This invention relates to hearing aid apparatus, and has particular reference to hearing aid apparatus adapted to be worn on the person of the user. In accordance with the present invention, a hearing aid apparatus is provided in which the complete hearing aid, including microphone, amplifier, batteries and volume control, except for the receiver, is worn on a limb of the wearer, such as the wrist, with the microphone so positioned as to be directable toward the sound source and so constructed as to greatly minimize noise caused by the rubbing contact with the clothing, whereby amplified clothing noises are avoided and the amplification substantially confined to the desired sounds.

In a preferred embodiment of the invention, the elongated casing of the instrument is provided with a suitable wrist band extending transversely of its length and the microphone is mounted on its front end in a plane normal to the surface of the wrist, so that the microphone faces in the direction of the extended fingers.

The casing is divided longitudinally and one of the two resulting compartments houses the chassis of the instrument on which the amplifier, volume control and switch are mounted, and the other compartment is open at the rear end of the casing and houses a drawer containing the batteries which make automatic electrical connection in the circuit when the drawer is closed and which disconnect therefrom when the drawer is released by pressing a button on the casing whenever such disconnection is required as when batteries are replaced. Owing to the requirement of more frequent A battery replacement, the normal position of the drawer upon opening provides access only to the A battery, but release of a second catch permits removal of the entire drawer for any desired purpose, such as replacement of the B battery. The receiver is connected to the instrument by a flexible electrical cord which may be passed upwardly within the sleeve of the wearer or may be worn outside of the clothing as desired.

Although the usual position of the microphone is at the forward end of the elongated casing, it may be uncoupled therefrom and worn separately on or within the clothing, being connected thereto by a flexible electrical cord leading to an adapter at the front end of the instrument. Also, instead of being worn on the wrist, upper arm or leg, the instrument may be carried in a pocket or bag, or clipped to the top edge of a pocket, blouse, or the like. In either case, the position and construction of the microphone on the casing again safeguards it from noisy rubbing contact with the clothing or other adjacent surface.

It will be seen that the hearing aid apparatus is unique in construction and operation and affords many advantages and benefits to the user that were not available heretofore.

For a more complete understanding of the invention, reference may be had to the accompanying drawings, in which:

Figure 1 is a side elevation of the hearing aid apparatus of this invention, showing it mounted on the wrist of the wearer;
Fig. 2 is a front elevation thereof;
Fig. 3 is a transverse section through the casing as seen along the line 3—3 of Fig. 1 and showing the battery drawer partially removed;
Fig. 4 is a longitudinal section through the battery drawer as seen along the line 4—4 of Fig. 3;
Fig. 5 shows the microphone removed from the remainder of the apparatus and the electrical connectors adapted to cooperate with like connectors on the apparatus;
Fig. 6 is a side elevation showing an adapter-connector mounted on the apparatus in place of the microphone and the microphone connected thereto by a flexible electrical cord; and
Fig. 7 is a side elevation showing the adapter-connector carrying the microphone on a clip for engaging the upper edge of the wearer's pocket, blouse or the like.

Referring to the drawings, numeral 10 designates the metal casing of the amplifier of the hearing aid apparatus, this casing being generally rectangular, having a relatively flat bottom 11 and a top 12 from the central portion of which gradually rises a ridge 13 terminating in a flat front end 14. Front end 14 lies substantially normal to the surface of the bottom 11 and being roughly square in elevation, is narrower in width than the casing 10, so that the sides 15 of casing 10 form shoulders 16 merging into the front 14, as is best shown in Figs. 2 and 3. By reason of the ridge 13, the casing 10 has greater height at its front end 14 than at the rear end.

The interior of the casing 10 is divided longitudinally by a vertical partition 17 into compartments 18 and 19, as shown in Fig. 3. Compartment 18 is closed at its rear end by wall 20 and houses the amplifier components, including vacuum tubes, transformers, resistors and condensers arranged on a chassis in a conventional manner forming no part of the present invention, and therefore, not shown in detail. The rear wall 20 of casing 10 has an opening 21 for the contact prongs of a separable electrical connector 22 suitably connecting the conductors 23 of the receiver 24 to the amplifier housed within compartment 18.

Normally housed within the other compartment 19 of the casing 10 is an elongated drawer 25 of metal having a bottom 26, sides 27 and 28 and a rear end 29 which lies flush with the end 20 of the casing when the drawer 25 is closed as shown in Figs. 1 and 4.

The top and front end of the drawer are open except that the sides 27 and 28 are turned inwardly at their front edges to form the respective shoulders 30 and 31.

A rearwardly extending tongue 32 is cut out of side wall 28 and provided with an abutment 33 adapted to lodge behind the end wall 20 of housing 10 to step the drawer after it has been withdrawn about halfway for access to the A battery for replacement. By pressing on tongue 32, abutment 33 is disengaged from wall 20 and the whole drawer 25 may be withdrawn from the casing 10 for access to the B battery for replacement. Another rearwardly extending tongue 34 is cut out of drawer bottom 26 and is provided with a projecting button 35 adapted to snap into a slot 37 in the bottom 11 of housing 10 to hold the drawer 25 in the closed position shown in Fig. 4. If the drawer 25 is to be withdrawn, button 35 is pressed to release it from slot 37.

