This invention relates to acoustical coupling devices, and more particularly to an acoustical coupling device useful in connection with instruments such as telephone receivers, microphones and the like for improving the acoustical performance and response of the instruments to which they are applied.

The problems associated with the reproduction of sound by acoustical instruments, such as earphones or the like, are many. However, they may be broadly separated into two groups: first, those concerning the acoustical, mechanical, and electrical constants of the driving element; and second, those concerning (1) the acoustical and mechanical constants of the coupling means employed between the driving element and the ear of the person using the instrument, and (2) personal comfort to the wearer. Performance of these acoustical instruments is determined jointly by the above factors, so that an improvement in either factor results in an improvement in the performance of the instrument.

Even though an earphone is provided with any of the well known types of earcaps in use at the present time, the instrument is still not as efficient acoustically as would be desired since extraneous noise is still found to reach the ear in four ways, namely, (1) direct paths, i.e., leakage underneath the earcap due to a poor fit, which becomes particularly noticeable in the case of low frequency noise; (2) sound transmission through the earcap itself; (3) sound transmission through the walls of the earphone itself; and (4) vibration of the instrument as a whole, due to sound pressure on the outside, which may result in resonance if the earcap is of suitable compliance.

It is the primary object of my present invention to provide an improved coupling device which is useful in connection with various acoustical mechano-acoustical and electro-acoustical instruments and which has the enhanced characteristics and advantages hereinafter set forth.

More particularly, it is an object of my present invention to provide an improved construction for the coupling means usually employed between the earphone or telephone receiver and the ear of a user thereof, which coupling means is more commonly referred to by those persons skilled in the art as an earcap, ear insert, "doughnut," etc.

It is also an object of my present invention to provide an earcap for earphones or the like which will improve the performance of the instrument to which it is applied.

Another object of my present invention is to provide an earcap which will improve the response characteristics of the instrument to which it is applied.

Still another object of the invention is to provide a coupling member for earphones which will prevent external noise from reaching the ear while at the same time providing a suitable acoustical path to the ear for sound waves produced by the earphone.

It is another object of the invention to provide a coupling member as aforesaid which will mold itself perfectly to the ear as well as provide comfort to the wearer.

In accordance with my present invention, the coupling means or earcap comprises a hollow, semi-fluid, material, which is attached to or otherwise fitted upon the cover of an earphone or telephone receiver, the shell being filled with a semi-fluid, putty-like material, and the shell being provided with an opening or sound passage which communicates with the openings in the earphone casing. When such an earcap is placed in contact with the human ear, the putty-like filler enables the earcap to quickly and readily conform to the surface irregularities of the ear, thereby providing an almost perfect seal against extraneous noises and, at the same time, affording comfort to the user.

The novel features characteristic of my present invention, as well as additional objects and advantages thereof, will become more readily apparent from the following detailed description of a single embodiment thereof, when read in connection with the accompanying drawing in which,

Figure 1 is a perspective view of a telephone receiver provided with an earcap in accordance with my present invention.

Figure 2 is a front view of the earcap shown in Figure 1.

Figure 3 is a side view, in section, taken on the line 3—3 of Figure 2 and showing the earcap attached to the removable cover of the earphone casing, and

Figure 4 is a rear view of the earcap shown in Figures 1 through 3.

Referring more particularly to the drawing, wherein similar reference characters designate corresponding parts throughout, there is shown, by way of illustration, an earphone receiver 1 which comprises a casing 3 in which may be housed any suitable electro-acoustical apparatus in well known manner. The earphone is provided with a coupling member or earcap 5 in accordance with the present invention, and a handle or other suitable support 7.

The coupling member or earcap 5 consists of a hollow, annular shell having an outside diameter which substantially conforms to the outside diameter of the removable cover 9 for the casing 3. The walls 11 of the earcap 5 are constituted of a thin, flexible material, preferably rubber, having a thickness of about 1/64 inch. The front wall 13 of the earcap 5 may be frusto-conical in form or of any other desired form, tapering toward the rear wall 15, as best seen in Figure 3 of the drawing. A central aperture 17 is provided in the earcap 5, the aperture 17 being in registry with and preferably concentrically arranged with respect to the sound openings 19 in the casing cover 9. The rear wall 15 is formed with a rather flat outer surface 21 which is fastened to the cover 9, as by cementing, gluing, or otherwise securely attaching the two parts to-
An annular opening 23 is provided in the rear face 15 which serves two purposes during the manufacture of the earcap 5, namely: (1) it facilitates removal of the male mold member from the interior of the finished shell; and (2) it provides an opening through which a filler may be inserted into the cavity of the shell.

