Jan. 24, 1950 S. POSEN ET AL 2,495,546

HEARING AID CHASSIS

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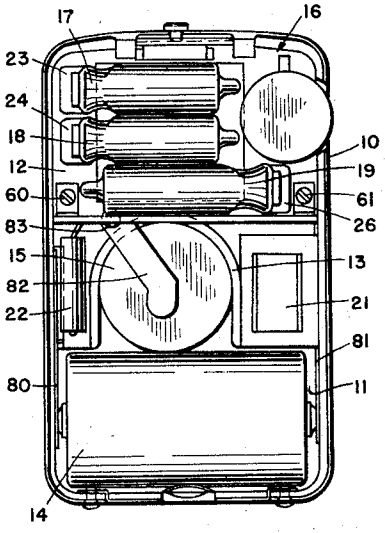

FIG. 1

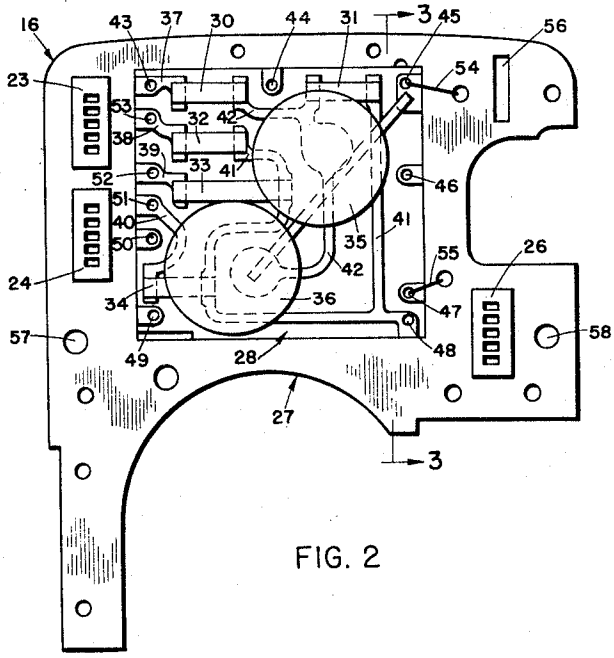

FIG. 2

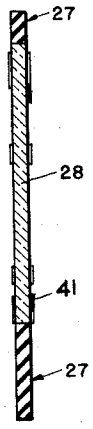

FIG. 3

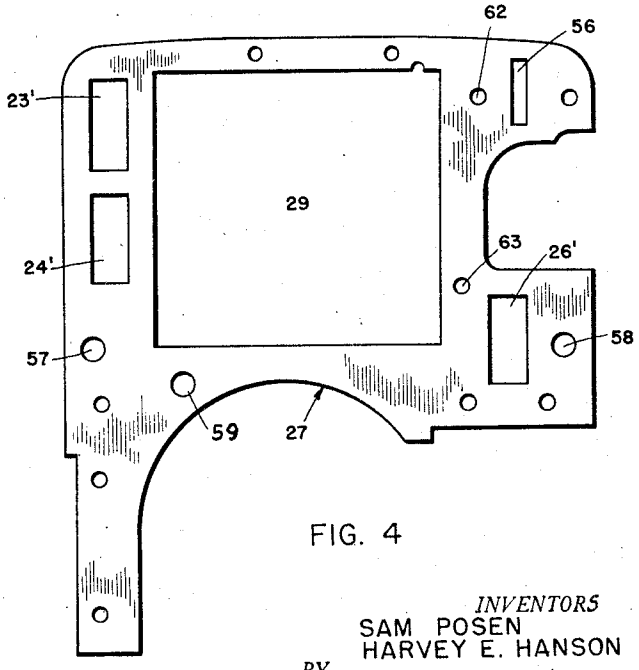

FIG. 4

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HEARING AID CHASSIS

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6 Claims. (Cl. 250—16)

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This invention relates to wearable electronic hearing aids and more particularly to the insulating chassis ordinarily used in such hearing aids for carrying the various elements of the electronic amplifier of the hearing aid.

It is an object of this invention to provide an insulating chassis which is composed of different parts to provide two different kinds of support for different elements of the electron tube amplifier.

During recent years, wearable electronic hearing aids have been developed to the point that, apart from the earphone or receiver, the entire instrument, i. e. the microphone, the electron tube amplifier and the supply batteries therefor, are housed in a single casing which is small enough to be worn in an ordinary garment pocket. The present invention has for one of its objects the provision of an insulating chassis which permits a further reduction of the size of the hearing aid.

A further object of the invention is to provide an insulating chassis for carrying the elements of the electron tube amplifier of a wearable hearing aid which is composed of two parts, one part being made of material which is of relatively high tensile, compressive and flexural strength and the other part of a rigid heat resistant material.

