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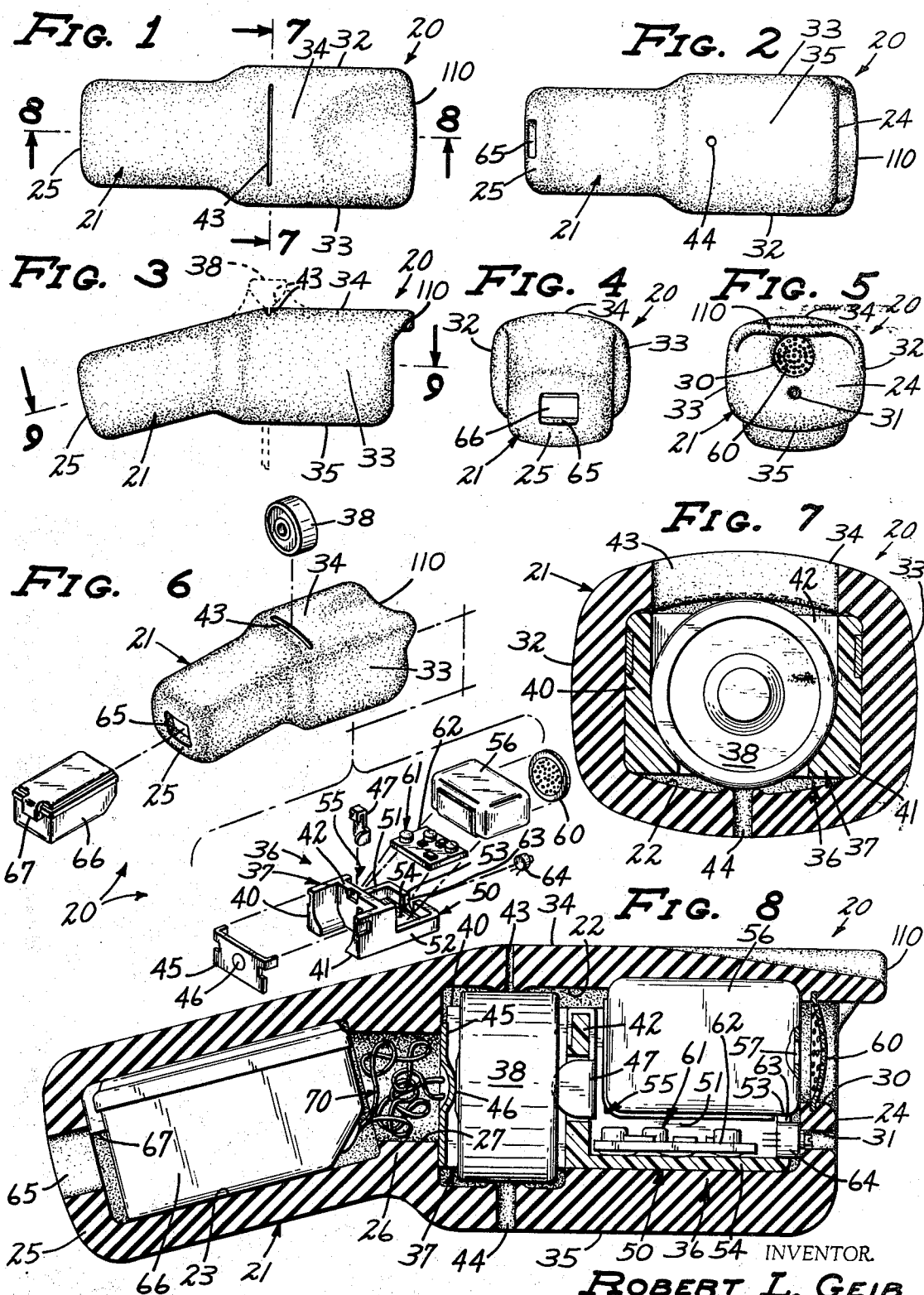
R. L. GEIB

