

Aug. 9, 1966

F. A. HERRMANN

3,265,819

EAR INSERT HEARING AID

Filed May 15, 1963

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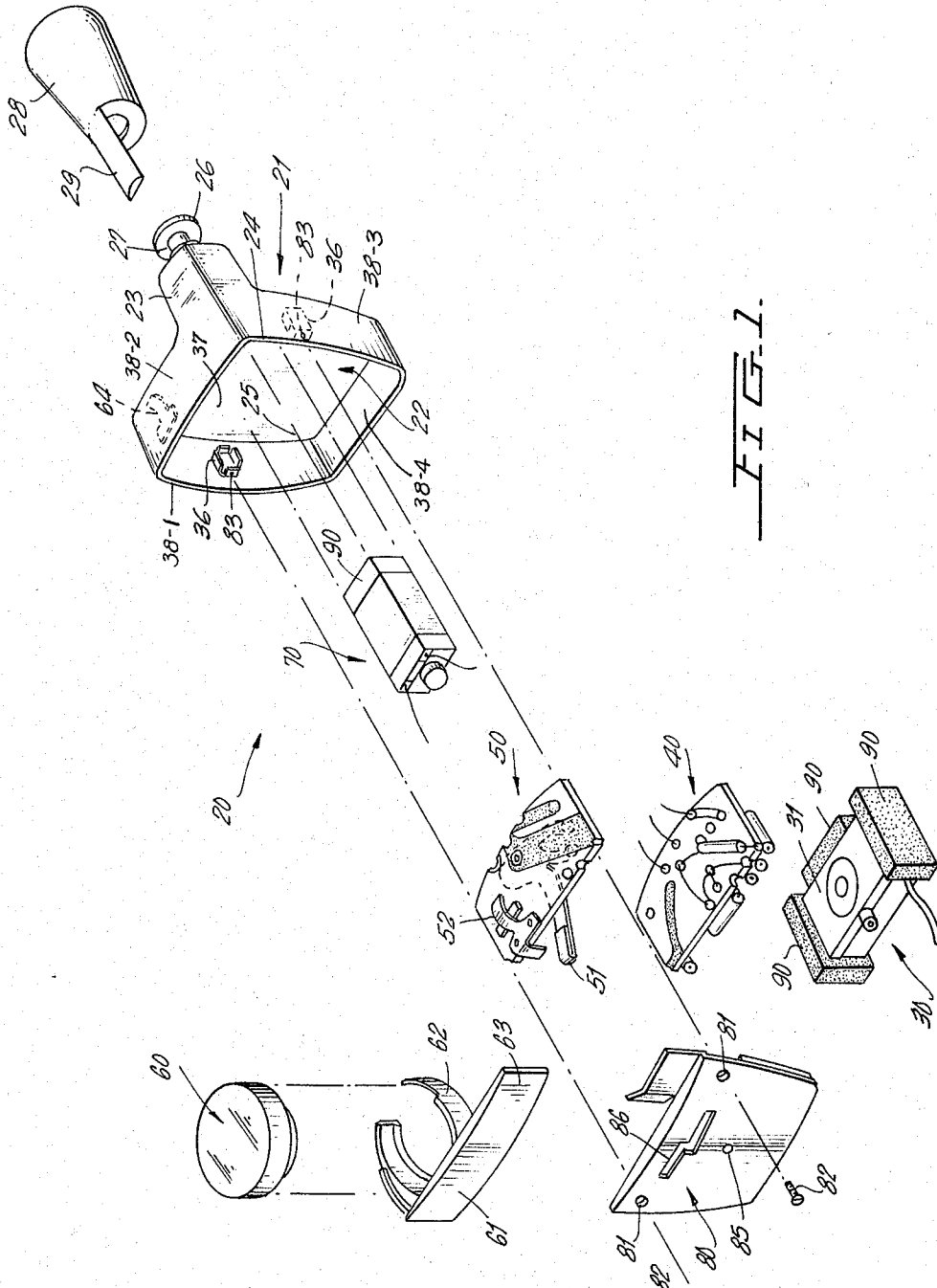


FIG. 1.

