

Sept. 25, 1962

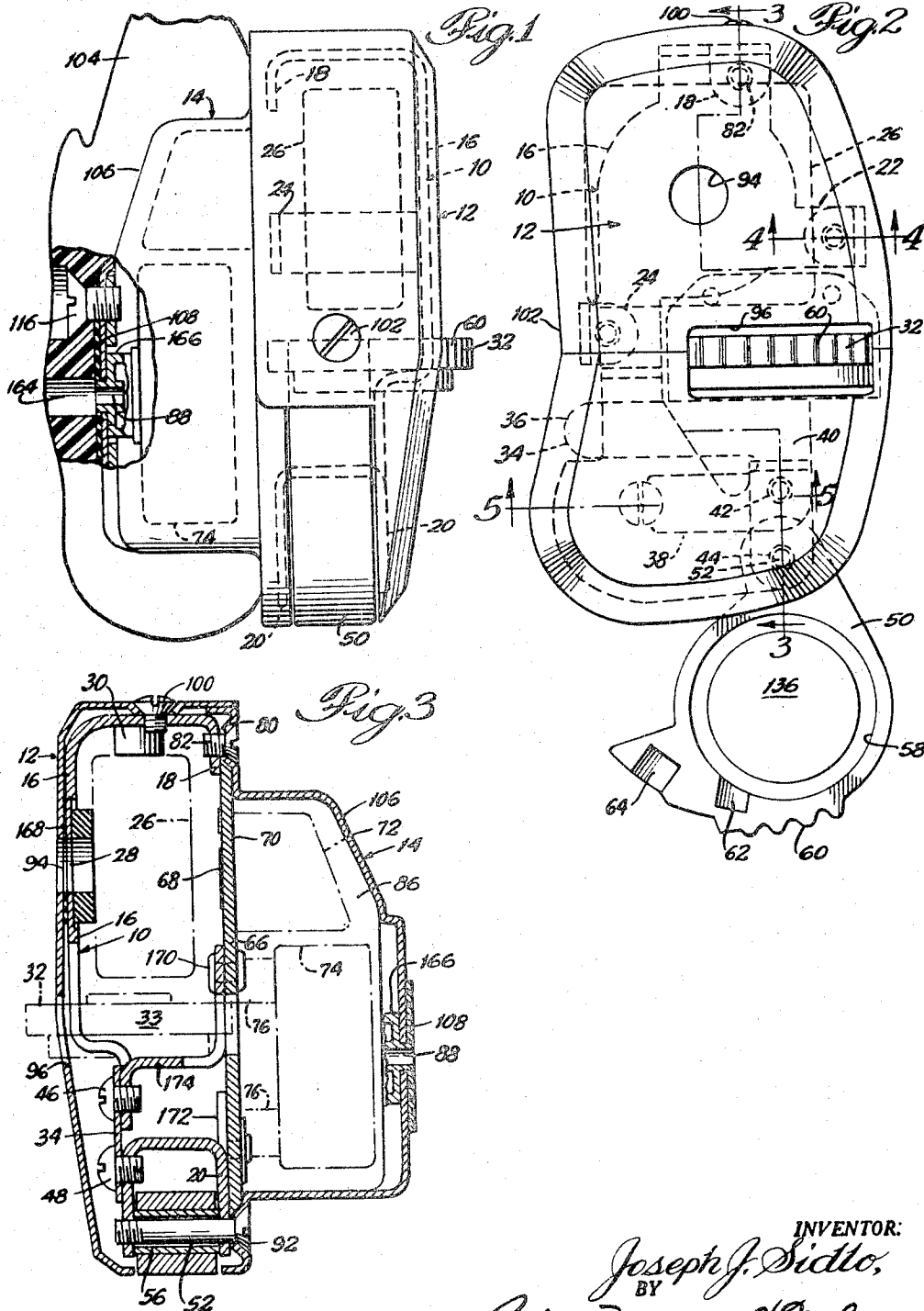
J. J. SIDLO

3,055,990

HEARING AID

Filed June 5, 1961

2 Sheets-Sheet 1



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Fig. 4

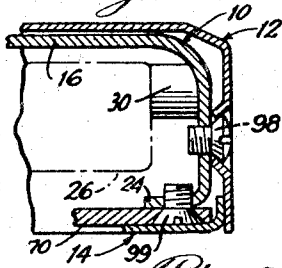


Fig. 5

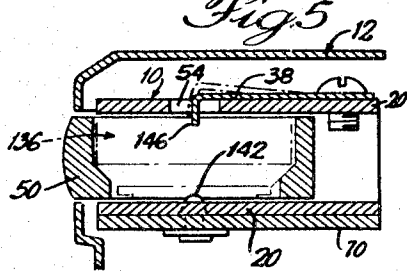


Fig. 7

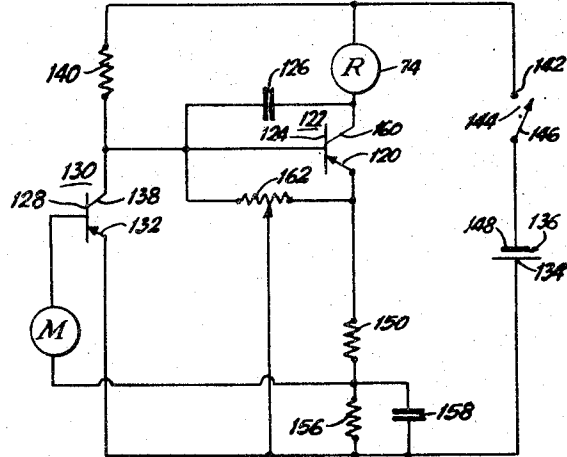
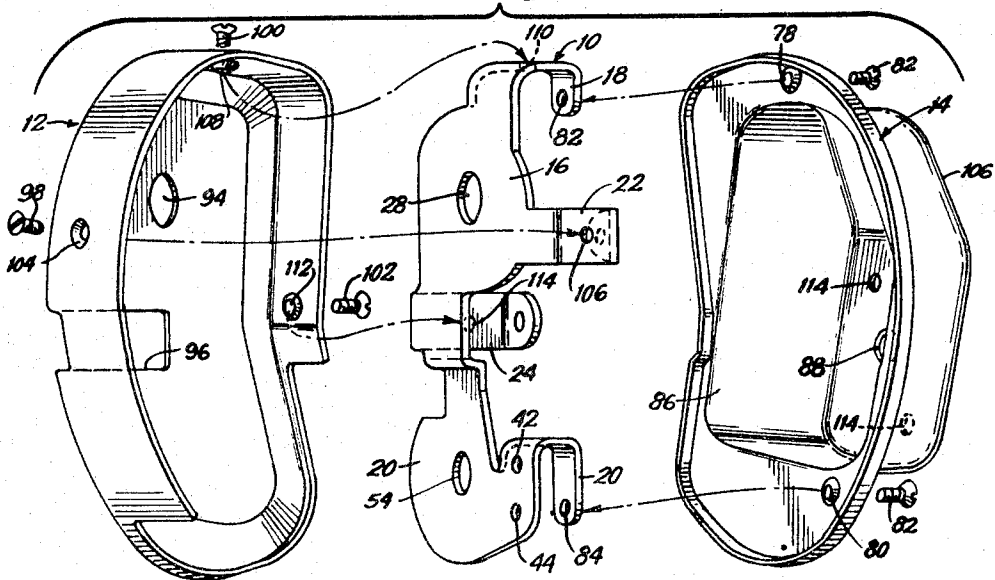


Fig. 6



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3,055,990

## HEARING AID

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Filed June 5, 1961, Ser. No. 114,906  
10 Claims. (Cl. 179-107)

This invention relates generally to compact hearing aid assemblies and more particularly to a new and improved hearing aid assembly of the type adapted to be completely worn at the ear of the user.

It is known to provide compact hearing aid assemblies in which all of the component parts are completely contained in a composite unitary structure adapted to be worn at the external ear of the user. A representative hearing aid of this type, for example, is shown in the co-pending application of Stuart G. McCarrell and Harry A. Wayne, Serial No. 661,628, filed May 27, 1957, of common assignee.

Due to the relatively small sizes of such hearing aid housings and the component parts positioned therewithin, problems have arisen in the assembly and dis-assembly of these hearing aids for manufacture and repair purposes. Thus, in such small hearing aids considerable time, expense and trouble often are required for assembly and dis-assembly operations.

Accordingly, it is a general object of this invention to provide a new and improved compact hearing aid construction which eliminates the above-described problems of prior art devices.

It is another object of this invention to provide a hearing aid support assembly comprised of only three parts, namely, an inner bracket upon which all of the hearing aid parts except the receiver are mounted, an inner shell adapted to support the receiver, and an outer shell or case.

