Aug. 14, 1951 F. S. CORSO ET AL 2,564,425

UNITARY AMPLIFIER FOR HEARING AIDS

Filed July 8, 1948 3 Sheets-Sheet 1

FIG. 1

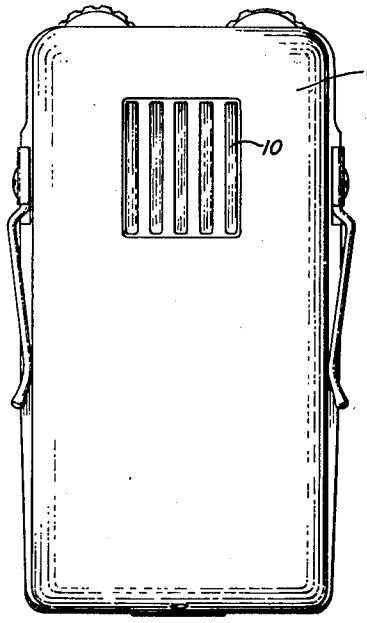


FIG. 2

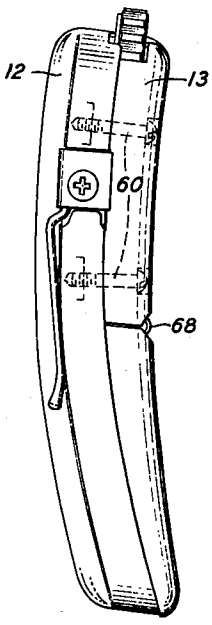


FIG. 3

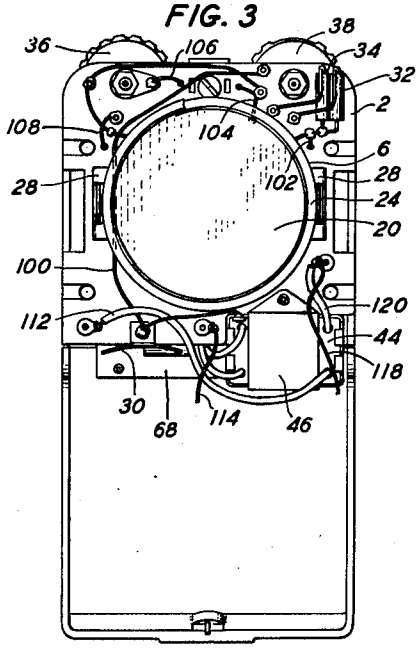
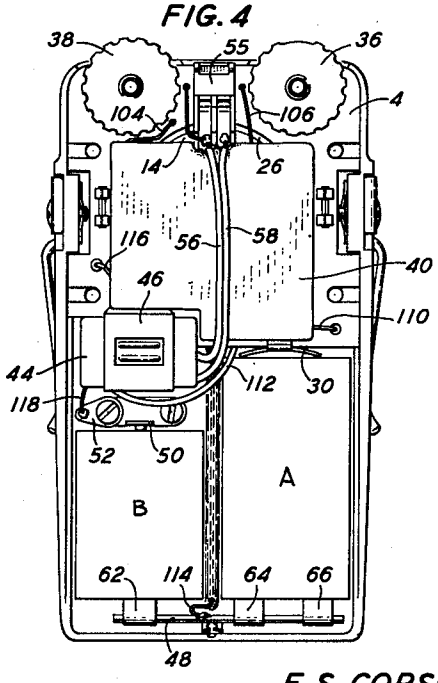


FIG. 4



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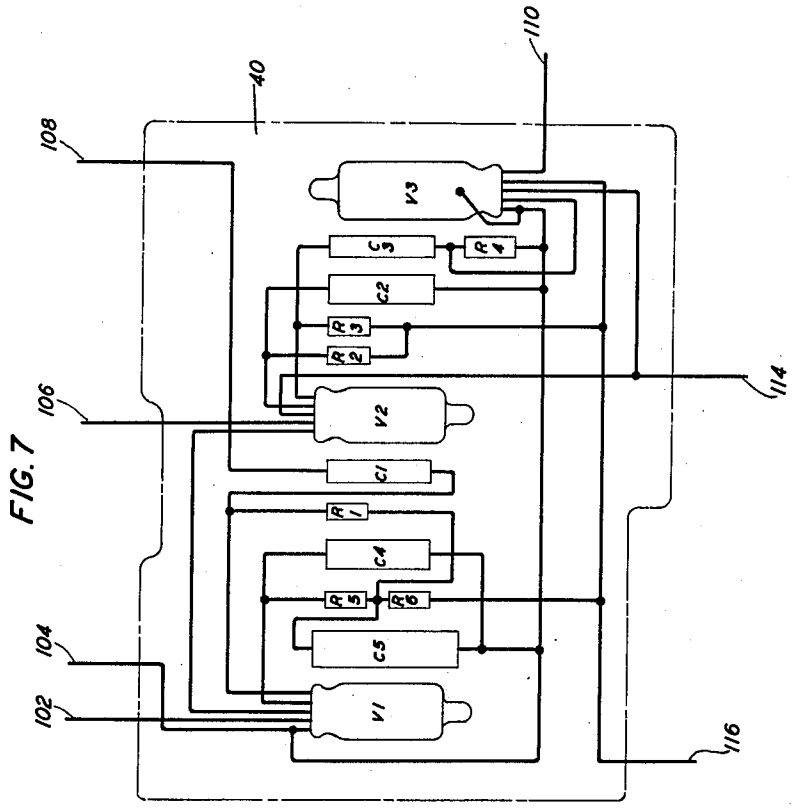