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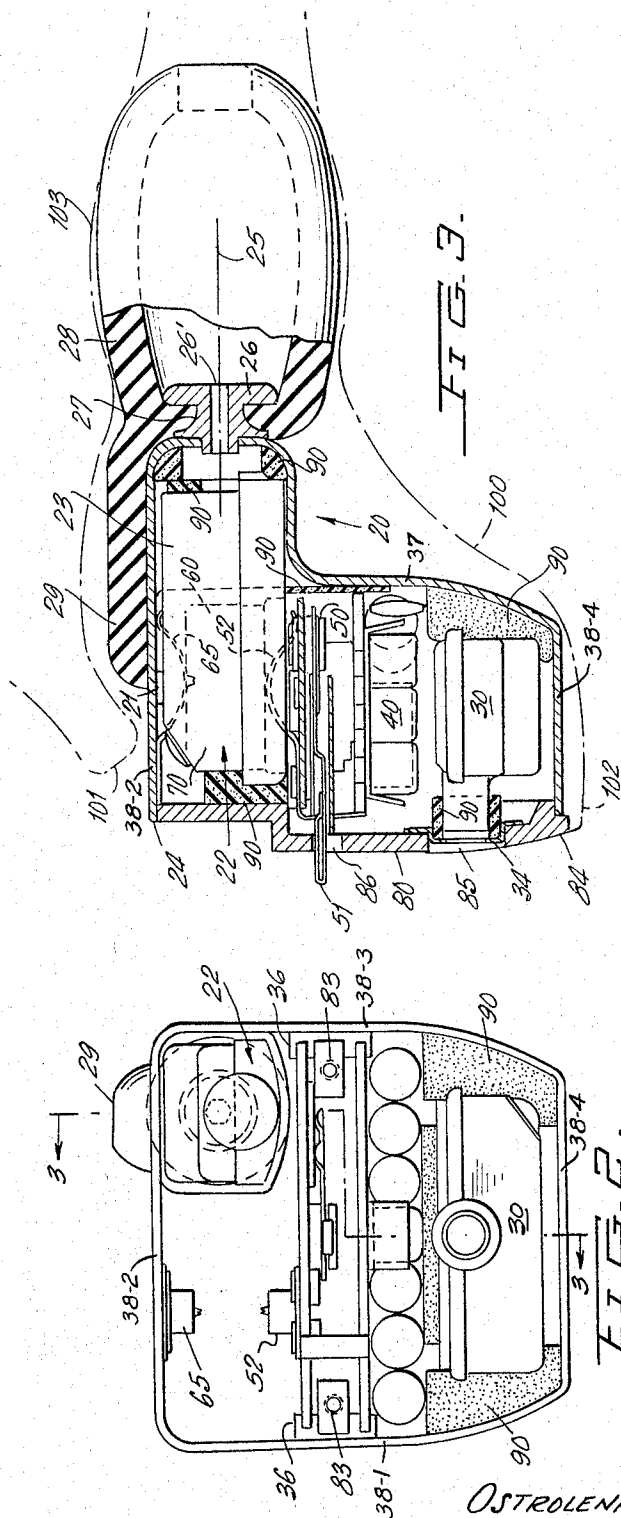
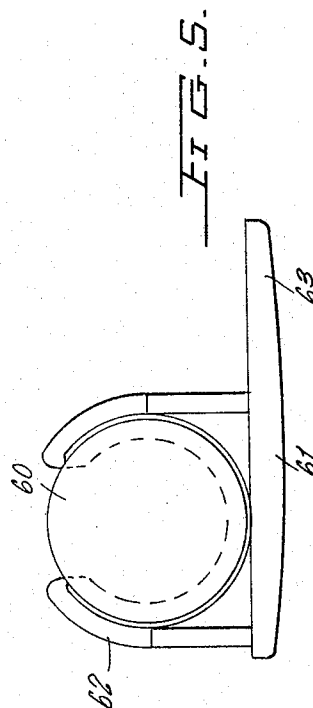
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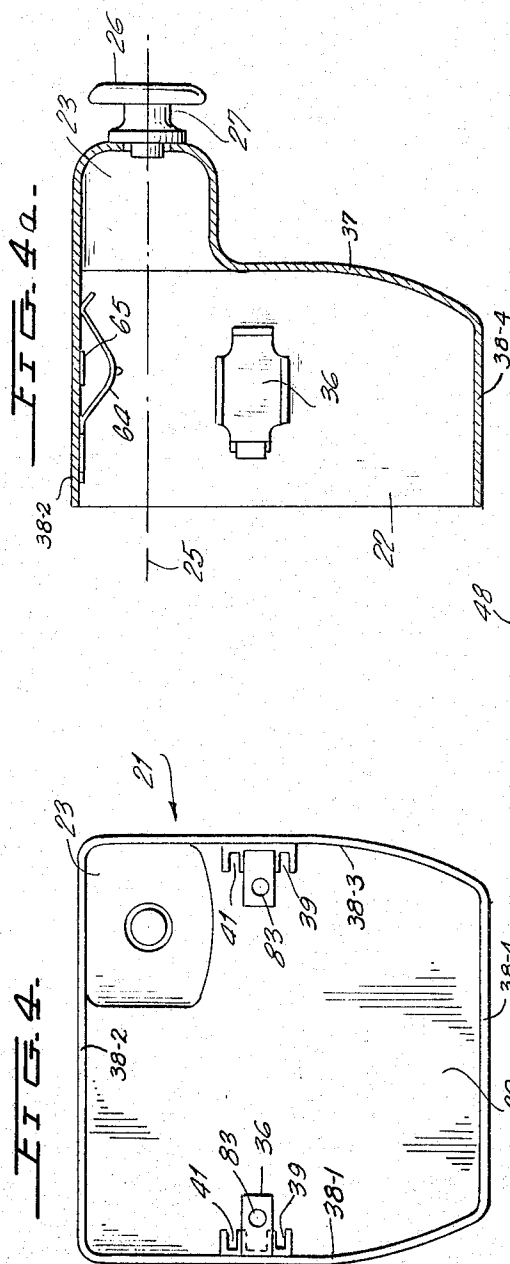
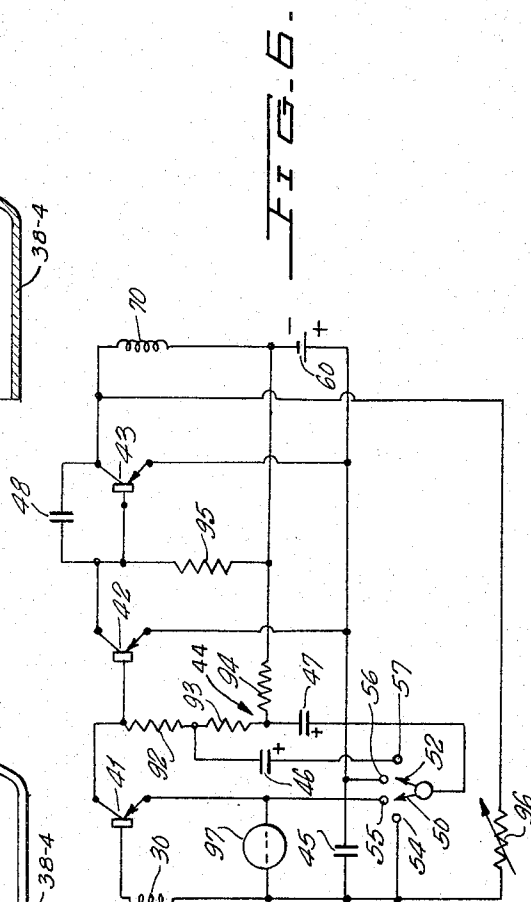
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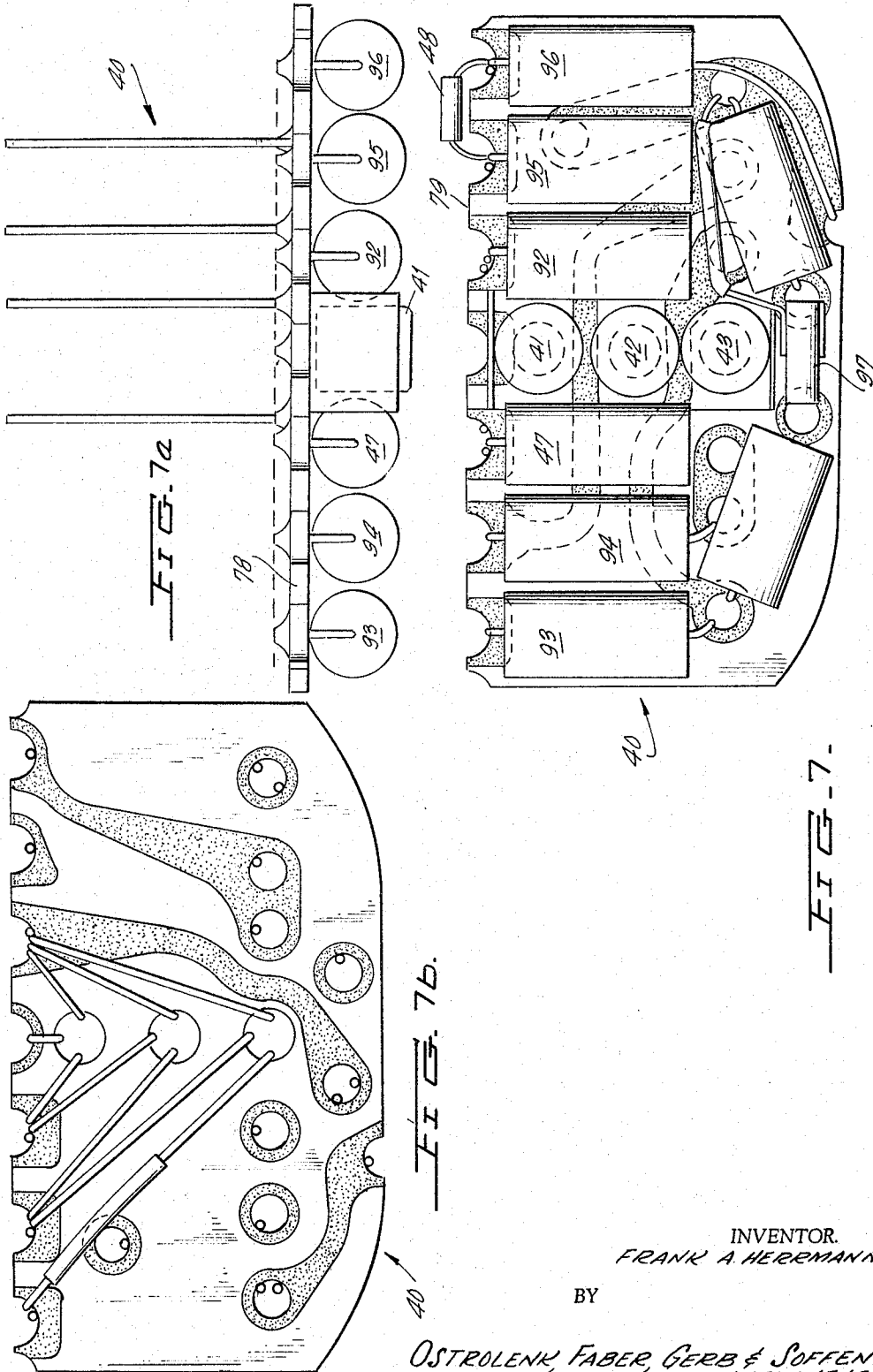
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FIG. 8a.