The earcap 5 is formed with a cavity or annular chamber 26 which is filled with a semi-fluid, viscous, putty-like material 27. A filler material of suitable fitness, such as methyl silicone polymer, which is also known as "bouncing putty," is found excellent for this purpose. The viscosity of "bouncing putty" is similar to that of the flesh in the average person's cheek when pressed slowly, and because of its density, it has very poor sound transmission quality. The material also possesses the characteristics of being plastic to slowly applied forces but elastic to rapidly applied forces. As a result there of, an earcap having a thin shell or casing such as above described and this material as a filler will mold itself perfectly to the contour of the ear in a matter of a few seconds after it is pressed against the ear. Because of the slow flow characteristic of the filler, the instrument will be prevented from shifting when the head is moved rapidly, turned up or down, or severely shocked. When the earcap is removed and left off the head for a period of time, it will sag slightly out of shape. However, this is not objectionable since the earcap will again conform to the contour of the ear in a matter of a few seconds after it is placed in contact therewith. Nevertheless, if the sag should be found to be objectionable, it may be fairly well remedied by employing several internal cells in the cavity or chamber 26 of the shell, each being filled with this same filler material. While the use of "bouncing putty" is recommended as an ideal filler material, it will, of course, be recognized by those persons skilled in the art that other similar materials which are more fluid and also have very poor sound transmission qualities may also be used, even to the extent of employing a thoroughly fluid material (in some instances under compression, if necessary) as a filler for the earcap.

Thus, an earcap such as described above is not only highly efficient, but is also superior to similar prior art structures, first, because its acoustical performance and response are considerably improved by reason of the improved construction thereof; second, because of its excellent sealing quality when in contact with a human ear, acoustic leaks are negligible, and, as a result, low frequency response will be reduced and distortion at the lower frequencies reduced; third, since a perfect seal is formed, the invention permits an earcap to be constructed with a smaller cavity between the ear canal and the receiver, thereby increasing the sensitivity of the instrument; and fourth, due to its completely yielding nature, and because there is no excessive pressure on any part of the ear, the earcap will be found to provide a high degree of comfort to the wearer, especially in cases where the instrument is worn for any length of time.

While the invention described herein has been applied to but one type of acoustical instrument, it will, of course, be recognized by those persons skilled in the art, that this type of construction may be applied to other devices of the same general type, particularly where comfort and fit are important. For example, it may be applied to mouthpieces used in microphone noise shields, as well as to oxygen and gas masks. Another application is to the bell ends of bell-type stethoscopes in which it may be used for obtaining a better seal to the body. Still another application is that of providing a form fitting, impedance matching, contact pad for the transmission of vibrations into human bodies for test and treatment, as well as into wooden structures, concrete columns, fruit, etc.

It will also be apparent that other modifications and changes in the improved earcap structure described herein will readily suggest themselves. Therefore, it is desired that the particular form of the invention described herein shall be considered as illustrative and not as limiting.

What is claimed is:

1. An ear cap for earphones comprising a shell of thin, yieldable material having an annular chamber therein, said shell having one surface thereof possessing a contour whereby it may be secured to the casing of a telephone receiver having an apertured portion to transmit sound, said shell having another surface thereof to be brought in contact with the ear of the user of the earphone, said shell having an opening there through adjacent the inner periphery of said chamber to register with the apertured portion of the casing to which said shell is attached, said chamber having a filler therein of a semi-fluid, viscous, putty-like material capable of flow upon compression of the ear contacting surface of said shell whereby the ear contacting surface of said shell assumes substantially the contour of the user's ear.

2. An ear cap for earphones comprising a shell of thin rubber having an annular chamber therein, said shell having one surface thereof possessing a contour whereby it may be secured to the casing of a telephone receiver having an apertured portion to transmit sound, said shell having another surface thereof to be brought in contact with the ear of a user of the earphone, said shell having an opening there through adjacent the inner periphery of said chamber to register with the apertured portion of the casing to which said shell is attached, said chamber having a filler therein of bouncing putty capable of flow upon compression of the ear contacting surface of said shell whereby the ear contacting surface of said shell assumes substantially the contour of the user's ear.

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