
the accompanying drawing, in which—

Fig. 1 is a face view or elevation of my de-
vice arranged for air conduction use, viewing
the same from its working side, and with cer-
tain parts broken away to disclose interior con-
struction.

Fig. 2 is a diametrical cross section along the
line 2—2 in Fig. 1.

Fig. 3 is a view similar to Fig. 1 but show-
ing the device arranged for bone conduction
use.

Fig. 4 is a diametrical cross section along the
line 4—4 in Fig. 1, the connecting and support-
ing cap or end member being shown in elevation
as detached from the main body of the device,
and this section being taken at right angles to
the plane of the section of Fig. 2.

Fig. 5 is a rear or outer end view of the unit,
the connecting and supporting cap being en-
tirely removed therefrom.

Fig. 6 is a side or edge view of the device at
more nearly its full size.

Referring now more particularly and by ref-
erence characters to the drawing my device will
be seen to comprise a basic or foundation unit
made up of a housing or body member 10, con-
taining the electromagnetic translating or vibrat-
ing mechanism or motor 11, and a supporting and
connecting end member or cap 12. For use with
such foundation or basic unit I provide an air
conduction cap or closure 13 and a bone conduc-
tion cap or closure 14, adapted to be interchange-
ably fitted on and used with such unit. When
thus combined the parts form a compact, neat
and light, button-like assembly which may be
readily and comfortably worn upon the head, the
whole being actually of a size on the order of
that shown in Fig. 6 of the original drawing.

The housing or body member 10 is moulded
of a plastic, insulating material and comprises a
flat, circular disk-shaped base portion 15 from
one face of which projects a narrow, annular
shell or flange 16 of smaller diameter, thus form-
ing a cavity 17. There is also thus formed an
annular radially projecting shoulder 18 entirely
around the base while within the shell 16 space
and surface are provided for the mechanism 11.
This mechanism comprises a flat, rectangular
base or magnet 19 to which at spaced points
are secured a pair of pole pieces 20 upon which
the magnet windings 21 are wound. Screws 22
secure the pole pieces rigidly upon one side of
the magnet or base plate 19, said screws being
countersunk into the opposite side of the plate.
Obviously the parts 19 and 20 will be made of
a steel or ferrous material having the requisite

magnetic properties. A recess 23 is formed in the base portion 15 to receive the magnet 19 and screws 24 are passed through the base portion and secured into the magnet to secure the entire mechanism in place. The heads of these screws are countersunk into the outer side of the base portion as clearly shown.

A substantial space exists between the edges of the magnet 19 and the interior of the shell 16 and at diametrically opposite points jack inserts 25 of tubular form are moulded into the base portion, opening at each side thereof. These inserts are metallic and connections are made thereto from the windings 21 as indicated at 26.

The member 12 is also moulded of a plastic, insulating material and comprises essentially a flat circular disk 27 rounded off around one side and edge as at 28, and flat at its inner side 29 to fit tightly against the outer side of the base portion 15. Split plugs 30 are extended from the side 29 of this member to fit tightly but removably into the jack inserts 25 and these plugs are secured in such positions by their circumferentially grooved heads 31 which are moulded into the disk. A transverse channel 32 between the heads 31 communicates with a radially extending passage 33 opening at 34 through one edge of the disk 27 so that the cable or cord 35 carrying the leads 36 from the microphone or other apparatus (not shown) may be led in and connected to the plugs as indicated at 37.

The air conduction cover or cap 13 is moulded of a plastic insulating material having a circular portion 38 and an annular rim or flange 39 adapted to fit over and around the shell 16 and seat upon the shoulder 18 of the body member base portion 15. Screws 40 are passed through said shoulder 18 and into the rim 39 to hold the cover in place, said screws being countersunk into the outer side of the base to permit the member 12 to fit tightly in place. Around its outer margin the rim 39 is extended in the form of a narrow lip 41 which fits around the circumferential margin of the shoulder 18 and ends flush with the outer surface of the base portion and with the peripheral edge of the member 12. The combination of the cover 13 (or 14) and the member 12 thus completely encloses and protects the body member 10 carrying the vibrating mechanism and conceals all mounting screws as will be evident.