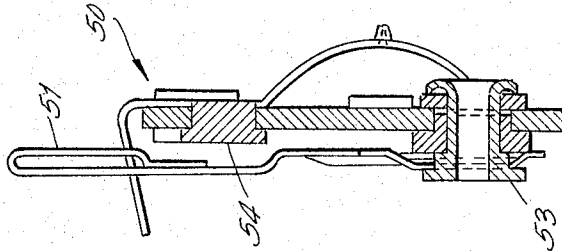
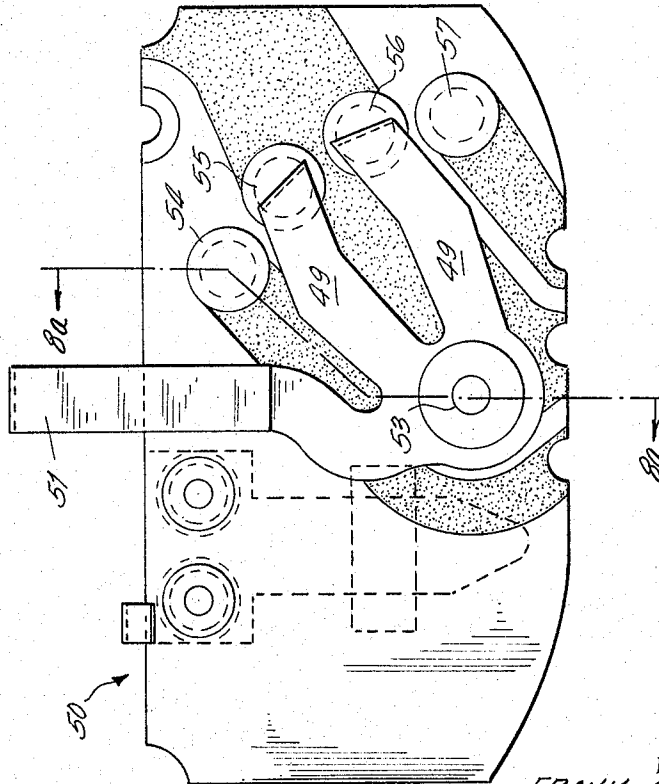


FIG. 8.