It is still another object of this invention to provide a new and improved hearing aid support assembly having an outer shell or case which is readily removable to enable the styling and color of the hearing aid to be varied as desired.

It is a further object of this invention to provide an improved hearing aid support assembly comprised of an inner bracket, and a pair of shells, which assembly is adapted to fit directly into a molded recess of a custom ear mold for efficient acoustical sealing and comfortable fit.

It is a still further object of this invention to provide a new and improved hearing aid assembly, as above, which is characterized by its dual advantages of economy and efficiency of assembly, and by its adaptability to desired color and styling variations.

The novel features which are characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following description taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a side elevational view, partly in cross-section of an illustrative hearing aid assembly embodying the invention, as mounted in the molded recess of an ear mold;

FIGURE 2 is a front elevational view of the illustrative hearing aid assembly shown in FIGURE 1;

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FIGURE 3 is a cross-sectional view taken substantially as shown along line 3-3 of FIGURE 2;

FIGURE 4 is a cross-sectional view taken substantially as shown along line 4-4 of FIGURE 2;

FIGURE 5 is a cross-sectional view taken substantially as shown along line 5-5 of FIGURE 2;

FIGURE 6 is an exploded view illustrating the inner bracket and cover shell assembly of the invention; and

FIGURE 7 is an electrical schematic diagram of an illustrative hearing aid circuit useful with the present invention.

Referring now to the drawing, and more particularly to FIGURES 1, 2, 3, and 6 thereof, there is illustrated a compact hearing aid assembly which embodies the novel features of the present invention. Advantageously, this illustrative embodiment comprises hearing aid support means, which for purposes of simplicity of construction and assembly, has been reduced to three major parts. Thus, the hearing aid support means comprises an elongated inner frame or bracket 10, and a pair of shaped concave shells 12 and 14 which are removably fastened to the inner bracket 10.

As brought out in greater detail hereinbelow, the inner bracket 10 has mounted thereon almost all of the component parts of the hearing aid including a microphone, volume control means, a battery holder and switch assembly, and an amplifier. The remaining hearing aid component, a receiver, is mounted in a shaped recess of one of the concave shells, and the two shells are adapted to be fastened to the inner bracket 10 to form the outer housing for the hearing aid assembly. The ease by which the two concave shells can be fastened to or unfastened from the inner bracket facilitates the assembly and dis-assembly of the hearing aid for purposes of manufacture, inspection, or repair. In addition, one of the concave shells forms an outer cover or case for the hearing aid and the ease by which this outer cover can be replaced serves to permit variations to be made in the styling or color of the hearing aid housing to suit the tastes and desires of the wearer. Those skilled in the art will appreciate that this feature gives rise to material savings in production and inventory costs.

As particularly shown in FIGURE 6, the inner frame or bracket 10 is formed with a main body portion 16 having a turned over flange 18 at one end thereof and a turned over flange 20 at the other end thereof. A pair of turned over side flanges 22 and 24 are provided on the main body 16 intermediate the end flanges 18 and 20. Advantageously, side flanges 22 and 24 may be off-set with respect to each other.

In the assembly of the hearing aid components upon the inner bracket 10, a microphone 26 is mounted by suitable transducer suspension means with its sound receiving opening adjacent an aperture 28 formed in the body of inner bracket 10. As known to those skilled in the art, feedback isolation for the microphone 26 may be provided by spacing the microphone from the bracket 10 by transducer suspension means of the type which reduces mechanical and acoustical feedback from the remainder of the hearing aid to the microphone. Such transducer isolation means may take the form of suitable resilient washers and bumpers, such as the isolators 30 or, alternatively, tubular transducer suspension means of the type disclosed in the co-pending application of Erwin Weiss,

Serial No. 103,637, filed Apr. 17, 1961, now Patent 3,048,688, issued Aug. 7, 1962, may be utilized for this purpose.

After the microphone 26 is mounted by the transducer isolators to the inner bracket 10, volume control means 33 may be mounted to the inner bracket 10. Advantageously, the mounting of the volume control means 33 upon bracket 10 may be facilitated by the optional use of a suitable intermediate support. Towards this end, a volume control support bracket 174 may be secured to bracket 10 by the screw fastener 46 and to a printed circuit panel board 68 by the eyelet 170. Preferably, a volume control knob 32, provided with suitable knurled edges if desired and rotatably secured to the volume control potentiometer, is mounted such that the knurled edges extend outwardly from the hearing aid to permit ready manual actuation of the volume level.

