June 5, 1945. R. S. WYCKOFF 2,377,739

HEARING AID

Filed June 26, 1942

Fig. 1.

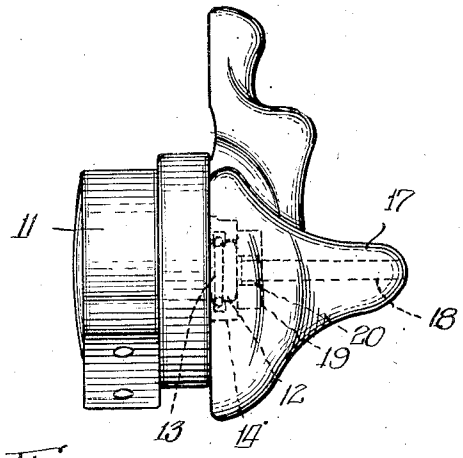



Fig. 2.

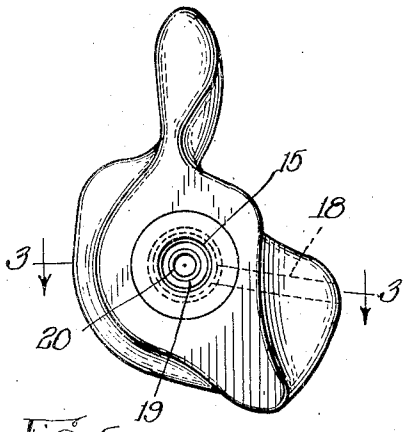



Fig. 3.

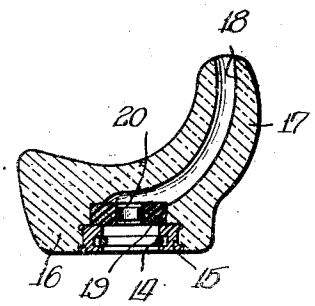



Fig. 5.

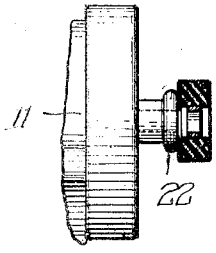



Fig. 4.

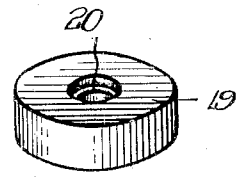
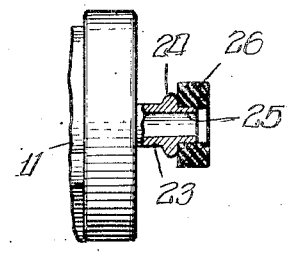



Fig. 6.




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Patented June 5, 1945

2,377,739

# UNITED STATES PATENT OFFICE

2,377,739

## HEARING AID

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Application June 26, 1942, Serial No. 448,523

8 Claims. (Cl. 181—23)

This invention relates to a new and improved hearing aid, and more particularly to such a device so constructed as to give an improved quality of reception.

Hearing aids of the character to which the present invention particularly applies comprise an ear piece fitting closely into the ear of the user, an electrically operated receiver connected to the ear piece, a transmitter or microphone, and electric or electronic means, which may include an amplifier, connecting the microphone and receiver and providing the operating current for the receiver. The particular construction or design of the microphone and electric or electronic means and the operating structure of the receiver form no part of the present invention and will not be described in detail, as many commercial constructions are available.

The usual form of receiver is of the magnetic type, although crystal and other types are used. It comprises essentially a relatively small housing containing a diaphragm which is electrically operated by mechanism in the housing by a variable electric current transmitted over wires connecting the receiver to the microphone and operating or amplifying mechanism. This receiver has an opening communicating with the face of the diaphragm, the opening being surrounded by a tubular extension or post by means of which the receiver is connected to the ear piece. This post is substantially rigid and may be formed of metal or other suitable material. The ear piece is normally formed to fit the convolutions of the concha of the ear and to have an extension which fits into the auditory canal and terminates adjacent the ear drum. The ear piece is provided with a recess into which the receiver post extends, and a sound opening passes from the recess through the extension of the ear piece to terminate adjacent the ear drum. A common form of securing means for connecting the receiver post and the ear piece comprises a peripheral groove on the post and a coacting split ring carried within the ear piece recess. This and other generally similar constructions are used which afford a satisfactory mechanical connection, but which are not efficient in preventing passage of undesired sound waves.