A still further object of the invention is to allocate the elements of the amplifier, which expression includes also the fastening elements, to the two parts of the composite insulating chassis in such manner that the part of relatively high mechanical strength carries those elements which are apt to impart substantial mechanical stresses to the chassis, such as fastening screws, sockets for the electron tube, contact springs for the batteries, etc., whereas the rigid heat resistant part carries other of the amplifier elements which may include layer resistors and/or ceramic condensers.

Another object of the invention is to provide an insulating chassis composed of a frame surrounding an opening and at least one ceramic plate placed in said opening, utilizing said frame for carrying some of the amplifier elements and the ceramic plate for carrying other amplifier elements.

A further object of the invention is to provide an insulating chassis of the kind just mentioned wherein the ceramic plate is anchored to the surrounding frame by means of wire connectors which extend between contact points on the ceramic plate and contact points on the frame.

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Other objects and features of the invention will appear as the description proceeds, reference being had to the accompanying drawings which illustrate by way of example one embodiment of the invention, and in which—

Fig. 1 shows a back view of a wearable electronic hearing aid with the back cover removed;

Fig. 2 shows in elevation and at a larger scale the composite chassis of the hearing aid shown in Fig. 1;

Fig. 3 is a section on the line 3—3 of Fig. 2; and

Fig. 4 shows the outer frame of the composite chassis without any of the amplifier elements attached.

Referring first to Fig. 1, 10 denotes the casing of a wearable electronic hearing aid which is divided into two compartments 11 and 12 by means of a partition wall 13. The lower compartment 11 accommodates two batteries 14 and 15, 14 being in this case a rod shaped B-battery held between two contact strips 80 and 81 and 15 a tablet shaped A-battery whose one pole makes contact with a contact spring 82. The upper compartment 12 houses the electron tube amplifier and is divided lengthwise by means of an insulating chassis or panel, generally indicated at 16, upon which the various amplifier elements are mounted. Electron tubes 17, 18 and 19 are placed at the back side of the chassis 16 whereas the usual microphone (not shown) is at the front side of the chassis. The reference numeral 21 denotes a choke coil or transformer and 22 an electrolytic condenser. 23, 24 and 26 are plug-in sockets for the electron tubes 17, 18 and 19, respectively. The axes of these sockets extend perpendicularly to the plane of the chassis 16. The tubes 17, 18 and 19 have leading-in wires which are bent down at a right angle in the manner described in the co-pending application Serial No. 571,218 of Sam Posen (Patent No. 2,431,198), so that these tubes can be plugged easily into the sockets 23, 24, 26 with the main axis of the bulbs of these tubes extending parallel to the plane of the chassis 16.

Referring now to Figs. 2 to 4, the chassis 16 is shown as consisting of two main parts, a frame 27 and an insert plate 28. The frame 27 is made of a slightly flexible material, such as from a sheet of synthetic plastic having the required electrical and mechanical characteristics. Laminated board coated with a synthetic resin of the phenol formaldehyde type, which material has high tensile, compressive and flexural strength, has been found to be well suited for the frame

27. The plate 28, which fits into a rectangular opening 29 of the frame 27, is made of a non-flexible heat resistant material, such as a ceramic material, preferably steatite.

The ceramic plate 28 is used as a support for a so-called "printed circuit," known in the art of electronic devices, which consists of elements sprayed or painted onto the ceramic plate and of elements which are so flat in shape that, when placed upon the ceramic plate, they increase the thickness of the ceramic plate only very slightly. In Fig. 2 there are shown as sprayed-on or otherwise deposited elements resistors 30 to 34 and connectors 37 to 42, whereas as elements attached as flat bodies to the ceramic plate 28 there are shown two so-called ceramic condensers 35 and 36 consisting of a very thin ceramic plate as a dielectric and a silver layer applied to each side of the ceramic dielectric. Near the edges of the plate 28 holes 43 to 53 for the reception of metal eyelets are provided to which wire connectors may be soldered. At the place of each of these eyelets there terminates one of the deposited connectors on the steatite plate 28 so that these eyelets establish a conductive connection between one of the deposited connectors and a wire connector. For the sake of greater clarity of the illustration of Fig. 2 only two such wire connectors 54 and 55 are shown. While Fig. 2 shows but the back side of the ceramic plate 28 with elements of an electronic circuit thereon, it is to be understood that further circuit elements may be, and ordinarily will be, arranged also on the front side of the ceramic plate 28. The eyelets in the openings 44, 46, 47, 49 and 50 are, according to Fig. 2, not connected to any circuit elements on the back side of the ceramic plate 28 but they are to be understood as being connected to circuit elements on the front side of the plate 28.

The frame 27 which surrounds the ceramic plate 28 is provided with three rectangular holes 23', 24' and 26' adapted to receive the electron tube sockets 23, 24 and 26, respectively. Another rectangular hole 56 is provided to receive a socket for the receiver cord (not shown). Circular holes 57, 58 and 59 permit the passage of fastening screws of which two are shown in Fig. 1 at 60 and 61. Other holes such as 62 and 63 are provided to accommodate metallic eyelets to which wire connectors, such as the wire connectors 54 and 55, may be secured, e. g. by soldering.