3,527,901

HEARING AID HAVING RESILIENT HOUSING

Filed March 28, 1967

3 Sheets-Sheet 1



INVENTOR
ROBERT L. GEIB
BY
Merchant & Gould
ATTORNEYS

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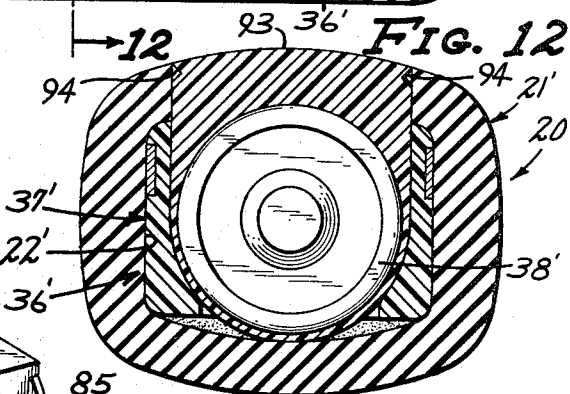
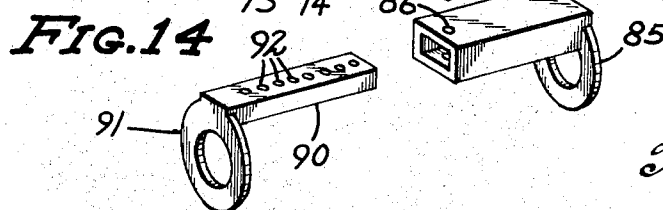
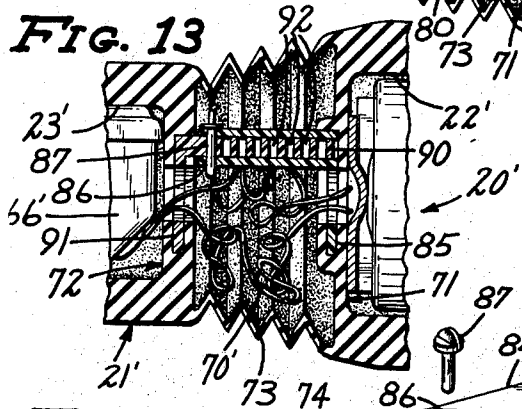
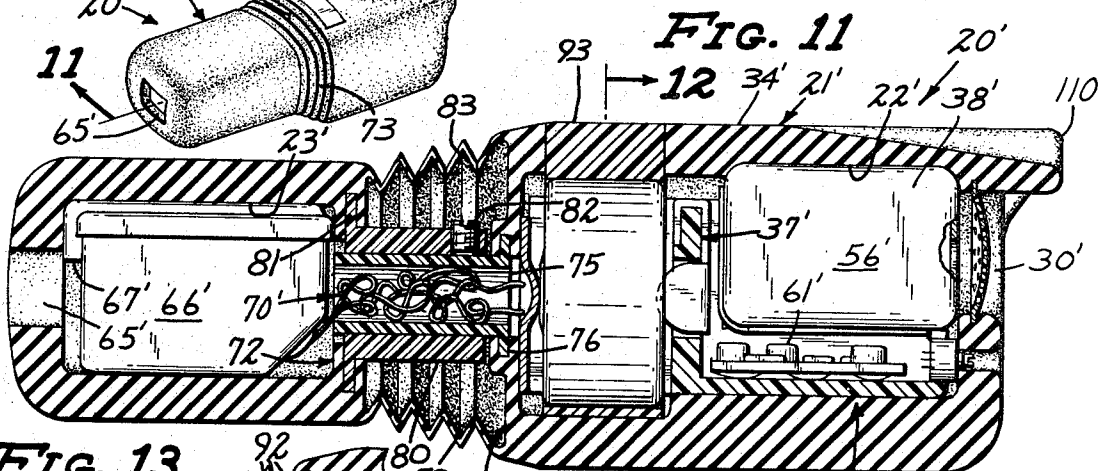
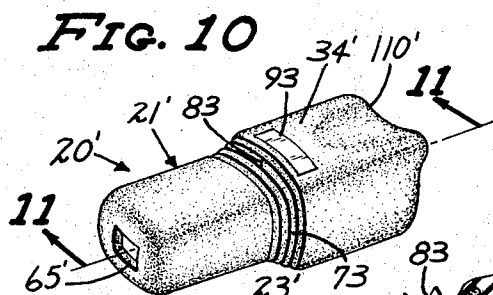
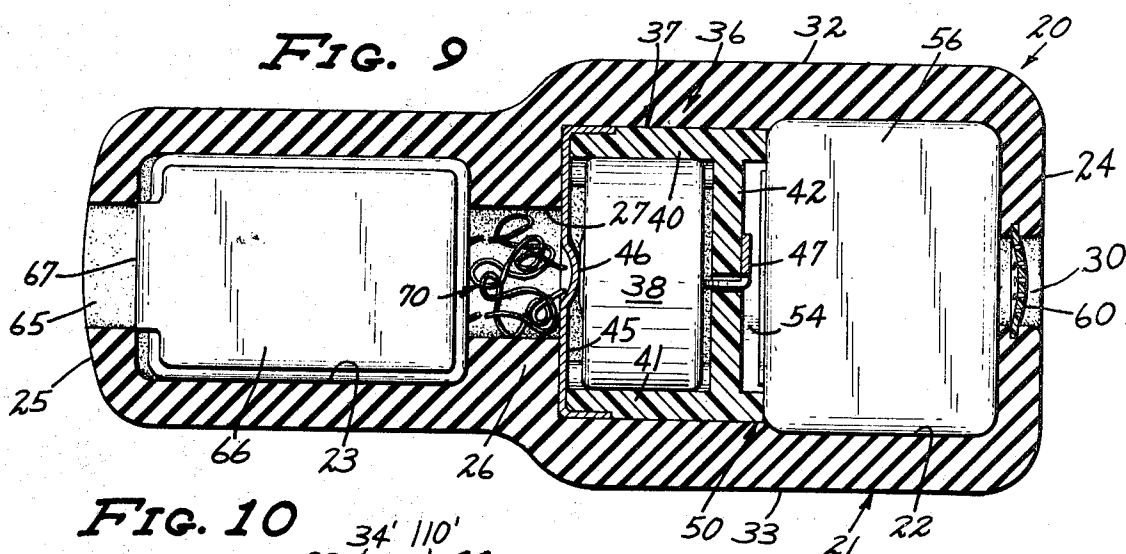
R. L. GEIB

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HEARING AID HAVING RESILIENT HOUSING