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FIG. 10a-

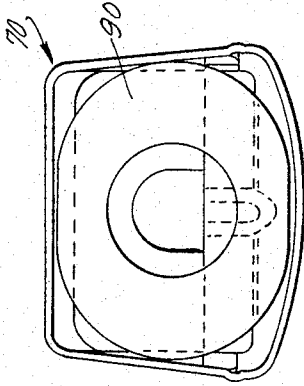


FIG. 10.

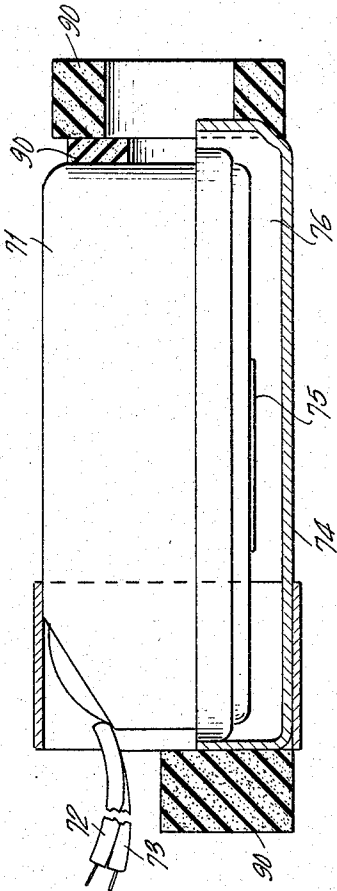


FIG. 9a-

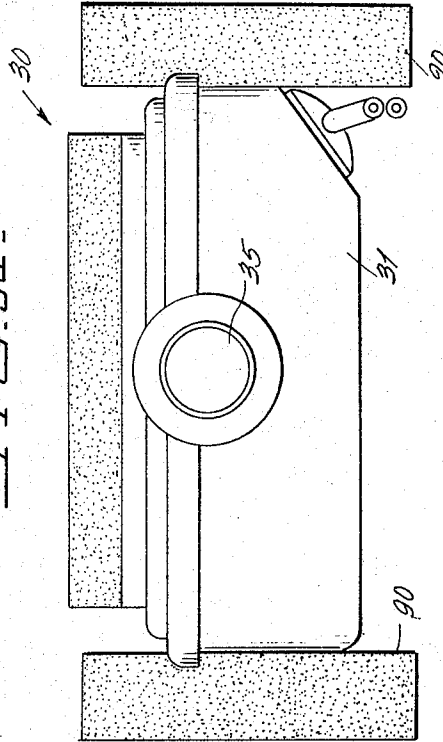
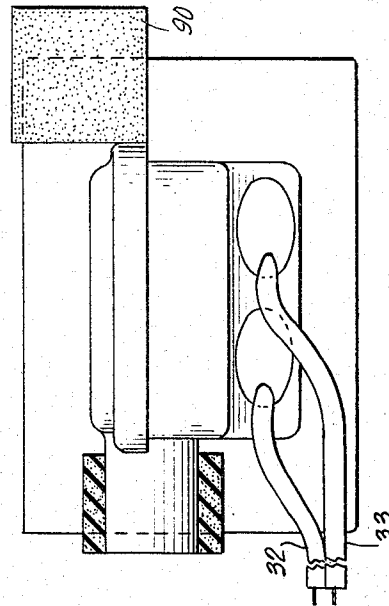


FIG. 9.



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EAR INSERT HEARING AID

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Filed May 15, 1963, Ser. No. 280,630

14 Claims. (Cl. 179-107)

This invention relates to a unitary self-contained hearing aid adapted to be completely located within the user's outer ear cavity, and more particularly to such a hearing aid having a preferable housing configuration and component location for minimum size and ease of assembly.

Many different configurations of hearing aid instruments are presently available, wherein sound received by a microphone is amplified and supplied to a receiver or earphone. These instruments are generally of two basic types.

One well-known type of hearing aid comprises two separable assemblies. The main assembly is located external to the ear and contains the microphone, amplifiers and battery. The other assembly includes the earphone, and is located within the user's ear. A wire connects the output of the first assembly to the earphone assembly. Such a hearing aid suffers from the disadvantage of being aesthetically displeasing and rather bulky.

Another type of hearing aid includes an assembly of the electrical components located behind the user's ear or in eyeglass frames, with a hollowed tube connected to an ear-tip holder within the user's ear. This type of hearing aid suffers from a degradation in high frequency performance, and is also aesthetically objectionable.

To avoid these disadvantages, recent advances in the electronic art have permitted the miniaturization of the hearing aid instrument such that it may be completely contained within the user's ear, as exemplified by U.S. Patent Nos. 2,938,083, filed December 30, 1957, in the name of F. A. Herrmann entitled, "Transistor Amplifier Hearing Aid Unit With Receiver Vibration Feedback Suppression," and Patent No. 2,971,065 filed December 30, 1957, in the name of H. M. Busse entitled, "Ear Insert Hearing Aid," both assigned to the assignee of the instant invention. These prior art in-the-ear instruments typically include a sandwich arrangement of the individual components disposed in planes generally perpendicular to the axis of the inner ear. Such a physical arrangement of the individual components requires electrical assembly prior to insertion in the external housing. Likewise, repair of defective units is quite tedious and time-consuming.

