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Johanson et al.

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[54] **HEARING AID HAVING RECESSED MICROPHONE**

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[52] **U.S. Cl.** ..... **179/107 R**

[51] **Int. Cl.** **H04r 25/04**

[58] **Field of Search** 179/107

[56] **References Cited**

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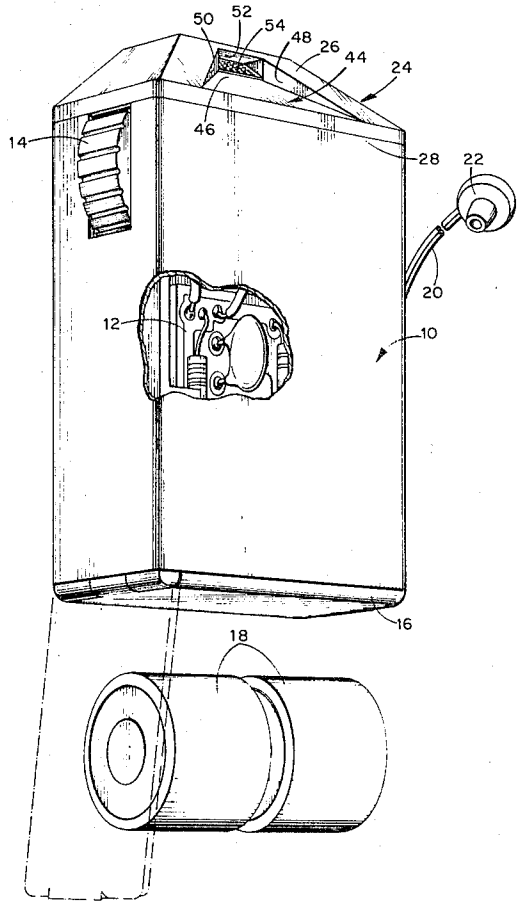
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[57] **ABSTRACT**

A body type hearing aid in which the microphone port is recessed from both the front and top surfaces of the hearing aid housing to substantially minimize clothing noise and to shield the microphone from contamination. The upper portion of the housing is of a multifacetted configuration for disposition of the microphone port therein in a position removed from the front and top surfaces of the housing while still maintaining a sufficient sound aperture for receipt of sounds emanating from points to the front and sides of a user.