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3 Sheets-Sheet 2



INVENTOR.
ROBERT L. GEIB
BY
Merchant & Gould
ATTORNEYS

Sept. 8, 1970

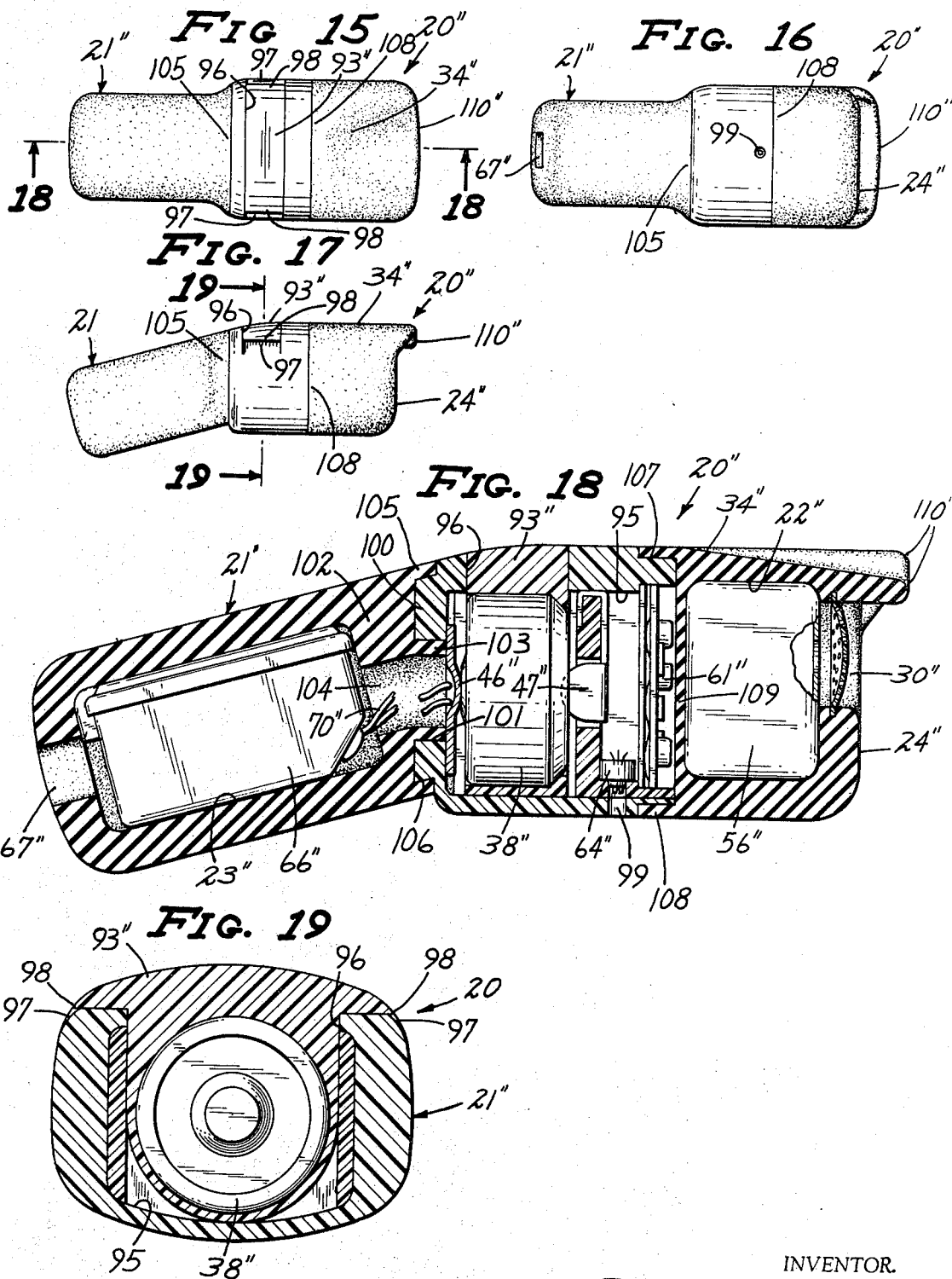
R. L. GEIB

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HEARING AID HAVING RESILIENT HOUSING

Filed March 28, 1967

3 Sheets-Sheet 3



INVENTOR.

ROBERT L. GEIB

BY

Merchant & Gould

ATTORNEYS

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3,527,901

HEARING AID HAVING RESILIENT HOUSING
Robert L. Geib, Wayzata, Minn., assignor to Dahlberg Electronics, Inc., Minneapolis, Minn., a corporation of Minnesota

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U.S. Cl. 179—107

20 Claims

ABSTRACT OF THE DISCLOSURE

A hearing aid adapted to be worn entirely within the ear of the user, where substantially all, or at least a major portion, of the housing is made of a relatively soft resilient material. In use, the portion of the hearing aid housing containing the receiver is positioned in the ear canal of the user so that the acoustic output of the receiver is as close as possible to the user's eardrum. The distance between the portion of the hearing aid housing containing the receiver, and that portion of the hearing aid housing containing the microphone amplifier and energy source, is adjustable so that differences in lengths and sizes of ear canals between different users can be taken into account to insure proper fitting.

BACKGROUND OF THE INVENTION

The present invention pertains to hearing aids in general, and more specifically to hearing aids which are worn entirely within the ear of the user.

All in-the-ear hearing aids, wherein the receiver portion of the aid extends into the ear canal of the user with the acoustic output of the receiver near the eardrum of the user, are known in the prior art, for example, U.S. Pat. 3,197,576. However, in-the-ear hearing aids have certain peculiar problems in their construction. Since the hearing aid must be necessarily small in order to fit into the ear of the user, the various components of the hearing aid are necessarily close together. Since an electronic hearing aid constitutes a sound amplifying system, serious problems of feedback occur when the system components are in close proximity to each other. The feedback problems are basically of two types: acoustic feedback, where the acoustic output from the receiver feeds back through air to the input of the microphone and is regeneratively amplified until the hearing aid amplifier is driven into saturation and a high pitch squeal is heard. This type of feedback is familiar to anyone who has ever placed the microphone of a public address system near or in close proximity to the speaker. The second type of feedback is called conductive feedback and occurs when acoustic energy is fed back through the hearing aid housing itself by way of vibration through the housing walls. Acoustic feedback can usually be prevented by properly sealing the ear canal when the hearing aid is positioned in the ear so that the acoustic output of the receiver cannot follow the ear canal back to the microphone input. However, elimination of conductive feedback is not as easily solved. In the prior art in-the-ear hearing aids, for example of the type disclosed in U.S. Pat. 3,197,576, it is necessary to acoustically insulate the receiver and its housing from the microphone and amplifier and its housing. To do this, the receiver and microphone are both usually suspended by way of some type of rubber or acoustically insulating shock mounting so that neither the receiver nor the microphone is in contact with the hearing aid housing. However, as hearing aids are made smaller, and approach the size where nearly the entire hearing aid fits in the ear canal of the user, the various components of the hearing aid are in such close proximity that it becomes more and more difficult to adequately acoustically insulate the hear-