FIG. 7

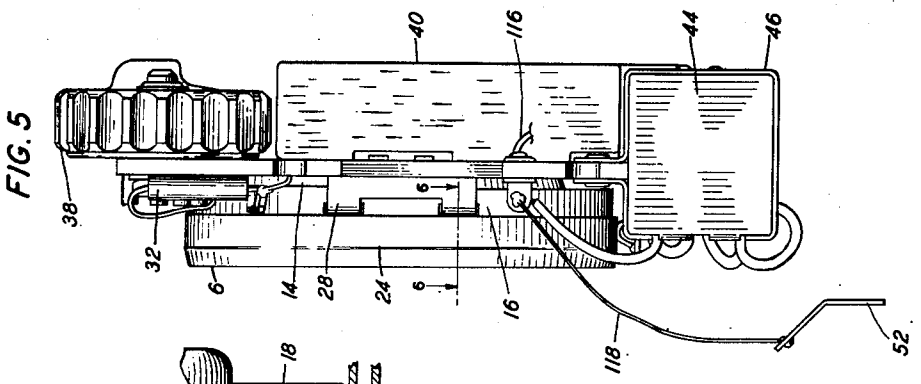

FIG. 5

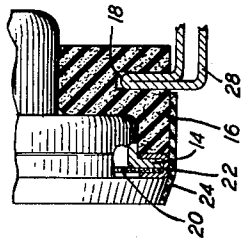

FIG. 6

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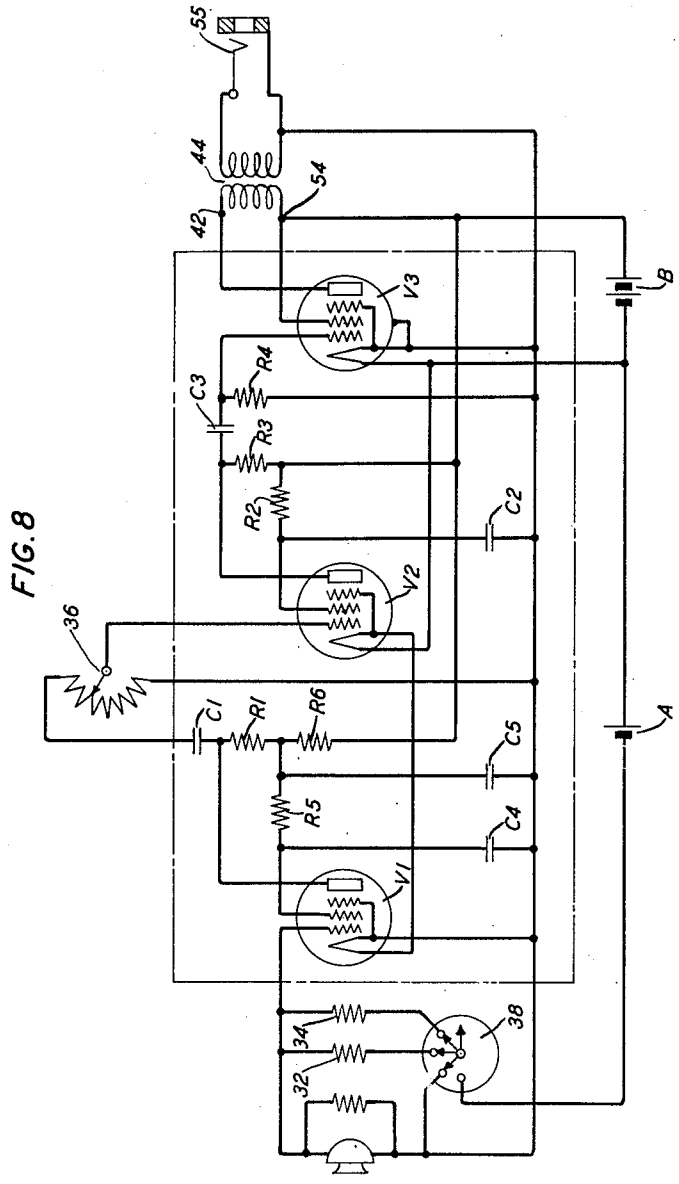