This invention avoids these problems by providing a structural arrangement wherein the individual components and circuit chassis are disposed in component spaces generally parallel to each other and the axis of the inner ear. It has been found that such a stacking of components permits a more efficient utilization of space than in the heretofore known arrangements. Further, the assembled unit may be provided with a cover, which when removed exposes an end portion of each of the individual electrical components. A significant portion of the inter-component wiring may be made accessible in this region, thereby providing convenient test points for easy and rapid analysis of defects. The ease of accessibility of the individual components greatly simplifies subsequent repair or substitution of the microphone or earphone to change the acoustic response to that required by the individual user. Thus the component to be replaced may be electrically disconnected and removed without the necessity of a cumbersome disassembly procedure.

As a further aspect of this invention, the exterior housing structure is formed of a unitary structure having a main or outer body or section, and an inner housing body or section projecting inwardly therefrom. The housing

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structure is dimensioned to snugly contain all of the necessary components, with the forward portion of the earphone projecting into the inner housing section. The outer housing section is dimensioned to fit and be held within the outer ear cavity of the user between the antihelix, tragus and anti-tragus, with the inner housing section containing the earphone projecting into the user's ear canal. To provide for variations in the ear opening of the individual user, the inner volume is located eccentric with respect to the outer volume, thereby permitting proper positioning within the user's concha cavity with the earphone projecting into the ear canal.

As another aspect of this invention the battery cell is of a planar disc-like configuration and is held in place by a spring clip. The spring clip includes a portion accessible to and forming a part of the rear cover to provide a grasping means for easily removing the battery from the unit. The rear cover also provides access to volume adjust and battery drain control switch.

As an additional aspect of this invention the terminus of the inner housing section projecting into the ear canal includes a rigid ear-tip holder acoustically interconnected to the output chamber of the earphone for transmission of the amplified signal to the user. The ear-tip holder snugly receives a flexible ear-tip dimensioned to enter a substantial length of the ear canal and be snugly contained therein. As a preferred feature the ear-tip includes a longitudinal handle to facilitate removal should it accidentally become lodged within the user's ear.

As still a further aspect of this invention a plurality of resilient members are disposed between the microphone, earphone and the portion of the unitary housing adjacent thereto to suppress microphonics and undesirable vibratory feed-back between the earphone and the microphone.

It is therefore seen that the basic concept of this invention resides in the physical location of the hearing aid components in generally parallel disposed component spaces along the direction of the axis of the user's inner ear canal, thereby providing an efficient utilization of volume and increased accessibility of the various components.

It is accordingly a primary object of this invention to provide a hearing aid instrument dimensioned to be located within the ear of the user, and constructed in a manner to minimize size, weight, and facilitate assembly.

Another object of this invention is to provide a hearing aid instrument enclosed within a unitary housing having a main volume dimensioned to be contained within the outer ear cavity of the user and adapted to locate the electrical components in substantially parallel arrangement along longitudinal cross-sections of the main housing section.

A further object of this invention is to provide such an in-the-ear hearing aid instrument including an inner housing section extending inward from the main housing section and dimensioned to project into the user's ear canal.

An additional object of this invention is to provide such an in-the-ear hearing aid instrument wherein the inner housing section is eccentrically located with respect to the main housing section to permit proper positioning within the user's ear.

Still another object of this invention is to provide an in-the-ear hearing aid instrument having a removable back cover, wherein substantially all the individual electrical components are readily accessible upon removal of the cover.

Still a further object of this invention is to provide such an in-the-ear hearing aid instrument wherein a portion of the removable cover includes a battery clip having an extending portion which may be readily grasped

to remove the battery cell from the hearing aid instrument.

Still an additional object of this invention is to provide a compact in-the-ear hearing aid instrument wherein a significant portion of the electrical connections between the individual components and chassis are accessible subsequent to the insertion of the components within the housing structure.

These as well as other objects of this invention will readily become apparent after reading the following descriptions of the accompanying drawings in which:

FIGURE 1 is an exploded perspective view of a hearing aid instrument constructed in accordance with the teachings of the instant invention.

FIGURE 2 is a plan view of the assembled hearing aid with the rear cover and battery cell removed.

FIGURE 3 is a cross-sectional view along line 3, 3 of FIGURE 2, with the rear cover and battery replaced, looking in the direction of the arrows and showing the manner in which the hearing aid is held in its operative position with the user's ear.

FIGURES 4 and 4a are plan and side cross-sectional views respectively of the hearing aid housing assembly.

FIGURE 5 is a side elevation of the battery clip, shown with the battery cell.

FIGURE 6 is an electrical schematic of the hearing aid of FIGURES 1-3.

FIGURES 7, 7a and 7b are plan, end and bottom views respectively of the transistor-amplifier chassis.

FIGURES 8 and 8a are plan and end views respectively of the volume control switch chassis.

FIGURES 9 and 9a are plan and side views respectively of the microphone assembly.

FIGURES 10 and 10a are plan and side views respectively of the earphone assembly.

Referring initially to FIGURES 1, 2 and 3, hearing aid 20 is contained within unitary housing member 21. Housing member 21 includes a main or outer section or body 22 and an inner section or body 23. Outer section 22 is of sufficiently small dimensions to fit within the concha cavity 100 of the user's ear between the tragus 101, antitragus (not shown) and the antihelix 102 thereof. Inner section 23 is of a substantially smaller cross-section and is dimensioned to project into the ear canal 103 of the user. When installed in the user's ear, it is seen that the longitudinal axis 25 of inner housing section 23 is disposed generally parallel to the axis of the inner ear canal 103. The outer housing body, or section 22, includes an inward wall 37 and spaced apart therefrom an outward wall formed by detachably removable wall portions 61 and 80. A transverse wall, including wall portions 38-1, 38-2, 38-3 and 38-4 extends between the edge regions of space separated inward and outward walls 37 and 61, 80 to define therewith a substantially enclosed outer housing volume.