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ing aid components from the housing. Further, the necessity of using additional acoustic insulating material adds to the physical size of the hearing aid.

The effectiveness of in-the-ear hearing aids wherein the receiver extends into the ear canal of the user is related to the distance that the acoustic output of the receiver is from the user's eardrum. The closer the acoustic output to the eardrum, the more effective is the hearing aid. The length, size, and angle which the ear canal makes with the concha of the ear is different for every person. Some people have relatively long ear canals, others relatively short ear canals. Some people have large ear canals, while other people have small ear canals. The ear canals of some people may make a relatively sharp angle with respect to the entrance of the concha of the ear, and in still other people the angle may be small. In all prior art in-the-ear hearing aids, the distance between the receiver and the hearing main housing was substantially fixed, so that if a person had a long ear canal the acoustic output of the receiver was a relatively long way from his eardrum, thereby decreasing the effectiveness of the hearing aid. Further, if a person had a short ear canal, or in the case of young children, the hearing aid housing cannot be properly fitted into the concha or outer ear of the user since the receiver cannot move far enough into the ear canal and hence holds the housing from proper seating in the concha of the ear.

SUMMARY OF THE INVENTION

In the present invention, the entire housing, or at least that portion housing the microphone and receiver units, is made from relatively soft resilient material. Since the resilient material housing the microphone and receiver units is a good acoustic insulator and all hard plastic or metal parts which may form a part of the housing or internal parts are effectively insulated from contact with the microphone and receiver, the hearing aid has no conductive acoustic feedback problems. Further, since the entire housing or at least a major portion thereof is resilient, the hearing aid makes a much better fit within the concha and ear canal of the user thereby providing a more effective seal and reducing problems of direct acoustic feedback, in addition to being more comfortable to the user since most, if not all, of the hard housing portions, which could cause sores and irritation, have been eliminated. The present invention further provides means for adjusting the distance between the portion of the hearing aid housing, the receiver, and the portion of the hearing aid housing, the microphone amplifier and energy source. In this way, the over-all length of the hearing aid is adjustable, and allows the hearing aid to be specifically, or individually fitted to each user. The adjustability of the receiver position allows the acoustic output to be placed very close to the eardrum, and further allows the portion of the hearing aid housing the receiver, amplifier, and energy source to be properly seated in the concha or outer ear canal of the user.

It is an object of the present invention, therefore, to provide an improved in-the-ear hearing aid.

It is another object of the present invention to provide an improved in-the-ear hearing aid wherein the hearing aid housing is made substantially of soft resilient material.

A further object of the invention is to provide an in-the-ear hearing aid wherein the over-all length of the hearing aid is adjustable.

A still further object of the invention is to provide an in-the-ear hearing aid wherein the microphone and receiver are housed within a soft resilient material to insulate same against acoustic feedback.

These and other objects of my invention will become apparent to those skilled in the art upon consideration of the accompanying specification, claims, and drawings.

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Referring to the drawings, wherein like numerals represent like parts throughout the several views:

FIG. 1 is a side elevational view of an in-the-ear hearing aid constructed in accordance with the present invention;

FIG. 2 is an elevational view thereof of the side opposite that shown in FIG. 1;

FIG. 3 is a side elevational view thereof rotated 90 degrees;

FIG. 4 is an end elevation thereof as seen from left to right of FIG. 1;

FIG. 5 is an end elevation thereof of the end opposite that seen in FIG. 4;

FIG. 6 is a view in exploded perspective thereof;

FIG. 7 is an enlarged transverse sectional view as seen from the line 7—7 of FIG. 1, portions thereof being shown in elevation;

FIG. 8 is a view in longitudinal axial section as seen from line 8—8 of FIG. 1 on an enlarged scale, portions thereof being shown in elevation;

FIG. 9 is a view in longitudinal axial section as seen from the line 9—9 of FIG. 3 on an enlarged scale, portions thereof being shown in elevation;

FIG. 10 is a view in perspective of a modified version of the structure shown in FIGS. 1—9 showing means for varying the longitudinal dimension thereof;

FIG. 11 is a view in longitudinal axial section as seen from the line 11—11 of FIG. 10 on an enlarged scale, portions thereof being shown in elevation;

FIG. 12 is a view in transverse section as seen from the line 12—12 of FIG. 11, portions thereof being shown in elevation;

FIG. 13 is a view in longitudinal axial section of a further modified version of the structure of FIG. 11, a portion thereof being broken away;

FIG. 14 is an enlarged view in perspective of a portion of FIG. 3 removed;

FIG. 15 is a side elevational view of a still further modified version of a hearing aid constructed in accordance with my invention;

FIG. 16 is a view in elevation of the side opposite that shown in FIG. 15;

FIG. 17 is a side elevational view of the structure of FIG. 15 rotated 90 degrees;

FIG. 18 is an enlarged axial sectional view as seen from the line 18—18 of FIG. 15, portions thereof being shown in elevation; and

FIG. 19 is an enlarged view in transverse section as seen from the line 19—19 of FIG. 17, portions thereof being shown in elevation.