At its center the cap or cover 13 has an opening 42 into which is fitted an insert or plug 43 having a central bore 44. A thin circular diaphragm 45 is placed over the end of the shell 16 before the cover is put in place and is then held thereby in proper position over the ends of the pole pieces 20 with an air gap determined by the position of these ends relative to the plane of the end of the shell, as clearly seen in Fig. 2. A damper 46 is secured to the diaphragm 45 and freedom for movement thereof is provided by a recess 47 formed in the interior surface of the cover. It will be noted that this interior surface of the cover has an annular ledge 48 adapted to bear against the margin of the diaphragm and press the same against the body member when the screws 40 are drawn tight. The diaphragm 45 is essentially a part of the cap 13 since it is applied to and removed from the basic unit with said cap, and the diaphragm may in fact be attached to the cap around its edge if so desired.

The bone conduction cover or cap 14 is similar in that it has a moulded center or wall portion 49 and annular rim 50 with an extended lip 51 to fit over the shell 16 and shoulder 18 in the same

manner as cap 13. The same screws 40 may be used for fastening this cover also. However, a heavy bone oscillator diaphragm or armature 52 is moulded or otherwise secured in the center of the cap portion 49 to be supported thereby with proper air gap relation to the ends of the pole pieces 20. This diaphragm is smaller in diameter than the cap and the center portion 49 of the cap carrying the diaphragm is thinner than is the corresponding center portion of the air conduction cap.

The edges of both caps 13-14 are rounded as at 53 to blend with the rounded edge of the member 12.

In use a headband of usual form is secured by a suitable fitting (neither here shown) to the member 12 so that the device may be worn or supported upon the head. Obviously the connection of member 12 to the headband permits the convenient removal of the body unit from the band simply by pulling the plugs 30 from the jacks 25 when it is desired to work upon or replace the unit.

For air conduction use, then, the cap 13 is placed on the foundation unit and the entire device is worn with the cap centered over the ear and the plug 43 partially entering the ear. The diaphragm 45 will then be vibrated by the mechanism 11 setting up sound wave vibrations in the air and conducting said vibrations to the ear in usual manner. For use as a bone conduction unit, on the other hand, the cap 13 is replaced by cap 14 on the foundation unit and the cap is now worn in contact with the mastoid bone behind the ear, or other hearing inducing bone. The vibrations of the armature 52 will then impart similar vibrations to the center portion 49 of the cap which, coupled to the bone, will by reaction cause the requisite vibratory effect in the bone structure of the head to conduct the sound to the inner ear.

From the foregoing it will be apparent that a single foundation unit may be easily and quickly adapted to use either as an air conduction or direct action receiver, or as a bone conduction or reaction type audiphone, merely by changing caps and diaphragms. Obviously the proper cooperative relationship between diaphragms and the poles of the electromagnetic vibrating unit will be maintained since the caps will be properly dimensioned to this end.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. A wearable hearing aid device comprising a basic unit including a body member and an electromagnetic motor mechanism, and interchangeable cap members adapted for mounting on said body member, one of said cap members having an opening for air conduction to the ear, a diaphragm adapted to be supported by that cap in cooperative relationship to the motor mechanism, and the other cap having a thin wall and a diaphragm adapted to be supported thereby in cooperative relationship with the motor mechanism for vibrating the cap itself and adapting the cap for bone conduction use.

2. A wearable hearing aid device of the character described comprising a basic unit including an electromagnetic motor means, and a pair of caps adapted for interchangeable use upon the

basic unit, one of said caps including a vibrating diaphragm adapted for air conduction coupling to the ear, and the other cap including a relatively heavier diaphragm adapted to vibrate the cap itself for bone conduction coupling.

3. A wearable hearing aid device of the character described, comprising a basic unit including a body member, an electromagnetic motor means supported by said body member, a pair of caps adapted for selective application to and fastening on the body member and each having a diaphragm member adapted to cooperate with the said motor means and to be vibrated thereby, one of said caps having an opening for conducting sound wave vibrations from its diaphragm, and the other cap having a wall portion capable of vibration and to which its diaphragm is rigidly secured.

4. A wearable hearing aid device of the character described, comprising a basic unit including a body member, an electromagnetic motor means supported by said body member, a pair of caps adapted for selective application to and fastening on the body member and each having a diaphragm member adapted to cooperate with the said motor means for vibration thereby, one of said caps having an opening for conducting sound wave vibrations from its diaphragm, and the other cap having a wall portion capable of vibration and to which its diaphragm is rigidly secured, both of said caps being adapted to seat against a surface of the said body member to hold the diaphragms in proper air gap relationship with the motor means.

FRANK J. FALTICO.