It is found in actual practice that it is important to prevent the transmission of air borne sound waves through the connection between the receiver and ear piece in either direction. The microphone is often worn by the user somewhat closely adjacent the receiver mounted upon the ear. Vibrations from the receiver, if they escape and impinge upon the microphone, may cause what is known as "feed back," which causes a shrill whistle or howl in the receiver, or, in some cases, a rattle or other recurrent noise. Such sounds are objectionable both to the user and to persons of normal hearing who may be adjacent the user. Consequently, sound should be prevented from entering or leaving the ear piece cavity with the exception of the entrance from the passage in receiver post of the desired sound. Extraneous sound, even if not sufficient in amount or of a frequnecy to cause actual feed back, can confuse and distort sound it is desired to transmit.

It is an object of the present invention to provide a new and improved hearing aid construction comprising separate ear and receiver members and affording more efficient transmission to the inner ear of the wearer.

It is an additional object to provide a device of this character which minimizes sound leakage between the elements of the device and further minimizes resonance and undesired vibrations of the elements.

It is also an object to provide a construction by means of which existing devices may be modified to embody the advantages of the improved device.

It is a further object to provide a device which is simple in design and construction and adapted for commercial production and use.

Other and further objects will appear as the description proceeds.

I have shown a preferred embodiment of my invention in the accompanying drawing, in which

Figure 1 is a side elevation of the assembled device;

Figure 2 is a view of the ear piece of Figure 1 as seen from the right;

Figure 3 is a section taken on line 3—3 of Figure 2;

Figure 4 is a perspective view, on an enlarged scale, of the cushioning and sound excluding washer;

Figure 5 is a fragmentary view showing a modified form of construction; and

Figure 6 is a view similar to Figure 5 and showing a further modification.

In the drawing, referring first to Figures 1 to 4, the receiver 11 is shown as provided with a tubular metal post 12 having a circumferential groove 13 to receive a snap ring 14. This ring 14 is carried by the inserted ring 15, which is permanently secured to the ear piece 16. This ear piece is shaped to conform to a portion of the concha of the ear and is provided with a horn 17 which extends into the auditory canal to terminate adjacent the ear drum of the wearer. The horn

17 is formed with a sound passage 18 extending therethrough and communicating with the space adjacent the opening surrounded by ring 15 and thus with the opening in the tubular post 12 of the receiver. This space receives the sealing and sound trapping washer 19, which has an inner ring 20 formed of rigid material. The washer 19 may be formed of any soft, resilient and sound-or-vibration deadening material, such as sponge rubber, cellulose sponge, felt, or fibre, or the like. The ring 20 may be formed of metal, such as brass, or may be formed of relatively hard or stiff material, such as Bakelite or other synthetic resins. The ring 20 is preferably thinner than the washer 19 so that it does not contact both the receiver and ear piece and consequently cannot act mechanically to transmit vibrations. The purpose of the ring 20 is to maintain a definite, clear passage for the transmission of sound from the receiver to the ear drum, this passage being of a definite and fixed size. If the ring were not provided, the opening in the washer would vary in size when installed, depending upon the care of installation and the exact size of the associated parts, which would cause it to be compressed in differing degree.

The form of construction shown in Figure 5 differs from that of Figures 1 to 4 only in that the washer 19 is fixedly secured to the end of the receiver post 12 by means of cement or other adhesive, as indicated at 22. This obviates any danger of the washer slipping out of the cavity in the ear piece and becoming lost or mislaid when the parts are separated. This construction also has the advantage that the opening in the ring 20 is permanently and positively aligned with the opening in the receiver post.

In the form of construction shown in Figure 6, the receiver post 23 has a circumferential ridge 24 adapted to coact with the snap ring or similar securing means carried by the ear piece. The post 23 is also provided with an extended portion 25 about which the cushion washer 26 is fitted. This washer is similar to the washer 19 and no inner ring 20 is needed in view of the post portion 25. The ridge 24 locates the washer 26 and compresses it in the ear piece cavity when the elements are assembled. The washer 26 may be held in place by its resilience or it may be cemented in place as desired.

The washer 19 or 26 is of such size as to be somewhat compressed laterally when inserted in the ear piece. It is of such thickness that it is compressed axially when the receiver is assembled upon the ear piece. The washer serves thus to substantially completely seal the connection between the ear piece and receiver in so far as passage of sound vibrations or other undesired vibrations inwardly or outwardly at this point is concerned. The washer also serves to cushion and make firm the connection between the ear piece and receiver so that any tendency for the ear piece to vibrate independently of the receiver is minimized. It minimizes or eliminates any tendency for vibration of the receiver, the receiver post, or the post securing means, and prevents transfer of vibrations from one element to another. It is thus effective not only in preventing entrance and exit of sound vibrations which might cause feed back or unwanted noise, but also eliminates any parasitic vibrations which would result in disturbance of sounds intended to be transmitted to the user and in reduction of intelligibility of such sounds. With the advantages referred to, the present invention has the advantage that before or after the ear piece has been inserted into the ear the receiver may be rotatably adjusted relative to said ear piece. Some persons desire that the cord leading to the receiver enter from the top so that the cord may be run over the top of the ear. Others desire the cord to enter the receiver from the bottom. Some desire it to enter from the rear. The use of snap rings to permit rotatable adjustment between two separable conduits is, of course, old, being shown for example in the patents to Robinson No. 721,746, Waters No. 738,503, Spencer No. 981,705, Meyer No. 1,754,639 and Blanchard No. 1,771,949.