Referring to the FIGS. 1—9, there is shown a hearing aid 20 comprising a generally longitudinal housing 21 made substantially entirely of a soft resilient material such as molded rubber. Resilient housing 21 has a first inner hollow compartment 22 and a second inner hollow compartment 23, compartments 22 and 23 being positioned adjacent one another along the longitudinal axis of housing 21.

If desired, and it is shown for example in FIG. 3, compartment 23 can be formed so that its axis is at a slight angle with respect to the axis of compartment 22.

Compartment 22 has an end wall 24 which forms one end wall of the housing 21, while compartment 23 has an end wall 25 which forms the opposite end wall of housing 21. A generally center wall 26 separates compartments 22 and 23, wall 26 having an aperture 27 therethrough.

End wall 24 of compartment 22 has a sound receiving aperture 30 therethrough. Laterally spaced from said aperture 30 is a potentiometer adjustment aperture 31 through end wall 24.

Four side walls 32, 33, 34, and 35 of housing 21 extend between and join end walls 24 and 25. Side walls 32 and 33 are opposite each other as are side walls 34 and 35.

A generally rigid frame member 36 is mounted in the

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inner compartment 22. Frame member 36 comprises a first frame portion 37, which includes opposed side wall elements 40 and 41 and a connecting wall element 42.

Side elements 40 and 41 extend along the inner surfaces of side walls 32 and 33 of housing 21 respectively, from center wall 26 toward end wall 24. Connecting wall element 42 extends between side wall elements 40 and 41 generally centrally of inner compartment 22. First frame portion 37 forms a mounting, or battery holder, for a battery or other suitable source of energizing potential, 38. Side wall element 34 has a generally transverse opening 43 therein to allow insertion and removal of battery 38 into the frame portion 37. The lower portions of side wall elements 40 and 41 adjacent housing side wall 35 are curved inwardly to form a stop means for limiting the movement of battery 38 into the first frame portion or battery holder 37.

In order to facilitate the removal of battery 38 from the battery holder 37, side wall 35 of housing 21 has an opening 44 therein, opening 44 being in generally opposed relation to the battery insertion opening 43. To remove battery 38, a suitable tool is inserted through opening 44 to engage battery 38 and push it out through opening 43, as shown in dotted lines in FIG. 3.

A first electrical contact 45 bridges the side wall elements 40 and 41 of battery holder 37. The center 46 of contact 45 is deformed toward connecting wall element 42 of battery holder 37, and engages one electrode of battery 38. A second electrical contact 47 is mounted on connecting wall 42, and engages a second electrode of battery 38.

Frame member 36 further comprises a second frame portion 50 which includes opposed side elements 51 and 52, a connecting wall element 53 and a bottom wall element 54. Side wall elements 51 and 52 extend along the inner surfaces of side walls 32 and 33 of housing 21 respectively, from connecting wall element 42 toward end wall 24. Connecting wall element 53 extends between side wall elements 51 and 52 along the inner surface of end wall 24. Bottom wall element 54 extends along the inner surface of side wall 35 from connecting wall element 42 to connecting wall element 53, and encloses the bottom of the recess formed by connecting wall elements 42 and 53 and side wall elements 51 and 52.

The height of side wall elements 51 and 52 and connecting wall element 53 is less than the height of connecting wall element 42 so that connecting wall elements 42 and 53 and side wall elements 51 and 52 form a notch 55 in the second frame portion 50.

A microphone 56, having an acoustic input aperture 57, is mounted in the notch 55 of the second frame portion 50, and is positioned so that the input aperture 57 is adjacent the acoustic input aperture 30 of housing 21. A perforated protection cover plate 60 is mounted in the acoustic input aperture 30 of housing 21 to protect the input 57 of microphone 56.

An amplifier circuit, shown generally at 61, is mounted on a printed circuit board 62. Amplifier 61 can be of any conventional audio-amplifier design, and the details of a particular amplifier design are not shown. Amplifier 61 and printed circuit board 62 are mounted in the recess of the second frame portion 50 formed by connecting wall elements 42 and 53 and side wall elements 51 and 52. Suitable connecting means (not shown) connect the microphone 56 to the input of amplifier 61, and in addition suitable connecting means (not shown) connect the first and second electrical contacts 45 and 47 of battery holder 37 to amplifier 61 to provide an energizing source for the amplifier.

Connecting wall element 53 has a groove or aperture 63 therein adjacent the potentiometer adjustment aperture 31. A screw driver adjust potentiometer 64 is mounted in groove 63, the screw driver adjustment of potentiometer 64 extending partially into potentiometer adjustment aperture 31 to allow the potentiometer to be adjusted from outside hearing aid 20. Suitable conducting means

(not shown) connect potentiometer 64 to amplifier circuit 61.

End wall 25 of compartment 23 has an aperture 65 therethrough. An elongated receiver member 66, having an acoustic output aperture 67 at one end thereof, is mounted inside of the second inner compartment 23 so that the acoustic output aperture 67 of receiver 66 is adjacent the aperture 65 of end wall 25. Suitable electrical conductors, shown generally at 70, connect the output of amplifier 61 to the input of receiver 66.