The principal electrical components of hearing aid instrument 20 comprises microphone 30, transistor amplifier chassis 40, volume control switch 50, battery 60 and earphone 70. In accordance with the preferred teachings of this invention these components are disposed in generally parallel component spaces in the direction of longitudinal axis 25. It has been found that the location of the components in such a manner, as contrasted to the heretofore practiced procedure of sandwiching the individual components generally perpendicular to longitudinal axis 25, significantly enhances the utilization of available space, thereby permitting minimum housing dimensions.

As a further advantage, it is seen that each of the components 30, 40, 50, 60, 70 is accessible along the opened surface 24 of the assembled unit, with components 30, 40, 50 and 60 being contained in generally parallel component housing spaces, extending generally parallel to longitudinal axis 25 and bounded by inward wall 37, outward wall 61, 80 and opposed sections 38-1,

38-3 of the transverse wall. This facilitates electrical assembly and repair of the unit; that is, a substantial portion of the electrical interconnections between the individual components may be made in the region of surface 24, thereby permitting such connections to provide test points after location of the individual components within the unit.

Housing 21 is illustratively shown as having a generally rectangular lateral cross-section with inward section 23 eccentrically located with respect thereto. This configuration facilitates the adaptation of the unit to various locations of individual user's ear opening with respect to the outer ear. Alternatively, housing 20 may be of various other cross-sections, such as diamond, oval or circular, with the individual electrical components and chassis suitably contoured to be snugly contained in a generally planar disposition along axis 25. In addition, the complete unit 20 may be incorporated into a customized earmold formed in the manner well known in the art.

The lowermost portion of inward housing 23 contains an ear-tip holder 26 acoustically connected to the chamber of earphone assembly 70 as by airtight brazing. Ear-tip holder 26 includes a sound outlet opening 26' for propagating the sound emitted from earphone sound emitting opening 75 (see FIG. 10). Ear-tip holder 26 contains an annular portion 27 dimensioned to snugly receive resilient ear-tip 28, typically constructed of soft rubber or other suitable elastomer. Ear-tip 28 is dimensioned to be snugly contained within the user's ear canal. The mating portions of members 26 and 28 are suitably constructed to provide a good acoustic seal. A projecting finger 29 is preferably provided on ear-tip 28 to facilitate removal should it be accidentally displaced from holder 26 and become lodged in the user's ear canal.

Microphone 30 and earphone 70 are conventional electromagnetic transducers designed and dimensioned to be snugly contained within housing 21. To reduce microphonics and vibratory feedback between these two members, resilient vibration damping members 90 are appropriately placed between these components and the housing 21. Members 90 may typically be formed of rubber or polyurethane foam.

Battery 60 is a conventional mercury-type cell of a disc-like configuration suitably contoured to be contained within housing 21. Battery cell 60 is located in position by spring clip 61.

Referring to FIGURE 5, spring clip 61 includes a circular portion 62 dimensioned to snugly contain battery cell 60 and a projecting portion 63 accessible at surface 24 for removing battery cell 60. Cover 80 includes apertures 81 to receive flathead screws 82 which mate with tapped openings 83 of housing assembly 21. Cover 80 encloses all the components except battery 60 and includes lip 84 snugly contoured to provide a smooth surface at the external region of hearing aid 20. Cover 80 also includes aperture 85 in alignment with the microphone grill opening, and generally Z-shaped aperture opening 86 to contain handle extension 51 of volume control switch chassis 50. Cover 80 may typically be constructed of a plastic material of flesh color. Battery clip 61 constructed of the same type of material as cover 80, forms a portion of the cover along the plane of the battery location, and is constructed in the manner set forth above to permit easy removal of the battery.

Reference is now made to FIGURES 4 and 4a showing housing assembly 21. Housing 21 is typically constructed of stainless steel and smoothly contoured and machined to safely permit insertion in the ear. Outer section 22 includes chassis slides 36 spot-welded in alignment along opposite transverse walls 38-1, 38-3. Chassis slides 36 include recesses 39, 41, positioned to receive the transistor amplifier 40 and switch chassis 50 respectively, and to maintain those chassis in their respective planes generally parallel to vertical axis 25. Chassis slides 36 also con-

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tain tapped openings 83 for fastening of cover 80, as set forth above. Spring-type battery clip 64, typically constructed of appropriately heat-treated beryllium copper, is secured as by spot-welding along transverse vertical wall 38-2. Stop 65 is provided to appropriately limit the movement of spring clip 64. As shown in FIGURE 3, battery cell 60 is disposed between spring clip 65 and a similar spring clip 52 secured to volume control switch chassis 50.

Reference is now made to FIGURES 6, 7, 7a, 7b, 8 and 8a which illustrate the schematic diagram and chassis assemblies of the transistor amplifier and volume control switch. The operation of the amplifier circuit is conventional and includes a three-stage transistor amplifier, appropriately biased by battery 60 decoupling network 44 and volume control switch 50, to provide the requisite amplification, as for example 60 db of voltage gain, of the signal between microphone 30 and earphone 70. Each of the transistors 41, 42, 43 is illustratively of the p-n-p type. Alternatively, n-p-n transistors may be employed with appropriate modification being made in the biasing circuitry. The input signal is presented between the base and emitter terminals. The amplified output is then obtained at the collector and emitter terminals, wherein it is then presented to the base and emitter terminals of the succeeding stage. A temperature compensating component, such as thermistor 97 is preferably included to stabilize the operation of the circuit over variations in ambient temperature. Capacitor 48 is adjusted for proper feedback control. Resistor 96 is adjustable to match the output current magnitude of transistor 43 to the characteristics of earphone 70.

The amplifier components comprise three transistors 41, 42, 43; four capacitors 45, 46, 47, 48; and six resistors 92, 93, 94, 95, 96, 97; all compactly assembled on printed chassis board 78. The interconnections of chassis assembly 40 are preferably arranged to be made along edge 79, accessible in the assembled hearing aid unit upon the removal of cover 80.