FIG. 8

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UNITED STATES PATENT OFFICE

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UNITARY AMPLIFIER FOR HEARING AIDS

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Application July 8, 1948, Serial No. 37,584

3 Claims. (Cl. 179—107)

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This invention relates to hearing aids and particularly to hearing aids employing moisture-resistant components.

It is well recognized that in order to be practically useful a hearing aid should not tax the user's mental or physical well-being. A hearing aid must be of such size and design that it may be worn comfortably without unduly advertising the fact that the user is a victim of a hearing impairment; and the construction thereof must be such as to afford simple and satisfactory operation, and reasonable assurance that those parts which will eventually require replacement will be replaced by standard parts of satisfactory quality.

In an effort to meet at least some of these requirements various steps have been taken to decrease the size of the apparatus units and power supplying units which are employed in hearing aids. As a result the small, unit type device in which the power supplying units are self-contained has made its appearance. Steps have also been taken to protect the sensitive transmitter unit against the damaging effects of moisture.

Experience has indicated that moisture may also seriously affect the quality and service life of other units employed in a hearing aid, and that provision should be made to protect not only the transmitter unit but also the apparatus units which constitute the amplifier. Experience in the field has also indicated the desirability of a structural arrangement which will provide some assurance for the user that those items requiring replacement will be replaced by comparable items which will meet the specified functional requirements and standards of quality.

According to this invention the protective features noted above are provided by a novel structural arrangement wherein the resistance elements, condenser elements, and vacuum tubes of the hearing aid amplifier are wired together and enclosed in a moisture-resistant envelope to form a single unit.

The nature of the invention and its distinguishing features and advantages will be more clearly understood from the following detailed description and the accompanying drawings in which:

Fig. 1 is a view in front elevation of a complete casing in which the operating parts of the hearing aid are mounted.

Fig. 2 is a view in side elevation of said complete casing showing the joined front and rear sections.

Fig. 3 is a view in front elevation of the hearing aid chassis and operating parts with the front section of the casing removed.

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Fig. 4 is a view in rear elevation of the hearing aid chassis and operating parts with the rear section of the casing removed.

Fig. 5 is a view in side elevation of the chassis showing, mounted on opposite sides thereof, the transmitter unit and the amplifier unit comprising the amplifier elements wired together and enclosed in a single moisture-resistant envelope.

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 5 showing the structural arrangements for yieldingly supporting and moisture proofing the transmitter unit.

Fig. 7 shows the manner in which the resistance elements, condenser elements and vacuum tubes of the amplifier unit are wired within the moisture-resistant envelope indicated by the dot-and-dash lines.

Fig. 8 is a circuit diagram of the hearing aid, that portion of the circuit which is wired and enclosed in the moisture-resistant envelope being shown within the boundaries established by the dot-and-dash lines.

Referring now to the accompanying drawings wherein like reference characters in the different figures designate similar elements, 2 is the front side and 4 the rear side of the chassis which consists of a panel of insulating material of the general shape shown in the drawings. Mounted on the front side of the chassis is a transmitter unit 6 which is held in its operative position within the casing 8 behind the acoustically-pervious wall portion 10 of the casing front section 12. The transmitter unit 6 comprises a crystal type transmitter in a casing 14 which is cemented into a cylindrical soft rubber ring 16 having a plurality of small mortices 18 in its periphery for mounting purposes. A moisture-proof plastic coated aluminum foil membrane 20 is provided over the front open end of the transmitter case and is fastened to said case by means of a ferrule 22 to effect a tight moisture-proof seal. A thin soft rubber cylindrical sleeve type gasket 24 is cemented around the rubber ring 16 at the front of the transmitter unit to provide a flexible, shock-resistant seal between the unit and the casing front section 12. The transmitter unit is mounted on the chassis, which has a centrally located opening 26 the diameter of which is greater than the diameter of transmitter casing 14, by means of metallic supporting members 28 which are fastened to the chassis and inserted into the mortices 18, whereby the transmitter unit is spaced from the chassis and a shock-resistant, resilient mounting is provided. Also mounted on the front side of the chassis are a contact member 30 which contacts

the A battery terminal and is connected by means of lead wire 100 to the tone and power control switch 38, and resistance elements 32 and 34 which constitute a tone control network.