7 Claims, 3 Drawing Figures



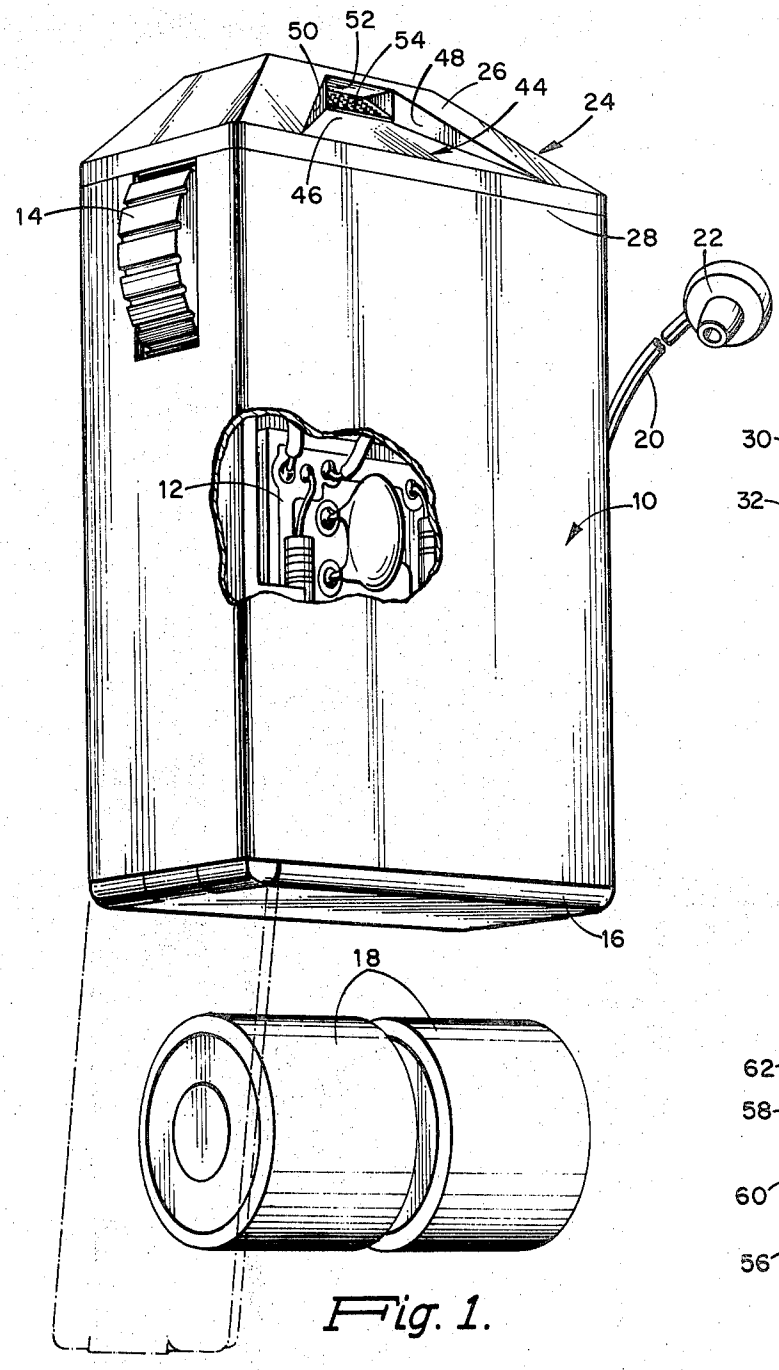


Fig. 1.

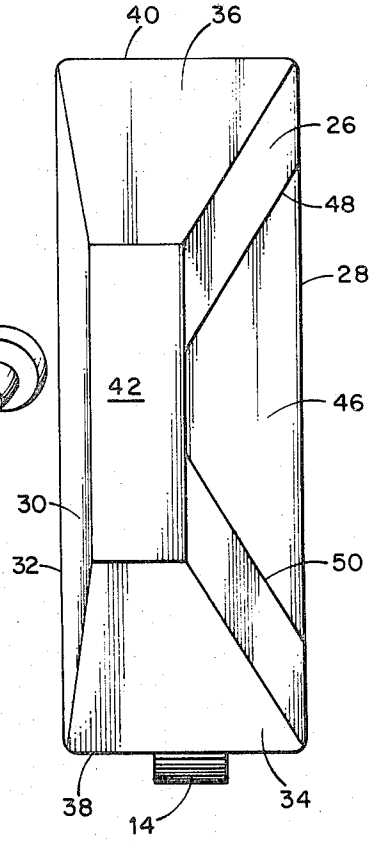


Fig. 2.

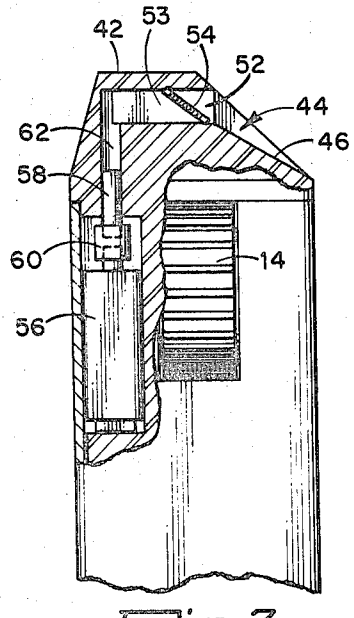


Fig. 3.

HEARING AID HAVING RECESSED MICROPHONE

FIELD OF THE INVENTION

This invention relates to hearing aids and more particularly to a hearing aid of the body type adapted to be worn on the clothing of a user.