Switch 50 includes spring contacts 49 movable about pivot point 53 by externally accessible handle 51. Movable contacts 49 interconnect to stationary rivet-type contacts 54-57 to appropriately adjust the transistor bias for high volume, low volume or minimum battery drain. These positions are defined by Z-shaped opening 86 in the top cover 80 to thereby provide detent controlled operation of the switch 50. The latter position is provided to allow the user to insert the instrument in the ear, and yet avoid the squealing sounds that otherwise would occur as the instrument is being thus inserted. The provision of such a position rather than a battery disconnect position permits the use of a smaller less complicated and more reliable switch. Further, it is preferable to have the user remove the battery when not in use to avoid damage resulting from chemical leakage. However, should it be desired, a switch including a battery disconnect position may be used in conjunction with the circuits of FIGURES 6 and 7.

Reference is now made to FIGURES 9, 9a 10 and 10a, earphone and microphone assemblies 70, 30 include conventional electromagnetic transducers 71, 31 to be connected to the amplifier chassis 40 via leads 72, 73 and 32, 33 respectively. Grill 74 is secured along the length of earphone 71, covering sound emitting opening 75, to provide an appropriately configured chamber 76 for frequency control. Alternative arrangements of the earphone grill and chamber configuration may be practiced, in the manner well known in the art. Microphone grill 34 affixed to cover 80 (see FIGURE 3) suitably presents sound to microphone opening 35, via cover aperture 85. Resilient members 90 are cemented to the earphone and microphone, appropriately located for reduction of microphonics and vibratory feedback, as discussed above.

Without thereby limiting the scope of the invention, there are given below data of a commercial form of hear-

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ing aid embodying the concepts of this invention.

The complete unit is contained within a housing structure having a maximum lateral cross-sectional area .625 x .615. The total length of the housing in the longitudinal direction is approximately .570" of which the maximum depth of the outer housing is .350".

The battery cell has a maximum outer diameter of $\frac{5}{16}$ " and a thickness of $\frac{1}{8}$ ".

The earphone has a cross-sectional area of .190" x .220" and an overall length corresponding to the longitudinal length of the housing section.

The entire exterior portion of the instrument is formed of smoothly-contoured stainless steel and enclosed with a medium impact styrene cover.

It is thus seen that this invention provides an extremely compact self-contained in-the-ear hearing aid yielding increased component accessibility over the devices heretofore known. A housing is provided which may be conveniently located in an aesthetically pleasing manner within the user's ear, and the individual electrical components are disposed in generally parallel planes along the direction of the longitudinal axis of the ear canal.

In the foregoing this invention has been described in conjunction with a preferred illustrative embodiment. Since many variations and modifications will now become obvious to those skilled in the art, it is accordingly desired that the breadth of the claims not be limited to the specific disclosure herein contained.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows:

1. In a hearing aid device dimensioned to fit within a user's outer ear cavity, and project into the ear canal; a plurality of operating components, including: a microphone, amplifier chassis, volume control switch, battery cell and earphone; at least some of said operating components disposed in parallel arrayed planes, generally parallel to the axis of the ear canal; a unitary housing assembly snugly containing said operating components; a portion of said housing having a removable cover disposed in a plane generally perpendicular to said parallel disposed components; said housing including a first and second section; said first section dimensioned to contain said earphone along a longitudinal axis generally parallel to the axis of the ear canal, and project into the ear canal; said second section having a cross-section in the direction of said longitudinal axis dimensioned to snugly contain said planar disposed components; said second section having a significantly greater lateral cross-sectional area than said first section; said first section projecting downward from said second section and positioned eccentric with respect to said second section; a battery clip releasably locating said battery cell in said housing; said battery clip including a first portion dimensioned to contain said battery cell, and a second portion operatively projecting towards the external portion of said housing; said second portion constructed to provide a smooth covering surface for a portion of said housing and provide a grasping means for releasing said battery cell; said removable cover including a first and second aperture means; said first aperture means operatively positioned to present sound to said microphone; said second aperture means providing detent controlled operation of said volume control switch.

2. In a hearing aid device: a unitary housing having a bottom surface and a first continuous wall surface extending upward and generally perpendicular therefrom to establish a first volume; a portion of said bottom surface having a continuous wall surface extending downward and generally perpendicular therefrom to establish a second volume; said first and second volumes being continuous; the lateral cross-sectioned area of said first volume being significantly greater than said second volume; said first volume dimensioned to fit and be held within a

user's outer ear cavity between the antihelix, tragus and antitragus; said second volume dimensioned to project into the ear canal; a plurality of electrical components contained in said housing; said components disposed in parallel arrayed component spaces each generally perpendicular to said bottom surface and bounded by said bottom surface and opposed portions of said continuous wall surface.

3. In a hearing aid device: a unitary housing having a bottom surface and a first continuous wall surface extending upward and generally perpendicular therefrom to establish a first volume; a portion of said bottom surface having a second continuous wall surface extending downward and generally perpendicular therefrom to establish a second volume; the upward terminus of said first continuous wall surface receiving a removable cover; said first and second volumes being continuous; the lateral cross-sectional area of said first volume being significantly greater than said second volume; said first volume dimensioned to fit and be held within a user's outer ear cavity between the antihelix, tragus and antitragus; said second volume dimensioned to project into the ear canal; a plurality of electrical components contained in said housing; said components disposed in parallel arrayed component spaces generally perpendicular to said bottom wall surfaces and extending to said cover; conducting means electrically interconnecting said plurality of electrical components; the removal of said cover exposing said electrical components, and a substantial portion of said conducting means.