As is shown in Fig. 4, drawer 25 is adapted to hold the A and B battery units in series connection, the positive housing of the A battery being electrically connected to the negative pole of the B battery through the intervening transverse tongue 38 cut out of the side wall 27, as shown in Figs. 3 and 4.

The negative pole of the A battery engages contact
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39 insulated from drawer 25 by fiber sheets 40 and having an extension 41 overlying the outer surface of side wall 28 from which it is insulated by fiber sheet 42. When drawer 25 is in the closed position shown in Figs. 1 and 4, the extension 41 of contact 39 engages a contact (not shown) of the amplifier 15, so that the latter is connected to the negative pole of the A battery. The B battery lodges behind the shoulders 30 and 31 at the front of the drawer 25, these shoulders holding the B battery in place with its negative pole engaging tongue 38 which also engages the positive housing of the A battery. Insuch as tongue 38 is part of the drawer 25, the batteries are electrically connected by drawer 25 through partition 17 to the corresponding terminal (not shown) of the amplifier 18.

Mounted on a conducting strip 43 suitably secured to and insulated from the casing 10 and extending rearwardly into the drawer compartment 19 is a spiral spring 44 which performs the dual function of mechanically ejecting drawer 25 when button 35 is pressed and of electrically connecting the electrical unit to the positive housing of the B battery. This connection is made from spring 44 and strip 43 to the corresponding terminal of the amplifier 18 and from strip 45 of strip 43 to one terminal of the usual volume control rheostat, not shown, but operated by thumb wheel 46 projecting through a slot in the top ridge 13 of the casing 10 as shown in Figs. 1 and 5. The usual “on and off” switch is operated by a lever 47 extending through a slot in the rear end 20 of the casing 10.

Removably mounted on the front panel 14 of the casing 10 is the microphone 50 which preferably comprises a piezo-electric crystal vibrated by a suitable diaphragm both contained within a square housing 51 having a front opening 52 covered by a grill behind which the diaphragm is positioned. The particular construction of the microphone unit forms no part of the present invention, being disclosed in copending application Serial No. 219,200, filed April 4, 1951, by applicant Nicholides.

Secured to front panel 14 of casing 10 by rivets 52 or other fastening means is a spring plate 53 having upwardly and outwardly turned ears 54 which have the springiness of the plate 53. Ears 54 are adapted to snap tightly behind flanges 55 on the microphone housing 51 and adapted to make electrical contact with corresponding contact pins 59 projecting through the front panel 14 of casing 10, as shown in Fig. 5. When microphone 50 is mechanically clipped onto the front of casing 10 by cooperation between ears 54 and flanges 55, contact pins 59 and 58 automatically engage.

In operation of the hearing aid apparatus previously described in connection with Figs. 1 to 5, inclusive, the unit comprising casing 10 with the microphone in place may be secured to the wrist of the user by means of straps 60 connected to the casing 10 and buckled around the wrist in a manner similar to any wrist band watch, as shown in Fig. 1. The housing of microphone 50 lies substantially normal to the surface of the wrist, with its sound receiving opening 52 directed in the general direction of the fingers, so that the instrument may be attached in any position desired to be heard, although the microphone is essentially directionless. This aiming action is simply effected by moving the arm.

As is shown in Fig. 1, the instrument may be concealed by a jacket sleeve if desired without encountering the usual “clothing noises” caused by rubbing of the clothing over the microphone, since here the microphone is so disposed as to be unaffected by clothing contact. This is the case, notwithstanding that the top edge of the microphone housing may be engaged by the sleeve or other piece of clothing. The receiver 24, whether of the air- or bone-conduction type, is connected to the instrument by plug 22 and the cord led up the sleeve to the receiver 24.

Although the instrument may be comfortably worn on the wrist, it may be strapped around the wearer’s leg with only the receiver 24 and its cord 23 extending therefrom within the clothing, since the instrument carries its own power supply.

Instead of strapping the instrument to a limb such as wrist or leg, the user may omit the band 60 and insert the instrument vertically in a breast pocket with the volume control 46 toward the back of the pocket, away from the wearer’s body, i.e., opposite to the position shown in Fig. 7. The disposition of the microphone 50 and ridge 13 causes the microphone to be inclined outwardly from the body to open the pocket and thus be better exposed to sound vibrations, even though the instrument is concealed in the pocket. However, if the instrument is carried in a pocket, it is desirable to secure the Judgement therefrom and to that end, the microphone 50 is disengaged from spring plate 53 and replaced by an adapter 61 which comprises two parts, 62 and 63, hinged together about hinge pin 64 and urged toward each other by spring 65, as shown in Fig. 7. Adapter part 62 has a base like that of the microphone 50, including the flanges 55 cooperating with ears 54 as spring plate 53 and contact pins like 58 cooperating with contact pins 59. The contact pins of adapter part 62 are connected to wires leading through adapter part 62 to corresponding contact pins on adapter part 63, which is fitted with the same spring plate 53 and contact pins 59, combined as the front panel 14 of the casing 10 for holding the microphone 50, as shown in Fig. 7. Hence, the microphone 50’ is connected through adapter 61 to the amplifier and controls of the instrument casing 10 just as though it were directly coupled thereto, in the manner of Fig. 7, 5.