A contact and detent assembly 34 is then fastened to the inner bracket 10 as shown in FIGURES 2 and 5 of the drawing. The contact and detent assembly advantageously comprises a detent arm 36 and a contact arm 38, in the form of leaf springs joined by an intermediate bridge 40 to provide a unitary assembly. As explained in greater detail hereinbelow, the resilient detent arm 36 is utilized to engage a pivotable battery holder, and the resilient contact arm 38 is utilized to provide sliding contact between its contact 146 and the battery in the battery holder to effect a circuit opening and closing function.

The contact and detent assembly 34 advantageously is secured to the inner bracket 10, as by the screw fastener 48 at the internally threaded aperture 42 provided adjacent the turned-over flange 20 of inner bracket 10. In addition, assembly 34 may be secured to the volume control potentiometer bracket by the screw fastener 46.

After the contact and detent assembly 34 is secured to the inner bracket 10, as described hereinabove, an amplifier board 66 is secured, as by eyelet 170, to the inner bracket 10 to substantially enclose the microphone 26 and the volume control means 33. The amplifier board 66 may take the form of a well-known printed circuit board wherein the circuit conductors are printed on the inner surface 68 of board 66 and wherein the circuit components including the resistors, the capacitors and amplifying elements, such as transistors, are mounted on the opposite surface 70. Advantageously, these components may be mounted on the printed circuit board 66 in the area identified at 72 so as to project outwardly from the board 66 in a direction away from the microphone 21.

Feedback isolating bumpers 76 for the hearing aid receiver 74 then are mounted to the printed circuit board 66 below the amplifier components 72, as shown in FIGURE 3. In this manner, the receiver 74 is provided with additional isolation with respect to acoustical and mechanical feedback between the receiver and the remainder of the hearing aid.

After the receiver 74 is mounted in inner shell 14, the latter is ready to be secured to the inner bracket 10. It can be seen in FIGURES 3 and 6, that the inner shell 14 is provided with suitable apertures 78 and 80 which are aligned with the apertures 83 and 84, respectively, of inner bracket 10 when the inner shell 14 is positioned on the inner bracket. Suitable threaded fasteners 82 may be utilized to securely fasten the inner shell 14 to the inner bracket 10 as indicated in FIGURE 6 of the drawing. It will be noted that the inner shell 14 is formed with a recessed portion 86 of sufficient depth to accommodate the receiver 74 and amplifier components 72. A sound outlet opening 88 is provided in the inner shell 14 and is aligned with the sound outlet of receiver 74 when the receiver is positioned in place within the recess 86. Advantageously, the receiver 74 may be mounted on a resilient spacer 166 which serves as a transducer isolator as well as a receiver support. As shown in FIGURES 1 and 3, the spacer 166, which may be formed of butyl rubber or a like resilient material of similar isolating proper-

ties, is adhesively attached to the receiver 74 and to the inner wall of shell 14 to space the receiver out of contacting relation with the shell. As explained hereinabove, the opposite wall of receiver 74 is isolated by means of the bumpers 76.

Those skilled in the art will appreciate that acoustical sealing means 90 also may be provided on the inner wall of shell 14 around spacer 166 to prevent acoustical feedback from the receiver to the microphone.

At this time, the battery holder 50 is inserted within the U-shaped frame defined by the flange 20 and the bracket 10. The flange 20 of the lower portion of the bracket 10 defines a U-shaped recess capable of pivotally receiving one end of a battery holder 50. As shown in FIGURE 2 of the drawing, the battery holder 50 is pivotally secured to the bracket 10, as by means of the elongated shaft 52 of screw fastener 92, which is inserted through an opening of the battery holder 50 into the internally threaded apertures 44 and 84 of the inner bracket 10. If desired, a suitable bushing 56 may be provided between the shaft 52 and the battery holder to facilitate the pivotal movement thereof.

The battery holder 50 is further provided with an enlarged inner opening 58 of a size suitable for receiving a battery therewithin. In addition, the peripheral edge of the battery holder 50 may be provided with suitable serration or knurled surface 60 to facilitate the manual actuation of the battery holder into and out of position. Still further, battery holder 50 may be provided with the cam surfaces 62 and 64, adjacent the serrated edge 60 to cooperate with the detent 36 to facilitate the switching operation of the hearing aid.