Mounted on the rear side of the chassis are the volume control potentiometer 36, the tone and power control switch 38, and the amplifier unit 40. The amplifier unit 40 consists of a matrix of microcrystalline wax or other suitable moisture-resistant material in which are embedded the resistances, condensers, and vacuum tubes shown in Fig. 7 and in Fig. 8 within the boundaries established by the dot-and-dash lines. These elements are wired together before being embedded in the moisture-resistant material.

In addition to moisture proofing the elements therein, the above-noted structural arrangement also provides the following advantages:

Vacuum tube sockets are eliminated since the vacuum tube lead-out wires are connected directly to the resistance and condenser elements.

The vacuum tube elements are protected against mechanical and electrical failures ordinarily caused by vibration and mechanical shock since the vacuum tubes, resistance elements and condenser elements assume fixed positions in the matrix and as individual elements are rendered motionless with respect to each other and the chassis proper.

The complete unit may be stocked as a standard piece part for replacement purposes. This provides reasonable assurance for the user that the parts furnished for his hearing aid device will meet the specified functional requirements and standards of quality.

As shown in Fig. 7, access to seven points in the amplifier unit is provided by leads brought out through the wax envelope. In assembly, the amplifier unit is held in place by these lead-out wires which are soldered to suitable eyelets and terminals mounted on the chassis. As shown in Figs. 3, 4, 5, 7 and 8 the amplifier unit is connected to the transmitter and the tone and power control switch by means of lead-out wires 102 and 104; to the volume control potentiometer by means of lead-out wires 106 and 108; to the upper terminal 42 of the input winding of transformer 44, which is mounted on the chassis by means of the bracket 46, by means of lead-out wire 110 and lead 112; to the A+ B− battery terminal contact arm 48, which is mounted on the front section 12 of casing 8, by means of lead-out wire 114; to the B+ battery terminal contact member 50, which is also mounted on the front section 12 of casing 8, by means of lead-out wire 116, lead 118, and the terminal clip 52; and to the lower terminal 54 of the input winding of transformer 44 by means of lead-out wire 116 and lead 120. The output winding of transformer 44 is connected to the output jack 55, which is also mounted on the rear side of the chassis, by means of leads 56 and 58. The chassis is attached to the front section 12 of the casing 8, between said front section 12 and the rear section 13 of said casing by means of mounting screws 60 which also serve to detachably join said front and rear sections. Contact members 62, 64 and 66 are attached to contact arm 48 which is secured to the front section 12 of casing 8. The B battery unit is removably supported between the contact members 50 and 62. The A battery unit is removably supported between the contact members 64, 66 and 30.

As shown in Fig. 2, the rear section 13 of casing 8 comprises upper and lower portions joined by a hinge 63. The upper portion of rear section 13 is detachably joined to the casing front section 12 by means of mounting screws 60. The lower position of rear section 13 is so arranged that it may be opened outwardly while supported by hinge 63 to permit access to the lower area of the casing enclosure wherein the power supplying units are located. When in a closed position the lower portion of rear section 13 is secured to the casing front section 12 by frictional engagement.

While modifications in the structures shown may occur to those skilled in the art, the invention is intended to be limited only by the scope of the following claims.

What is claimed is:

1. In a unit type hearing aid including a transmitter, a transformer and self-contained power supplying units, a chassis of insulating material having removably mounted thereon said transmitter and said transformer, and fixedly mounted thereon terminals to which said transmitter, said transformer and said power supplying units are connected electricallly, a unitary electronic amplifier comprising resistance elements, condenser elements, electronic amplifying elements, input terminals, output terminals and power supply terminals wired and embedded together in a matrix of moisture-resistant material, means for detachably mounting said amplifier on said chassis comprising means for connecting said input terminals to said terminals on said chassis to which said transmitter is electrically connected, said output terminals to said terminals on said chassis to which said transformer is electrically connected, and said power supply terminals to said terminals on said chassis to which said power supplying units are electrically connected, said means comprising electrical conductors attached at one end to said terminals embedded in said matrix of moisture-resistant material and removably attached at the other end to said terminals on said chassis to which said transmitter, said transformer and said power supplying units are electrically connected.

2. A unit type hearing aid in accordance with claim 1 wherein the electronic amplifying elements of the amplifier unit are vacuum tubes.

3. A unit type hearing aid in accordance with claim 1 wherein the moisture-resistant material in which the amplifier elements are embedded is microcrystalline wax.

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