In constructing a hearing aid in accordance with the present invention, the housing 21, as explained previously, can be molded from a soft resilient material. The microphone, amplifier, battery contacts, and other components are assembled on the rigid frame 50 in the positions previously described, and as shown in exploded view in FIG. 6. The receiver input conductors are connected to the receiver 66 and threaded through aperture 65, housing 21, and aperture 30, and are connected to the output of amplifier 61. Aperture 30 in end wall 24 is stretched and the preassembled frame 36 is inserted in the first inner compartment 22. Similarly, aperture 65 in end wall 25 is stretched and receiver 66 is inserted into the second inner compartment 23. The battery 38 is inserted through slot 43 and the hearing aid 20 is ready for use.

Another embodiment of the present invention is shown in FIGS. 10-14, wherein the hearing aid housing 21' has a pair of intermediate internal end walls 71 and 72, which are spaced from each other along the longitudinal axis of housing 21'. Wall 71 forms an internal end wall for the first inner compartment 22', while wall 72 forms an internal end wall for a second inner compartment 23'.

Housing 21' further has a resilient stretchable portion 73, shown in FIGS. 10, 11, and 13 in the form of a bellows, or membranous sleeve, which extends between end walls 71 and 72. Suitable means are provided for varying the over-all length of the housing hearing aid 21' by stretching resilient portion 73. For example, FIG. 11 shows a first tubular member 75 having a flanged end 76 which is mounted in end wall 71; tubular member 75 extending in the direction of the longitudinal axis of housing 21'. A second tubular member 80 has a flanged end 81 which is mounted in end wall 72; tubular member 80 also extends in the direction of the longitudinal axis of housing 21' and telescopically receives the tubular member 75. A locking means, such as a set screw 82, is threaded through a threaded aperture in tubular member 80 and engages tubular member 75 to lock the tubular members in any desired degree of telescopic movement. A slot 83 is provided in stretchable portion 73 to allow set screw 82 to be adjusted. The tubular members 75 and 80 have apertures extending longitudinally therethrough to allow for the passage of the electrical conductors 70' to receiver 66.

An alternate form of the tubular members is shown in FIGS. 13 and 14. A first tubular member 84 has a flange portion 85 in the form of a ring which is mounted in end wall 71. As explained previously with respect to tubular member 80, member 84 extends in the direction of the longitudinal axis of housing 21'. The extended end of member 84 has an aperture 86 therethrough suitable for receiving a pin 87. A second tubular member 90 has a flange portion 91, also in the form of a ring, which is mounted in end wall 72. Member 90 extends in the direction of the longitudinal axis of housing 21' and telescopes into the member 84. A plurality of apertures 92 are longitudinally spaced along tubular member 90. The telescopic movement between tubular members 84 and 90, and hence the over-all length of housing 21', is controlled by inserting pin 87 through aperture 86 of member 84 and a selected one of the apertures 92 of member 90.

There is also shown in FIGS. 11 and 12 an alternate form of battery compartment, wherein the battery 38' is held in a drawer-like member 93 which slides into the

first frame portion 37' of frame member 36'. Drawer member 93 is made of any suitable rigid material, such as plastic, and is formed so that its outer surface is flush with the side wall 34' of housing 21' when drawer 93 is closed. A groove 94 is formed in the upper side faces of drawer 93 to allow the drawer to be grasped by the fingers for removal during battery replacement.

A still further embodiment of the present invention is shown in FIGS. 15-19 wherein a hearing aid 20'' is formed of a housing 21'' having a plurality of housing portions which define first, second and third hollow compartments indicated generally by the numerals 22'', 23'' and 95 respectively. As shown, hollow compartments 22'', 23'' are formed from a relatively soft resilient material such as in the previously described hearing aids 20, 20', and in this modification serve to house a microphone 56'' and receiver 66'' respectively.

The portion of the housing 21'' defining the third compartment 95 is formed from a relatively rigid plastic material and has mounted therein a battery 38'', an amplifier 61'', and a potentiometer 64''. Also, mounted within the third compartment is a first electrical contact 46'', in engagement with one electrode of the battery 38'', and a second electrical contact 47'' in engagement with the other electrode of the battery 38''. A first opening 96 is formed in one side wall of compartment 95 to permit insertion and/or removal of a drawer-like battery carrier 93'' which positions the electrodes of the battery 38'' in engagement with their respective electrical contacts 46'', 47''. As seen particularly in FIG. 19, housing 21'' adjacent the drawer-like battery carrier 93'' is formed with the recesses 97 to permit access to portions 98 of carrier 93'' by the fingernails of a user for purposes of removal or replacement of the battery 38''. A second opening 99 is formed in an opposite side wall of compartment 95 adjacent the potentiometer 64'' to permit adjustment of the potentiometer 64'' from the exterior of the housing 21''.

Referring particularly to FIG. 18, it will be seen that one end of compartment 95 is defined by a transverse wall portion 100 having a central opening 101. The adjacent end of compartment 23'' is in turn defined by a transverse wall portion 102 which is provided with a throat portion 103 extending outwardly therefrom. Throat portion 103 is received through opening 101, and the extended end thereof is anchored to electrical contact 46'' by bonding or the like, such as with a suitable adhesive, not shown. Suitable electrical conductors 70'' extend from the receiver 66'' through an opening 104 formed in the wall 102 and throat 103 and connect the output of the amplifier 61'' to the input of receiver 66''. Other suitable connecting means, not shown, connect the microphone 56'' to the input of amplifier 61'', and in addition, suitable connecting means, not shown, connect the electrical contacts 46'', 47'', to amplifier 61'' to provide an energizing source for the amplifier 61''. With the above construction, compartment 23'' is securely anchored to compartment 95 in a manner to prevent any conductive acoustic feedback through the medium of the compartment 95. To assist the anchoring of compartment 23'' to compartment 95 and to provide a relatively smooth contour at the juncture of compartments 23'', 95, compartment 23'' is provided with a flange portion 105 which is received in a peripheral channel or recess 106 formed in the adjacent end of compartment 95. Flange 105 is likewise secured in recess 106 by means of bonding or the like with a suitable adhesive, not shown.