By constructing the insulating chassis 16 as the combination of a slightly flexible part of great mechanical strength and a part which is absolutely inflexible and heat resistant, even though relatively brittle, it is possible to assign to each of these two parts making up the composite chassis those tasks for which each is best suited. Even the slightest dislocation of the particles of a deposited or layer resistor due to flexing of the base of such resistor would manifest itself in the quality of reception of a hearing aid. The ceramic plate serving as the dielectric in a ceramic condenser is so thin and brittle that it would break even under a small bending force. Therefore, if such a ceramic condenser is to be secured against a flat support so as to be in structural contact therewith, this support must be absolutely rigid. The ceramic plate 28 satisfies this requirement of absolute rigidity which a support made of a resin-impregnated laminated board would not do. The layer resistors, such as 30 to 34, have in certain production methods to be heated to temperatures far above the decomposition temperature of any plastic resin. A ceramic support such as the steatite plate 28 will not be adversely affected at all by the high temperature necessary for "firing" the layer or deposit resistors. On the other hand, a relatively thin steatite plate could not stand up well under such mechanical strains as exerted by fastening screws pressing against the chassis, or those stresses which will occur when plugging in or pulling out the electron tubes 17, 18 and 19 or the receiver cord, or when exchanging a battery 14 or 15. The frame 27 made of such slightly flexible material as laminated board coated with a synthetic resin of the phenol formaldehyde type easily withstands such mechanical strains as have just been mentioned.

While we have illustrated and described a particular embodiment of our invention, it will be evident to those skilled in the art that the composite chassis of the invention may be incorporated in various wearable electronic hearing aid devices and is capable of various modifications without departing from the spirit of the invention or the scope of the appended claims. Accordingly, the illustrated and described embodiment should be taken as merely illustrative and not as limiting.

What we claim is:

1. In or for a wearable electronic hearing aid having an electron tube amplifier, an insulating support for carrying the elements of the electron tube amplifier composed of a frame of a material of high tensile, compressive and flexural strength surrounding an opening and at least one plate placed in said opening consisting of a non-flexible, heat resistant material, some of the elements of said amplifier being carried by said frame and others by said plate.

2. In or for a wearable electronic hearing aid having an electron tube amplifier, an insulating chassis for carrying the elements of the electron tube amplifier comprising a frame made of a laminated plastic sheet surrounding an opening and at least one ceramic plate placed in said opening, some of said elements of said amplifier being carried by said frame and some by said ceramic plate.

3. In or for a wearable electronic hearing aid having an electron tube amplifier, an insulating support for carrying the elements of the electron tube amplifier comprising a frame of a material of high tensile, compressive, and flexural strength surrounding an opening and at least one ceramic plate placed in said opening, some of said elements of said amplifier, including such that are apt to impart substantial mechanical stresses to the support being mounted on or in said frame, and other of said amplifier elements, including at least one of the two types of elements of "printed" circuits: ceramic condensers and layer resistors, being supported by said ceramic plate.

4. In or for a wearable electronic hearing aid having an electron tube amplifier, an insulating support for carrying the elements of the electron tube amplifier comprising a frame of a material of high tensile, compressive and flexural strength surrounding an opening and at least one ceramic plate placed in said opening, some of said elements of said amplifier, including such that are apt to impart substantial mechanical stresses to the support, being mounted on or in said frame and other of said amplifier elements, including at least one of the two types of elements of "printed" circuits: ceramic condensers and layer resistors, being supported by said ceramic plate, said frame and said

ceramic plate being joined in such a manner that mechanical stresses imparted to said frame will not be transmitted to any appreciable extent to said ceramic plate.

5. In or for a wearable electronic hearing aid comprising an electron tube amplifier having sockets for plug-in tubes, an insulating support for carrying the elements of the electron tube amplifier, comprising a frame of a material of high tensile, compressive and flexural strength surrounding an opening for supporting those elements of said amplifier which are apt to impart substantial mechanical stresses to the support, including said tube sockets, and at least one ceramic plate placed in said opening for supporting other elements of said amplifier, including at least one of the two types of elements of "printed" circuits: ceramic condensers and layer resistors.

6. In or for a wearable electronic hearing aid having an electron tube amplifier, an insulating support for carrying the elements of the electron tube amplifier comprising a frame of a material of high tensile, compressive and flexural strength surrounding an opening and at least one ceramic plate placed in said opening, some of said elements of said amplifier, including such that are apt to impart substantial mechanical stresses to the support being mounted on said frame, and other

of said amplifier elements, including at least one of the two types of elements of "printed" circuits: ceramic condensers and layer resistors, being supported by said ceramic plate, and wire connectors extending between, and soldered to, contact points on said ceramic plate and contact points on said frame.

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