4. In a hearing aid device: a unitary housing having a bottom surface and a first continuous wall surface extending upward and generally perpendicular therefrom to establish a first volume; a portion of said bottom surface having a continuous wall surface extending downward and generally perpendicular therefrom to establish a second volume; said first and second volumes being continuous; the lateral cross-sectional area of said first volume being significantly greater than said second volume; said first volume dimensioned to fit and be held within a user's outer ear cavity between the antihelix, tragus and antitragus; said second volume dimensioned to project into the ear canal; a plurality of electrical components contained in said housing; said components disposed in parallel arrayed planes generally parallel to the direction of said wall surfaces; conducting means electrically interconnecting said plurality of electrical components; the upward terminus of said first wall surface adapted to receive a removable cover; the removal of said cover exposing said electrical components, and a substantial portion of said conducting means; said electrical components including a receiver, amplifier chassis; volume control switch and battery cell contained in said first volume, and an earphone contained in said second volume; means snugly locating said components in said parallel arrayed planes.

5. In an in-the-ear hearing aid:

electrical components including a microphone, an amplifier chassis, a battery cell, an earphone and circuit connections for supplying amplified microphone output to said earphone;

a housing structure housing said electrical components comprising an outer housing body and an inner housing body;

said outer housing body being dimensioned to fit and be held within the outer ear cavity of the user;

said outer housing body including space separated inward and outward walls and a transverse wall extending between the edge regions of said inward and outward walls and defining therewith a substantially enclosed outer housing volume;

said inner housing body extending from said inward wall away from said outer housing volume and having a cross-section dimensioned sufficiently small for insertion within the ear canal of the user;

said inner housing body having a longitudinal axis disposed generally parallel to the axis of the user's ear canal and having a sound outlet opening at an end region remote from said outer housing volume; said inward and outward walls extending transverse to said longitudinal axis;

said microphone, said amplifier chassis and said battery cell being contained within said outer housing volume and positioned along generally parallel component housing spaces thereof;

each of said component housing spaces extending generally parallel to said longitudinal axis and bounded by said inward and outward end walls and opposed portions of said transverse wall;

said earphone being disposed along said inner housing body and having a sound emitting opening propagating sound through said inner-housing body outlet opening.

6. An in-the-ear hearing aid device as claimed in claim 5,

at least a portion of one of said space separated walls detachably removable for exposing the underlying circuit connections within said outer housing volume.

7. An in-the-ear hearing aid as claimed in claim 5,

at least a portion of one of said space separated walls detachably removable for providing an opening to said outer housing volume generally perpendicular to the parallel direction of said component spaces; a substantial portion of said circuit connections being accessible from said opening, and operatively positioned to provide electrical circuit access points after physical assembly of the individual hearing aid electrical components within said outer housing body.

8. In a hearing aid device as claimed in claim 7, a battery clip releasably locating said battery cell within said outer housing volume; said battery clip including a first portion dimensioned to contain said battery cell, and a second portion constructed to provide a smooth covering surface for a portion of said one end wall, and provide a grasping means for releasing said battery cell.

9. An in-the-ear hearing aid device as claimed in claim 5,

a flexible ear tip removably mounted to said inner housing body, and dimensioned to be snugly contained within the user's ear canal.

10. In a hearing aid device as claimed in claim 5, said outer housing body having a significantly greater lateral cross-sectional area than said inner housing body; said inner housing body projecting inwardly from said outer housing body and positioned eccentric with respect to said outer housing body.

11. In a hearing aid device as claimed in claim 5, resilient means disposed between said microphone, earphone and the portion of said housing structure adjacent thereto; said resilient means operatively constructed and positioned to suppress vibratory feedback between said earphone and microphone.

12. In a hearing aid device as claimed in claim 5, said electrical components further including a volume control switch, said volume control switch disposed in a component housing space substantially parallel to the component housing spaces of said microphone amplifier chassis and battery cell.

13. In a hearing aid device as claimed in claim 12, at least a portion of one of said space separated walls detachably removable for providing an opening to said outer housing volume generally perpendicular to the parallel direction of said component spaces, said opening positioned to expose a portion of each of said electrical components including said microphone, battery cell switch and amplifier chassis; a substantial end portion of said electrical components being accessible from said opening, and operatively positioned to provide electrical circuit access points after physical assembly of the individual hearing aid electrical components within said outer housing

ing body, a cover means enclosing said opening; said cover means including a first and second aperture means; said first aperture means operatively positioned to present sound to said microphone; said sound aperture means providing detent controlled operation of said volume control switch.

14. In an in-the-ear hearing aid device
 electrical components comprising a microphone, amplifier chassis, battery cell, earphone and circuit connections therebetween for supplying an amplified microphone output to said earphone;
 a housing structure enclosing said electric components comprising a first housing section and a second housing section;
 said first housing section dimensioned to fit and being held within the outer ear cavity of the user, and defining a first housing volume;
 said first housing section including
 a pair of spaced apart first and second walls;
 a transverse wall having opposed first and second peripheral regions connected respectively to peripheral regions of said first and second walls;
 said first wall including a wall section detachably removable from at least a portion of said peripheral wall region;
 said first, second and transverse walls defining together the exterior boundaries of said first housing volume with said detachable wall section constituting a cover means for access into said first housing volume;

said second housing section extending from one of said pair of spaced-apart walls in a direction transverse to said one wall and away from said first housing volume;
 said second housing section defining a second housing volume, and having a cross-section dimension significantly less than said first housing section and being sufficiently small for insertion within the ear canal of the user;
 said second housing section having a sound outlet opening at the end remote from said first housing volume; said microphone, amplifier chassis and battery cell contained within said first housing volume, and positioned along generally parallel component spaces each bounded by said first and second walls and opposed portions of said transverse wall;
 said earphone disposed along said second housing volume and having a sound emitting opening acoustically coupled to said sound outlet opening.

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S. J. BOR, *Assistant Examiner*.