Aug. 19, 1941. A. M. WENGEL 2,253,216

CASE FOR A PORTABLE HEARING AID DEVICE

Filed Sept. 13, 1939

Fig. 1.

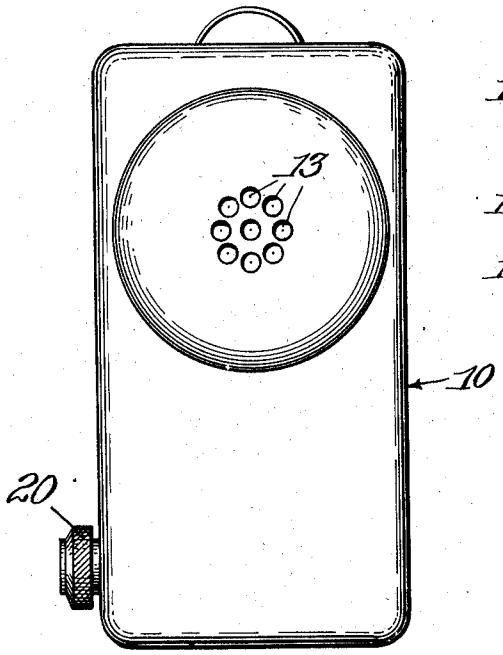


Fig. 2.

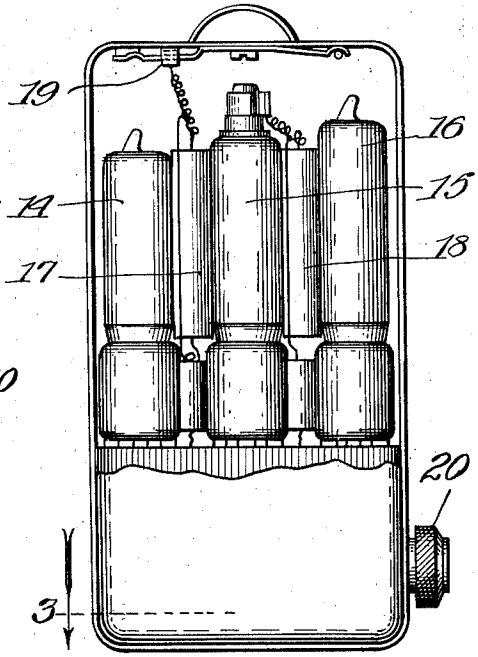
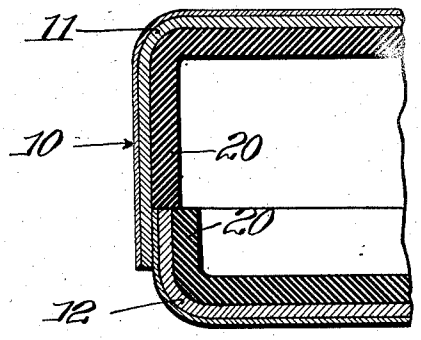


Fig. 3.



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CASE FOR A PORTABLE HEARING AID DEVICE

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3 Claims. (Cl. 179—107)

This invention relates to a case for a portable hearing aid device, and more particularly to means for minimizing vibration in the thin metal case of a compact high-gain hearing aid device.

One feature of this invention is that it minimizes vibrations of a thin-walled metal case used for a hearing aid device; another feature of this invention is that it enables a light metal case to be used to house the operative elements of a portable hearing aid device adapted to be worn on the person of the user and to highly amplify mechanical vibrations; still another feature of this invention is that it provides a corrosion inhibiting super-smooth exterior surface on a light metal case, which serves to protect the metal of the case and at the same time results in an absolute minimum of vibration therein when the case is rubbed by the clothing of the wearer, or the like. Other features and advantages of the invention will be apparent from the following specification and the drawing, in which:

Figure 1 is a front elevation of a compact hearing aid device embodying my invention; Figure 2 is a back view, with part of the case broken away, of the same device; and Figure 3 is a fragmentary sectional view along the line 3 of Figure 2.

While hearing aid devices to assist ear deficiencies have been known and used for a number of years, they have generally consisted of either a small compact device adapted to be worn by the user, but having low amplification; or a large device using electron tubes and providing considerable amplification, but placed on a desk, table, or the like. I have recently developed compact portable hearing aid devices of a size and weight enabling them to be carried in a man's vest pocket, or pinned to a woman's dress, slip, or the like; yet including a high gain amplifier employing three electronic tubes. The very high overall gain or amplification of this device, however, has rendered previously unimportant and unconsidered rubbing of the case against the clothing or the like a considerable difficulty. The constant movement of a man's chest, as in breathing, moving his arms, walking and the like, causes practically constant friction between the case of the device and the fabric in contact with it; and the same is true of one of these devices pinned to the front of a woman's dress, for example.

I must have the greatest possible interior volume for a given set of outside dimensions, in order to include in the device a microphone, three electron tubes, an off-on switch, a variable volume control, resistors, condensers, chokes, and other elements necessary to a three-tube amplifier circuit. The only case which I have found practicable under these conditions is one formed of a shell of thin metal; and this has proved exceedingly likely to deliver undesired vibrations to the microphone when it is rubbed against the lining of the pocket, or against some other portion of the clothing.