The rear surface of adapter part 63 may be roughened as indicated at 66, so that when the top edge of the pocket is clamped between the adapter part 63 and the base 11 of the casing 10, it is frictionally secured within the pocket with the ornamental microphone 50’ outside, as shown in Fig. 6. The adapter 63 not only disengages the user to clip the instrument to the top edge of a blouse in the same way described in connection with the pocket clip illustrated in Fig. 7.

Instead of clipping the microphone to the pocket containing the instrument, the instrument may be carried on the person by means of strap 60 or in a pouch or pocket, and the microphone 50” clipped to the top edge of a blouse or pocket as shown in Fig. 6. An adapter 67 similar to adapter part 62 of Fig. 7 is coupled mechanically and electrically to the instrument 10” and the adapter contacts are connected by a flexible cord 68 to adapter 69, which is like adapter part 63 of Fig. 7 for receiving the microphone 50”. Adapter 67 is provided with a clip 70 or other fastening means for securing the microphone to the clothing of the wearer.

The means shown in Figs. 6 and 7 for supporting the divided portions of the hearing aid apparatus in or on the clothing, depending upon the requirements or convenience of the user, do not affect the operation of the apparatus, which functions in the manner described in connection with the wrist-supported apparatus shown in Fig. 1.

Wherever carried or worn on the person of the user, the A and B batteries may be simply and easily replaced, and since the life of the A battery is usually considerably shorter than that of the B battery, the drawer 25 is arranged by reason of catch 33 to open only far enough to
render the A battery accessible for replacement, the spring 44 moving the drawer 25 to that position when button 35 is pressed. However, when the B battery is to be replaced, it is rendered accessible for that purpose by pressing lever 32 to release catch 33 for withdrawal of the entire drawer 25. Replacement of the batteries is simply effected and they cannot be incorrectly introduced if the user matches the + signs on the batteries with the + signs indicated in the bottom of the drawer 25, as shown in Fig. 3.

Although a preferred embodiment of the invention has been illustrated and described herein, the invention is not limited thereby, but is susceptible of changes in form and detail within the scope of the appended claims.

We claim:

1. In wearable hearing aid apparatus having a substantially flat casing having opposite sides and ends, a longitudinal partition in said casing dividing it into two compartments, an electrical sound amplifier within one of said casing compartments, a microphone and a receiver respectively connected to the input and output circuits of said amplifier, the invention comprising a drawer slidably mounted in the other casing compartment for containing the power supply source, a latch interposed between said drawer and said casing for normally holding said drawer in the corresponding compartment, and a spring interposed between the power supply source in said drawer and said amplifier for electrically connecting the same and ejecting said drawer upon release of said latch.

2. In wearable hearing aid apparatus having a substantially flat casing having opposite sides and ends, a longitudinal partition in said casing dividing it into two compartments, an electrical sound amplifier within one of said casing compartments, a microphone and a receiver respectively connected to the input and output circuits of said amplifier, the invention comprising a drawer slidably mounted in the other casing compartment for containing the power supply source comprising an A battery unit and a B battery unit axially arranged in said drawer, an electrical connector at the rear end of said drawer and insulated therefrom engaging one pole of one of said units for connecting the same to one terminal of said amplifier when the drawer is in closed position, a second electrical connector interposed between one pole of said other unit and another terminal of said amplifier when the drawer is in closed position, and a third electrical connector interposed between the A and B battery units and electrically connected each to said drawer, said drawer being electrically connected to another terminal of said amplifier.

3. In wearable hearing aid apparatus having a substantially flat casing having opposite sides and ends, a longitudinal partition in said casing dividing it into two compartments, an electrical sound amplifier within one of said casing compartments, a microphone and a receiver respectively connected to the input and output circuits of said amplifier, the invention comprising a drawer slidably mounted in the other casing compartment for containing the power supply source comprising an A battery unit and a B battery unit axially arranged in said drawer, an electrical connector at the rear end of said drawer and insulated therefrom engaging one pole of one of said units for connecting the same to one terminal of said amplifier when the drawer is in closed position, a second electrical connector interposed between one pole of said other unit and another terminal of said amplifier when the drawer is in closed position, and a third electrical connector interposed between the A and B battery units and electrically connected each to said drawer, said drawer being electrically connected to another terminal of said amplifier.

4. Hearing aid apparatus as set forth in claim 3, including a latch interposed between said drawer and said casing for normally holding said drawer in the corresponding compartment, a spring interposed between the B battery in said drawer and said amplifier for both electrically connecting the same to the amplifier and for ejecting the said drawer upon release of said latch, a stop interposed between said drawer and said casing for arresting withdrawal of said drawer beyond a point exposing only the A battery unit for replacement, and means for releasing said stop to withdraw said drawer to expose the B battery for replacement.

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