The end of compartment 95 adjacent compartment 22'' is also provided with a peripheral channel or recess 107 which serves to receive a flange 108 formed on the adjacent end of compartment 22''. Flange 108 is likewise bonded or the like with a suitable adhesive, not shown, in recess 107 and anchors compartment 22'' to compartment 95 in a manner to provide a relatively smooth con-

tour to housing 21" at the juncture of compartments 22", 95.

To further isolate microphone 56" from conductive acoustic feedback through compartment 95 or parts housed therein, there is provided a transverse wall portion 109 formed integrally with the side walls of compartment 22" and also of a similarly soft resilient material. It will be appreciated, of course, that such a wall 109 need not be formed integrally with compartment 22", but only needs to be positioned in such a manner as to isolate microphone 56" from the adjacent portions of compartment 95 and parts housed therein when flange 108 is anchored in recess 107.

In operation, the housings 21, 21', 21" of hearing aids 20, 20', 20" are worn entirely within the ear of the user, with the receiver extending down into the user's ear canal. The over-all length of the hearing aid 20' is adjusted so that the acoustic output of the receiver will be as close as possible to the user's eardrum. It will also be noted that the longitudinal axis of the compartments 22', 23' are normally disposed in a coaxial relationship. The soft resilient nature of the housing 21' permits the hearing aid 20' to assume the particular shape of the ear canal when mounted in the ear of different users.

The side walls 34, 34', 34" of hearing aids 20, 20', 20" each have an overhang portion 110, 110', 110" which overhangs end walls 24, 24', 24". These overhang portions 110, 110', 110" provide tab means by which the hearing aids 20, 20', 20" may be grasped for removal from the ear. In addition, when the hearing aids 20, 20', 20" are worn in the ear, the overhang portion 110, 110', 110" faces the bowl or sound collecting portion of the ear, and acts to reflect sound waves received by the ear into the acoustic input aperture 30, 30', 30" of hearing aids 20, 20', 20". These sound waves are picked up by microphones 56, 56', 56", amplified by amplifiers 61, 61', 61", and fed to receivers 66, 66', 66", which produces an acoustic output at apertures 67, 67', 67", which energizes the eardrum of the user.

I claim:

1. An in-the-ear hearing aid comprising:
 - (a) a generally longitudinal housing having opposed side walls and opposite end walls;
 - (b) said housing defining a plurality of hollow compartments, said hollow compartments being adjacent one another along a longitudinal axis of said housing;
 - (c) a first of said compartments terminating at one of said end walls of said housing and a second of said compartments terminating at the opposite of said end walls of said housing, the walls of said housing defining said first and second compartments being formed of soft resilient material;
 - (d) one of said walls of said first compartment of said housing having a sound receiving aperture therethrough and said opposite end wall of said housing having an acoustic output aperture therethrough;
 - (e) a microphone, amplifier, battery and elongated receiver mounted inside of said longitudinal housing;
 - (f) frame means mounting said microphone, amplifier and battery in said first compartment, said frame means including a first frame portion and a second frame portion, said first frame portion including opposed side wall elements and a connecting wall element which define a battery receiving recess disposed adjacent said battery receiving opening, said second frame portion extending toward said one end wall of said first compartment from said connecting wall element and defining with said connecting wall element a notch adapted to receive and mount said microphone in said first compartment, said second frame portion and said connecting wall element further cooperating to define a second recess opening toward said notch and adapted to receive said amplifier;
 - (g) said microphone being mounted in said first com-

partment with the acoustic input of said microphone adjacent said sound receiving aperture;

- (h) said elongated receiver being mounted within said second compartment of said housing, said receiver having an acoustic output disposed adjacent said sound output aperture; and
 - (i) means connecting said microphone, amplifier, battery, and receiver in an electrically operable relationship.
2. An in-the-ear hearing aid comprising:
 - (a) a housing having a first hollow compartment and a second hollow compartment;
 - (b) said first compartment having a microphone, amplifier, and battery mounted therein;
 - (c) said second compartment having a receiver mounted therein;
 - (d) means connecting said microphone, amplifier, battery and receiver in an electrically operable amplifying relationship;
 - (e) said housing having a resilient stretchable portion separating said first compartment from said second compartment; and
 - (f) means connected to said housing for varying the spacing between said first and second compartments.
 3. The structure defined in claim 1 in which said first frame portion includes stop means limiting movement of said battery into said battery receiving recess.
 4. The structure defined in claim 1 in which said second frame portion includes:
 - (a) opposed side wall elements, and
 - (b) a connecting wall element connecting said opposed side wall elements adjacent said one end wall of said first compartment.
 5. The structure defined in claim 4 in which said one end wall of said first compartment has a second aperture formed therein laterally of said sound-receiving aperture and in which said connecting wall portion of said second frame portion has an aperture formed therein for mounting a potentiometer adjacent said second aperture to permit adjustments from the exterior of said housing.
 6. The structure defined in claim 1 in which said opposed side walls of said first frame portion are adapted to mount an electrical contact bridging said side wall elements and in engagement with one electrode of said battery and in which said connecting wall element of said first frame portion is adapted to mount an electrical contact in engagement with the other electrode of said battery when said battery is received in said battery recess.
 7. The structure defined in claim 2 in which:
 - (a) said housing is further provided with a pair of intermediate end wall elements spaced axially of the longitudinal axes of said first and second compartments, one each forming an end wall for adjacent ends of said first and second compartments and in which said resilient stretchable portion is in the form of a membranous sleeve connecting said intermediate end walls; and
 - (b) in which said means for varying the spacing between said first and second compartments extends between said pair of intermediate end wall elements.
 8. The structure defined in claim 7 in which at least one of said spaced intermediate wall elements and means varying the spacing between said first and second compartments of said housing has aperture means formed therein for passage of electrical conductors from said first compartment to said second compartment.
 9. The structure defined in claim 2 in which said means for varying the spacing between said first and second compartments of said housing includes:
 - (a) a first member carried by one of said compartments and extending therefrom in the direction of the longitudinal axes of said first and second compartments;
 - (b) a second tubular member carried by and extend-