The present application is a continuation-in-part of my application, Serial No. 232,899, filed October 1, 1938, for a case for a hearing aid device. In that application I disclosed a sound-deadening or vibration-damping inner layer, as liquid rubber or latex sprayed on the interior of the thin metal case. I have now found that the exterior surface of the case is of even more importance; and that creation of the vibrations can be prevented or greatly minimized, instead of endeavoring to damp them out afterwards, if the exterior surface of the metal case is provided with a super-smooth finish.

In the particular embodiment of the invention illustrated herewith the case 10 of a hearing aid device is shown as formed of a shell of two pieces of metal, the principal metal shell being indicated as 11 and the cover or back of the case as 12. The front of the case is perforated as at 13; and the microphone is mounted directly behind these perforations, in a manner disclosed by me in another co-pending application. The case also contains or houses electronic amplifying tubes 14, 15 and 16; condensers 17 and 18; the off-on switch 19; the volume control resistor, having the projecting control knob 20; and other elements, such as resistors, chokes, and the like, necessary to provide an operative device for picking up sound waves, translating them into electrical impulses, and highly amplifying the impulses. The representation of the device in Figures 1 and 2 is a full-sized drawing of a preferred embodiment of my invention; while the showing in Figure 3 is an enlarged illustrative partial section.

The parts of the case are drawn from thin sheet metal, in the present embodiment from soft aluminum about .02 inch in thickness. Other light metals, as aluminum alloys, may be used; and in order to keep the weight and size of the device as small as possible the thickness of the metal wall of the case should be less than one-twentieth of an inch. The back or cover may, if desired, be even slightly thinner than the front portion. I sometimes make this from duraluminum or soft sheet aluminum .0015 inch thick. The inside surface of the metal shell of the case is coated with liquid rubber, generally sprayed

on in several layers, to reduce or damp vibrations set up in the metal of the case. A thin primer coat is first sprayed on, and then slightly more viscous liquid rubber used for further layers. The finished layer of rubber, when the solvent has dried out of it, is indicated here as 20. It adheres to the inner surface of the case, and should be at least one thirty-second of an inch thick.

In order to provide a corrosion-inhibiting protective surface on the exterior of the case which is super-smooth, I subject the exterior of the case to an anodic treatment known in the art. It is practiced under certain patents, and is generally known as the Alumilite Process. In this process the surface of the metal is first buffed or otherwise cleaned. It is then made the anode in an electrolytic bath or solution, so that a portion of the surface is converted to aluminum oxide. In order to provide a pleasing appearance, the case may be then submerged in a dye, as for example a black dye; and the surface is then sealed by immersing it in a hot hydration solution, where it may be boiled for thirty minutes, for example. The surface is then given a finishing buff, and when it leaves this last buffing operation it has the supersmooth finish desired.

While I cannot explain the precise reason for it, it is a fact that an exterior finish made in this manner provides a protective and pleasing coating, yet has the smoothness of a piece of highly polished metal. It is so smooth that the fibers of the fabric of which clothing is made do not get any grip on the surface, and do not cause any vibration to speak of when they are moved along it. The difference between a supersmooth finish of this kind and a conventional enamel, lacquer, or the like finish is absolutely amazing in practice. I have tested thin metal cases of the kind disclosed here with various finishes, and with and without the interior rubber layer, by placing a noisemeter, reading in decimals, near a receiver connected to the case. I have then subjected the exterior of the case to rubbing with a fabric, under controlled speed and pressure, so that all tests would be alike in this respect. If the distance of the noisemeter from the receiver was adjusted so that the noise level of the case disclosed herewith was 1, the other cases provided a noise background many times greater. A case with a lacquer enamel finish, for example, tested at 9 decibels; a plain unfinished duraluminum case with rubber coating inside at 12; the same case with no rubber coating at 14; and a rubber-coated case with a so-called crackle exterior finish gave the high noise level of 21.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. A compact hearing aid device comprising a unit adapted to be carried on the person of the user, including: a microphone; a high gain tube amplifier; and a case housing both of said elements, said case being formed of thin metal provided with a supersmooth outer surface, whereby sound impulses resulting from unintended frictional rubbing against the case are minimized.

2. A compact hearing aid device comprising a unit adapted to be carried on the person of the user, including: a microphone; a high gain tube amplifier; the microphone being adapted to convert mechanical impulses into electrical impulses and the amplifier being adapted to highly amplify these and deliver them to an earphone; and a case housing both of said elements, said case being formed of thin sheet aluminum provided with a supersmooth exterior effected by anodic treatment of the surface of the aluminum, whereby sound impulses resulting from unintended frictional rubbing against the case are minimized.

3. A compact hearing aid device comprising a unit adapted to be carried on the person of the user, including: a microphone; a high gain tube amplifier, the microphone being adapted to convert mechanical impulses into electrical impulses and the amplifier being adapted to highly amplify these and deliver them to an earphone; and a case housing both of said elements, said case being formed of thin sheet aluminum having means on the inner surface damping vibrations therein and provided with an outer corrosion-inhibiting surface which is supersmooth, said surface being provided by making the aluminum the anode in an electrolytic process, submerging it in a hot hydration solution, and buffing it, whereby sound impulses resulting from unintended frictional rubbing against the case are minimized.

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