In addition, the washer serves to largely fill the cavity in the ear piece so as to minimize or eliminate any resonance within the cavity. By thus eliminating or minimizing all undesired vibrations of the elements of the device, the undesired entrance and exit of sounds or vibrations relative to the sound channels in the parts, and by preventing resonance in the ear piece cavity, the efficiency, clarity and fidelity of sound transmission of the device is substantially increased.

While I have shown certain preferred embodiments of my invention, these are to be understood to be illustrative only, as it is capable of variation to meet differing conditions and requirements, and I contemplate such modifications as come within the spirit and scope of the appended claims.

What is claimed is:

1. In a hearing aid construction, in combination, a receiver having a post extending therefrom and provided with a sound channel, an ear piece having a cavity therein to receive said receiver post and having a sound channel extending from said cavity and terminating upon the inner face of said ear piece, means operatively associated with said receiver and said ear piece for detachably holding said post in said cavity, and an apertured cushioning washer positioned to abut said tubular post with the aperture in said washer in registration with the tubular channel in said post and with the channel in said ear piece for preventing leakage of sound at the junction of said receiver and said ear piece.

2. In a hearing aid construction, in combination, a receiver unit, an ear piece unit, said receiver unit having a tubular sound-conveying post extending therefrom, said ear piece unit having a cavity therein for receiving said post and also having a passage extending therefrom to the extremity of said ear piece unit adapted to be located within the ear of a wearer, said post and said ear piece unit having cooperating means for detachably and rotatably connecting them together, and a cushioning washer located within said cavity having a hole therethrough registering with the tubular channel in said post, said cushioning washer being disposed in position to be compressed when said receiver unit and said ear piece unit are connected together.

3. In a hearing aid construction, in combination, a receiver unit, an ear piece unit, said receiver unit having a tubular sound-conveying post extending therefrom, said ear piece unit having a cavity therein for receiving said post and also having a passage extending therefrom to the extremity of said ear piece unit adapted to be located within the ear of a wearer, said post and said ear piece unit having cooperating means for detachably and rotatably connecting them together, and a cushioning washer located within said cavity having a hole therethrough registering with the tubular channel in said post, said

cushioning washer being disposed in position to be compressed when said receiver unit and said ear piece unit are connected together, said cavity and said washer having sizes such that said washer is compressed laterally when inserted in said cavity, said washer having therein a tubular rigid portion to maintain an opening of predetermined diameter.

4. In a hearing aid construction, an ear piece unit having a horn for extending into the aural cavity and having a sound conducting passage therein, said unit having a cavity communicating with said passageway, and an apertured cushioning washer located within said cavity and adapted to be engaged and compressed by a sound conducting post of a receiver unit.

5. In a hearing aid construction, a receiver unit having a sound conducting post extending therefrom and adapted to be inserted into an ear piece unit, and an apertured cushioning washer located upon said post coaxially with said post and adapted to be compressed when said post is disposed in operative position in an ear piece unit.

6. In a hearing aid construction, in combination, a receiver unit, an ear piece unit, each of said units having a sound passage, and an apertured cushioning washer in abutting relationship to said units, with the aperture in said washer in registration with said passages whereby said washer serves to minimize leakage of sound at the region between said units.

7. In a hearing aid construction, in combination, a receiver unit and an ear piece unit, one of said units having a post extending therefrom, said post being provided with a sound channel and being adapted to extend into the other of said units, said other unit having an apertured cushioning washer positioned to abut said post, with the aperture in said washer in registration with said channel in said post and communicating with the interior of said receiver unit whereby said washer serves to minimize leakage of sound at the junction of said receiver unit and said ear piece unit.

8. In a hearing aid construction, in combination, a receiver unit, an ear piece unit, each of said units having a sound passage, and an apertured cushioning washer in abutting relationship to said units, with the aperture in said washer in registration with said passages whereby said washer serves to minimize leakage of sound at the region between said units, said annular washer having a substantially rigid tubular member fitted in the hole therein to maintain an opening of predetermined diameter when said washer is compressed.

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