The outer shell or case 12 then can be placed over the opposite side of the inner bracket 10 to complete a housing or enclosure for the hearing aid components. Advantageously, the outer shell or casing 12 is formed with an aperture 94 which is in alignment with the aperture 28 in inner bracket 10 and the microphone sound receiving opening so that acoustical signals can be received by the microphone 26 to be converted into corresponding electrical signals for amplification. In addition, the outer shell 12 is formed with a rectangular opening 96 through which the volume control knob 32 extends so that the volume control knob is accessible for mechanical actuation from the outside of the hearing aid assembly.

In accordance with a feature of this invention, it will be noted that the outer shell 12 is fastened to the inner bracket 10 in a readily removable manner, as by means of the three threaded fasteners 98, 100 and 102, respectively. The fastener 98 extends through an aperture 104 in outer shell 12 into the internally threaded opening 106 of the flange 22 in inner bracket 10. The screw fastener 100 extends through the aperture 108 of outer shell 12 into the internally threaded opening 110 of inner bracket 10. Similarly, the screw fastener 102 extends through the aperture 112 of outer shell 12 into the internally threaded opening 114 of the inner bracket 10. Accordingly, those skilled in the art can now appreciate that the outer shell or case 12 can be attached to or removed from the outer bracket 10 merely through the use of the three threaded screw fasteners 98, 100 and 102.

It is contemplated that the outer shell 12 may be formed of any suitable plastic material which may be colored as desired. Alternatively, the outer shell may be formed of a suitable brass or drawn aluminum which is anodized in various colors. The ready replacement of the outer shell or case on the hearing aid assembly permits the styling and color of the hearing aid to be varied as desired in a quick and easy manner, thereby reducing the costs of construction, assembly and sale of such hearing aids.

After the hearing aid is assembled, as described above, it is secured to a suitable plastic ear mold 104 such as that shown in FIGURE 1 of the drawing. Ear mold 104 may be custom fitted to the ear of the wearer, in a well-known manner, and is provided with an inner

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recess 106 shaped to receive the inner shell 14 so as to provide an acoustically sealed fit therebetween. This acoustically sealed fit is enhanced by means of a layer of sealing material 108 which is provided at the outside surface of inner shell 14 adjacent the receiver opening 88.

As shown in FIGURES 1 and 6 of the drawing, the inner shell is provided with internally threaded openings 114 and the hearing aid is fixedly secured to the ear mold 104 as by means of the threaded fasteners 116 which extend through suitable opening in the ear mold into the internally threaded apertures 114.

An illustrative electrical schematic diagram for the hearing aid is shown in FIGURE 7 of the drawing. It can there be seen that one terminal of the microphone 26 is connected to the base 128 of transistor 130. The emitter 132 of transistor 130 is connected to one terminal 134 of the power supply battery 136. The collector 138 of transistor 130 is connected through a resistor 140 to a contact 142 of the on-off switch 144. The armature contact 146 of on-off switch 144 is connected to the other terminal 148 of the power supply battery 136.

The other terminal of microphone 26 is connected to a junction of the resistors 150 and 152. Resistor 152 is connected in parallel with capacitor 158 to the battery terminal 134. Resistor 150 is connected to the emitter 120 of transistor 122, the base 124 of which is connected to the collector 138 of transistor 130. A capacitor 126 is connected between the base 124 and the collector 160 of transistor 122.

The volume control potentiometer resistance 162 is connected between the base 124 and emitter 120 of transistor 122. The potentiometer armature 162, which is mechanically coupled to the volume control knob 32, is connected to the battery terminal 134. Further, the receiver 74 is connected between the collector 160 of transistor 122 and the on-off switch contact 142. Thus, it can be seen that when the contacts 142 and 146 of on-off switch 144 are closed, the circuit is energized by the power supply battery 136. Sound detected by the microphone 26 is converted into an electrical current and is amplified by the two stages of amplification provided by transistors 130 and 122. This amplification is controlled by the position of the volume control potentiometer in accordance with the setting of the volume control knob 32. The amplified output of the amplifier circuit is supplied to the receiver 74 where it is converted into sound waves that are transmitted through the sound conducting passage 164 in the ear mold 104. As shown in FIGURE 1, when the hearing aid assembly is positioned in acoustically sealed relation to the ear mold 104, the sound conducting passage 164 in the ear mold is aligned with the receiver sound output opening 88 in the hearing aid assembly.