BACKGROUND OF THE INVENTION

One well known class of hearing aids is the body type aid which generally includes a housing containing a microphone and associated electronic circuitry, and adapted to be worn on the clothing of the user such as in a shirt pocket or blouse. An earpiece connected to the circuitry by suitable wiring is provided for placement on or in the ear of a user. A major disadvantage of such body type hearing aids is their sensitivity to so-called clothing noise caused by abrasion or contact of confronting pieces of clothing with microphone aperture or port, which gives rise to often obtrusive noise which can partially or completely mask intended sounds. Such clothing noise can occur, for example, by the rubbing of the inside surface of a shirt pocket against the microphone port which conventionally is located on the front surface of the hearing aid housing.

Attempts to minimize such clothing noise have employed a microphone disposed in the top surface of the housing rather than the front surface thereof to remove the microphone from a position subject to contact by the user's clothing. Although such a top mounting location offers some minimization of clothing noise, noise reduction is at the expense of other desirable features. The placement of a microphone at the top surface of the hearing aid housing is inefficient for detection of sounds emanating from points to the front and sides of a user and thus the sensitivity and directionality of a hearing aid so constructed is impaired. In addition, such top mounted microphones are also subject to contamination by falling debris, liquid spills and the like which can occlude the microphone port and detract from overall performance.

SUMMARY OF THE INVENTION

In accordance with the present invention, a body type hearing aid is provided in which the microphone is disposed in a position removed from the surfaces of the hearing aid housing which are likely to contact a user's clothing and which does not materially detract from the performance of the hearing aid. The hearing aid housing includes a multi-facetted upper portion in which the microphone port is recessed both from the front and top surfaces of the housing to substantially eliminate the tendency of clothing to contact the microphone port while maintaining sufficient sensitivity for proper sound reception.

In a preferred implementation, the hearing aid housing includes an upper portion of truncated pyramidal configuration. A flared aperture is provided in the front facing pyramidal surface, the inner end of this aperture terminating in a microphone port which, in turn, is communicative with a microphone disposed within the housings. The microphone port is recessed from the front surface of the housing and cannot readily be contacted by clothing of a user. As a result, clothing noise is markedly reduced. The microphone port is, moreover, recessed with respect to the top housing surface such that the microphone is shielded from contamination such as can be caused by dust, linit, liquid or other debris.

DESCRIPTION OF THE DRAWINGS

The invention will be more fully understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a partially cut-away pictorial view of a body type hearing aid according to the invention;

FIG. 2 is a top view of the embodiment of FIG. 1; and

FIG. 3 is a partially cut-away elevation view of the embodiment of FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

A preferred embodiment of the invention is depicted in FIG. 1 through 3 and includes a generally rectangular housing 10 enclosing a circuit board 12 which contains circuitry for amplifying and processing sound information. A rotary control knob 14 is provided, as illustrated, at the upper portion of one side of housing 10, this control being operative to provide on-off and volume adjusting functions. A tone control can be provided if desired on the opposite side of housing 10 or other suitable location. A bottom cover 16 is hinged to the bottom end of housing 10 and in its opened condition, as shown in dashed outline in FIG. 1, exposes a battery compartment adapted to contain a battery source, such as cells 18, as a source of energizing potential for the hearing aid. A cable 20 interconnects the hearing aid circuitry to an associated earpiece 22 of any suitable construction for disposition in or on the ear of a user.

The upper portion 24 of hearing aid housing 10 is of truncated pyramidal configuration including a front surface 26 which tapers rearward and upward from the front surface of housing 10. A rear surface 30 is similarly tapered inward and upward from the rear surface 32 of housing 10, while respective side surfaces 34 and 36 taper upward and inward from the respective sides 38 and 40 of housing 10. The inclined surfaces 26, 30, 34 and 36 converge toward and terminate at a flat top surface 42 which is generally parallel to the transverse axis of housing 10.