ing from the other of said compartments and telescopically receiving said first member; and

(c) means locking said first and second members in a selected degree of telescopic movement.

10. The structure defined in claim 7 in which said means for varying the spacing between said compartments includes:

(a) a first member carried by one of said intermediate end wall elements and extending therefrom generally in the direction of the longitudinal axes of said first and second compartments;

(b) a second tubular member carried by and extending from the other of said intermediate wall elements and telescopically receiving said first member; and

(c) means locking said first and second members in a selected degree of telescopic movement.

11. The structure defined in claim 7 in which said membranous sleeve is slit to provide access to said last mentioned means from the exterior of said housing.

12. The structure defined in claim 2 including frame means mounting said microphone, amplifier and battery in said first compartment.

13. The structure defined in claim 2 in which said housing has an opening therein for insertion and removal of said battery.

14. The structure defined in claim 12 in which said frame means comprises:

(a) a first frame portion and a second frame portion,

(1) said first frame portion including opposed side wall elements and a connecting wall element which define a battery receiving recess disposed adjacent said battery receiving opening,

(2) said second frame portion extending toward said one end wall of said first compartment from said connecting wall element and defining with said connecting wall element a notch adapted to receive and mount said microphone in said first compartment,

(3) said second frame portion and said connecting wall element further cooperating to define a second recess opening toward said notch and adapted to receive said amplifier.

15. The structure defined in claim 14 in which said first frame portion includes stop means limiting movement of said battery into said battery receiving recess.

16. The structure defined in claim 13 in which said second frame portion includes:

(a) opposed side wall elements, and

(b) a connecting wall element connecting said opposed side wall elements adjacent said one end wall of said first compartment.

17. The structure defined in claim 16 in which said one end wall of said first compartment has a second aperture formed therein laterally of said sound receiving aperture and in which said connecting wall portion of said second frame portion has an aperture formed therein for mounting a potentiometer adjacent said second aperture to permit adjustments from the exterior of said housing.

18. The structure defined in claim 14 in which said opposed side walls of said first frame portion are adapted to mount an electrical contact bridging said wall elements and in engagement with one electrode of said battery and in which said connecting wall element of said first frame portion is adapted to mount an electrical contact in engagement with the other electrode of said battery when said battery is received in said battery recess.

19. An in-the-ear hearing aid comprising:

(a) a generally longitudinal housing having opposed side walls and opposite end walls;

(b) said housing defining a plurality of hollow compartments, said hollow compartments being adjacent one another along a longitudinal axis of said housing;

(c) a first of said compartments terminating at one of said end walls of said housing and a second of said compartments terminating at the opposite of said end walls of said housing, the walls of said housing defining said first and second compartments being formed of soft resilient material;

(d) one of said walls of said first compartment of said housing having a sound receiving aperture therethrough and said opposite end wall of said housing having an acoustic output aperture therethrough;

(e) a microphone, amplifier, battery and elongated receiver mounted inside of said longitudinal housing;

(f) said microphone being mounted in said first compartment with the acoustic input of said microphone adjacent said sound receiving aperture;

(g) said elongated receiver being mounted within said second compartment of said housing, said receiver having an acoustic output disposed adjacent said sound output aperture;

(h) means connecting said microphone, amplifier, battery, and receiver in an electrically operable relationship; and

(i) said housing having an opening formed in one of said side walls for the insertion and removal of said battery and a second opening in the opposed side wall in generally opposed relation to said battery receiving opening whereby a tool inserted therethrough will engage said battery and move same outwardly through said battery receiving opening.

20. An in-the-ear hearing aid comprising:

(a) a generally longitudinal housing formed of soft resilient, stretchable material and having opposed side walls and opposite end walls;

(b) said housing defining therein a plurality of hollow compartments, said hollow compartments being adjacent one another along a longitudinal axis of said housing and separated by a portion of the soft resilient, stretchable material forming the housing with a communicating opening therethrough;

(c) a first of said compartments terminating at one of said end walls of said housing and a second of said compartments terminating at the opposite of said end walls of said housing;

(d) one of said end walls of said housing having a sound receiving aperture therethrough and said opposite end wall of said housing having an acoustic output aperture therethrough;

(e) a microphone, amplifier, battery and elongated receiver mounted inside of said longitudinal housing;

(f) said microphone being mounted in said first compartment with the acoustic input of said microphone adjacent said sound receiving aperture;

(g) said elongated receiver being mounted within said second compartment of said housing, said receiver having an acoustic output disposed adjacent said sound output aperture; and

(h) means connecting said microphone, amplifier, battery, and receiver in an electrically operable relationship.

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KATHLEEN H. CLAFFY, Primary Examiner

R. P. MYERS, Assistant Examiner