While there has been shown and described a specific embodiment of the present invention, it will, of course, be understood that various modifications and alternative constructions may be made without departing from the true spirit and scope of the invention. Therefore, it is intended by the appended claims to cover all such modifications and alternative constructions as fall within their true spirit and scope.

What is claimed as the invention is:

1. The improvement of a compact hearing aid assembly comprising in combination hearing aid support means including an inner bracket and first and second concave shells removably fastened to said inner bracket to form a housing for the hearing aid assembly; said inner bracket having mounted thereon a microphone, volume control means, a battery holder, switch means and an amplifier, said first shell having a receiver mounted therein, said second shell forming an outside case for said hearing aid assembly and being readily removable from said bracket to permit variations in the styling or

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color of said hearing aid housing, an ear mold having a sound passage and a shaped recess therein for receiving said first shell; and means for securing said first shell to said ear mold for sound communication between said receiver and the sound channel of said ear mold.

2. The improvement of a compact hearing aid assembly comprising in combination hearing aid support means including an inner bracket and first and second concave shells removably fastened to said inner bracket to form a housing for the hearing aid assembly; said inner bracket having mounted thereon a microphone, volume control means, a battery holder, switch means and an amplifier; said first shell having a receiver mounted therein, said second shell forming an outside case for said hearing aid assembly and being readily removable from said bracket to permit variations in the styling or color of said hearing aid housing.

3. The improvement of a compact hearing aid assembly in accordance with claim 2 further comprising a first plurality of threaded fasteners fastening said first shell to said bracket and a second plurality of threaded fasteners fastening said second shell to said bracket whereby either shell may selectively be fastened to or removed from said bracket as desired.

4. The improvement of a compact hearing aid assembly in accordance with claim 3 wherein said second shell is formed of molded plastic material.

5. The improvement of a compact hearing aid assembly comprising in combination hearing aid support means including an inner bracket and a pair of concave shells for enclosing said inner bracket and forming the housing of the hearing aid assembly; said inner bracket having mounted thereon a microphone, volume control means, a battery holder, switch means and an amplifier; one of said shells being attached to said bracket in a readily removable manner and having a receiver supportingly mounted therein; means connecting the other shell in a readily removable manner to said bracket to permit variations to be made in the styling or color of said hearing aid housing, an ear mold having a sound passage and a shaped recess therein for receiving one of said shells, and means for securing said last named shell to said ear mold for sound communication from said receiver to the sound channel of said ear mold.

6. The improvement of a compact hearing aid assembly comprising in combination hearing aid support means including an inner bracket and inner and outer shells for enclosing said inner bracket to form a housing for the hearing aid assembly; said inner bracket having mounted thereon a microphone, a battery, and an amplifier, said inner shell having a receiver mounted therein; said microphone, amplifier, receiver, and battery being connected in an electrical circuit to provide a sound amplifying function, and means removably fastening said outer shell to said bracket to permit variations in the styling or color of said hearing aid housing.

7. The improvement of a compact hearing aid assembly comprising in combination hearing aid support means including an inner bracket and inner and outer shells for enclosing said inner bracket to form a housing for the hearing aid assembly; said inner bracket having mounted thereon a microphone, a battery, and an amplifier, said inner shell having a shaped recess formed therein, and a receiver mounted in said shaped recess, said microphone, amplifier, receiver, and battery being connected in an electrical circuit to provide a sound amplifying function.

8. The improvement of a compact hearing aid assembly comprising in combination hearing aid support means including an inner bracket and inner and outer shells for enclosing said inner bracket to form a housing for the hearing aid assembly; said inner bracket having mounted thereon a microphone, a battery and an ampli-

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fier, said inner shell having a shaped recess formed therein, a receiver mounted in said shaped recess, said microphone, amplifier, receiver, and battery being connected in an electrical circuit to provide a sound amplifying function, and said outer shell being readily removable from said bracket to permit variations in the styling or color of said hearing aid housing.

9. The improvement of a compact hearing aid assembly in accordance with claim 8 further comprising an ear mold having a sound passage and a shaped recess therein for receiving said inner shell, and means for securing said inner shell to said ear mold for amplified sound com-

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munication from said receiver to the sound channel of said ear mold.

10. The improvement of hearing aid support means comprising a bracket and first and second concave shells for enclosing said bracket to form a housing for a hearing aid assembly; said second shell being readily removable from said bracket to permit variations in the styling or color of said hearing aid housing and an ear mold having a shaped recess therein for receiving said first shell in sound sealing engagement.

No references cited.