A flared aperture 44 is provided in the front surface 26 and includes a bottom surface 46 of lower slope than that of surface 26, and side surfaces 48 and 50. The aperture 44 tapers from a widest portion at the front surface of housing 10 rearwardly and upwardly to a microphone port 52 of generally rectangular configuration and disposed generally parallel to the longitudinal axis of housing 10 and rearwardly of front surface 26. A microphone grill 54 is disposed behind port 52 in a passage 53 which terminates at port 52. A microphone 56 is mounted within housing 10 adjacent the rear surface thereof and is coupled to sound receiving port 52 by means of a tube 58 having one end connected to the microphone by means of a coupling 60, and the other end in communication with a passage 62 which terminates at the rearward end of passage 53.

The upper portion 24 of housing 10 containing the flared aperture and sound receiving port is typically formed of a plastic material which in the preferred embodiment is formed integrally with the chassis assembly disposed within housing 10 for containing circuit board 12, microphone 56 and battery source 18.

The aperture 44 serves as a receiving horn for receipt of sounds emanating from points forward and to the

side of a user such that the invention provides good sound reception over a rather wide angle of coverage. The microphone port **52** is recessed from the front surface of housing **10** and is substantially immune to contact by the clothing of a user. For example, the housing **10** is typically contained in the shirt pocket or blouse of a user with the front surface of housing **10** engaging the clothing. The rubbing of clothing against this surface is the major source of clothing noise in body type hearing aids of conventional construction, as discussed. By virtue of the invention, however, clothing cannot easily engage the microphone port and clothing noise is thus substantially reduced.

Viewing the hearing aid from the top, as illustrated in FIG. **2**, it is evident that the microphone port is not visible and that the grill **54** is recessed beneath top surface **42**. This recessed position is of particular benefit in preventing contamination of the microphone by dust or other debris, which otherwise could fall or become deposited on an upwardly facing microphone port. The surface **46** which slopes downward from grill **54** also serves to prevent contamination from liquids which may be spilled onto housing **10**.

It will be appreciated that the invention can be constructed with a variety of materials and in particular configuration to suit specific performance requirements. Accordingly, it is not intended to limit the invention by what has been particularly shown and described except as indicated in the appended claims.

What is claimed is:

1. A body type hearing aid comprising:

a housing adapted to be worn on the clothing of a user;

a microphone contained within said housing;

electronic circuitry contained within said housing for amplifying and processing sound information received by said microphone;

a sound receiving port provided in the upper portion of said housing disposed generally parallel to the front surface of said housing and recessed from said front surface;

a flared aperture provided in said upper housing portion having a smaller end terminating at said sound receiving port and a wider end terminating at the front surface of said housing and operative to provide a sound receiving horn for receipt of sounds emanating from points forward and to the sides of said housing;

at least one sound transmitting passage coupling said port to said microphone; and

an earpiece adapted to be attached to the ear of a user and coupled to said circuitry.

2. The invention according to claim **1** wherein said flared aperture includes a bottom surface which slops downwardly from said sound receiving port to direct contaminants which may fall on said bottom surface away from said port.

3. The invention according to claim **2** wherein said housing further includes a top surface below which said sound receiving port is disposed.

4. The invention according to claim **1** wherein the upper portion of said housing includes an inclined surface in which said flared aperture is provided, said flared aperture having a bottom surface of lower slope than that of said inclined surface.

5. In a body type hearing aid adapted to be worn on the clothing of a user, means for reducing clothing noise and for minimizing the opportunity for microphone contamination while providing proper sound reception, said means comprising:

a housing adapted for generally vertical disposition and having a truncated pyramidal top portion which includes:

a front surface which extends rearward and upward from the front surface of said housing;

a sound receiving port in said front surface and disposed parallel to and recessed from said front surface; and

a flared aperture within said front surface which extends from the front surface of said housing inwardly and upwardly to said sound receiving port to provide a horn for receipt of sounds from points forward and to the sides of said housing.

6. The invention according to claim **5** wherein said flared aperture includes a bottom surface having a lower slope than that of the front surface of said housing.

7. The invention according to claim **6** wherein the top portion of said housing includes a top surface at which said front surface terminates; and

inclined rear and side surfaces, each of which extends toward and terminates at said top surface.

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