March 28, 1961 H. NOYES ET AL 2,977,426

EAR PAD

Filed June 25, 1956 2 Sheets-Sheet 1

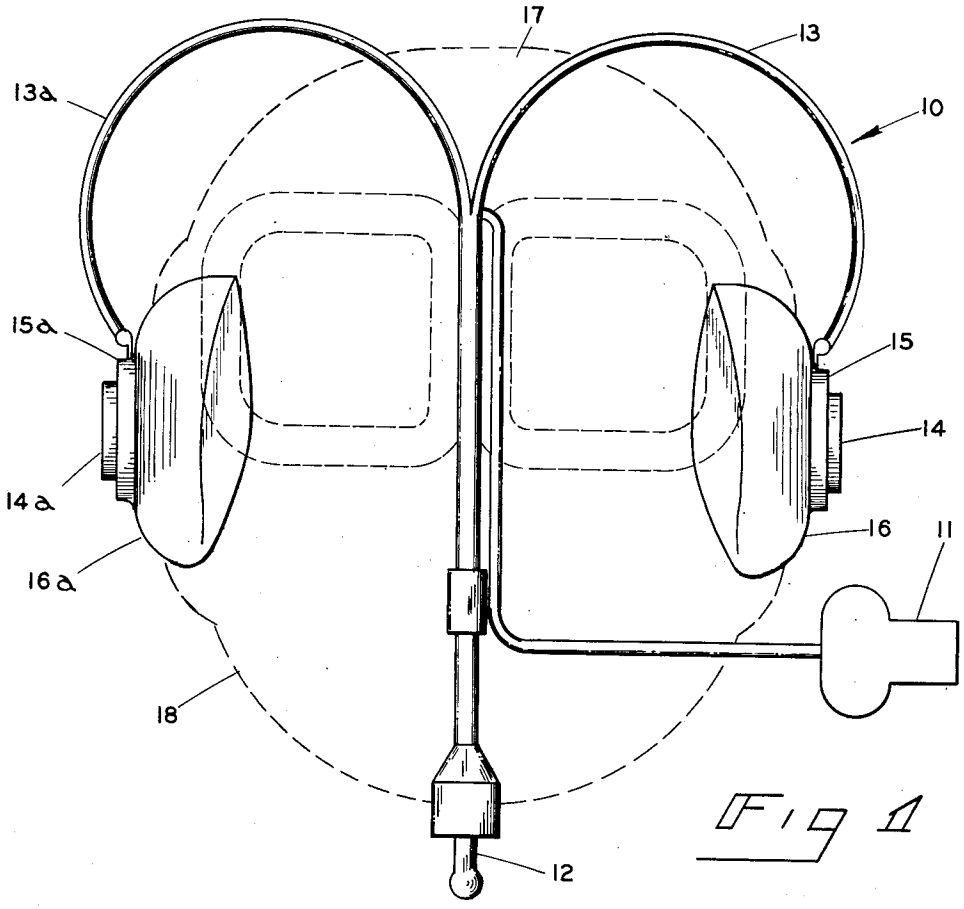


Fig 1

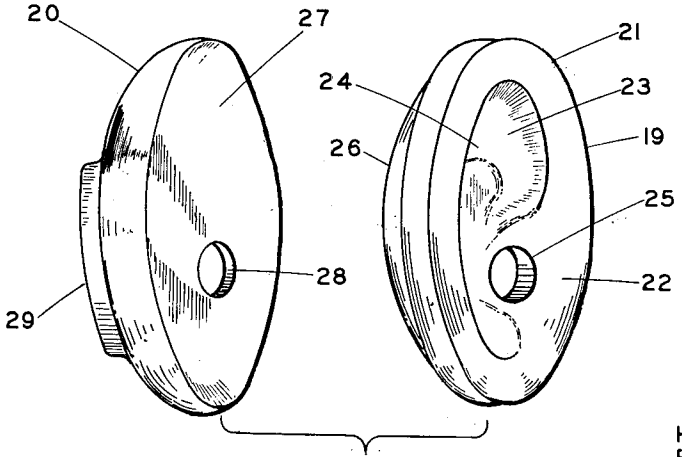


Fig 2

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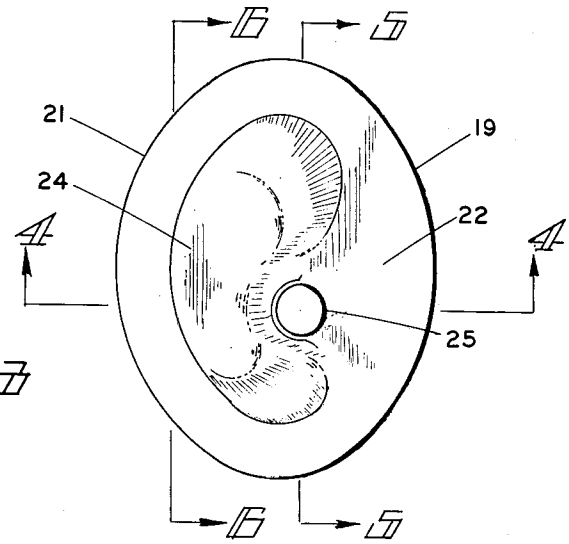


Fig 3

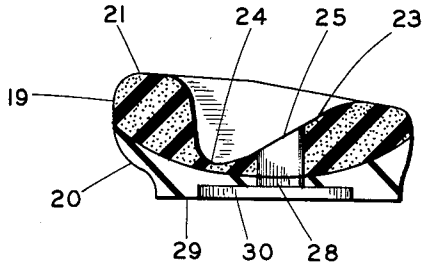


Fig 4

Fig 6

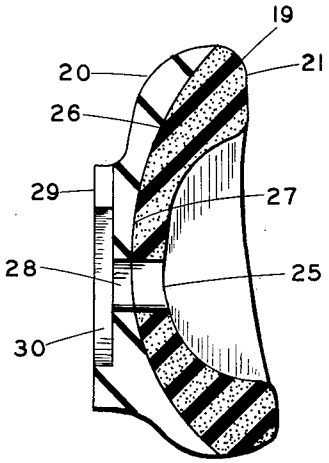
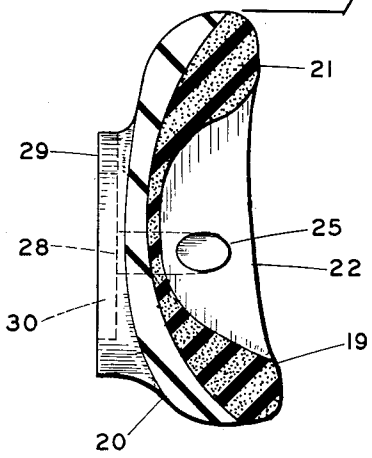


Fig 5



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EAR PAD

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Filed June 25, 1956, Ser. No. 593,686

6 Claims. (Cl. 179—182)

This is a continuation-in-part of our application No. 518,573, filed June 28, 1955.

The present invention relates to heat and/or sound-insulating ear pads and particularly to such as may be employed to relieve fatigue and provide comfort to the user in connection with acoustical devices such as radio headphones and the like.

In the past, ear pads of one form or another have been employed for many purposes including warmth, comfort, protection and the like, and pads or headphones have been commonly employed for use in connection with radio receivers particularly in aeronautics where it is required that the pilot be able to hear his radio at all times above the noises attending the operation of an aircraft while at the same time having his hands free for such operation. These headphones have in the past involved a rigid or semi-rigid diaphragm-carrying device, usually in the form of a flat cylinder which has been forced against the ear by a suitable head-spanning clamp to cover the aural cavity, thereby leaving it exposed only to sounds coming through the headphones. While this apparatus has proven satisfactory from the standpoint of acoustical requirements, it has necessarily involved forcing the headphone against the ear resulting in its displacement from its normal position; this displacement has in turn resulted in discomfort and fatigue to the user of the same, particularly when use has been required for long periods of time such as are now normally encountered in long range aircraft operations.

In view of the disadvantages inherent in this form of headphone which resulted in a dislocation of the ear, more recent experiments have been undertaken with regard to ear pads which are capable of carrying headphones and which rest against the head of the user around his ear rather than directly against the ear. Such pads have consisted of a shell of the general shape of a truncated semi-ellipsoid, the open portion of which has been designed to surround the ear of the user and to contact his head. The truncated portion is usually provided, in the case of headphones on radio devices, with an opening which may be exposed to an audio signal. These pads can be made of such sufficient depth that the ear of the user would not be deformed or displaced at all, and the hitherto experienced discomfort attending the use of the old type of phone has been eliminated. At the same time, however, it has been found that while it is possible to obtain a satisfactory sound insulation seal around the ear with the head-contacting portion of the pad, the word intelligibility, i.e., the user's ability to understand words transmitted through the audio portion of the radio receiver associated with the pad, has been considerably less satisfactory than in the case of the previously employed headphones which actually press the transmitter against the aural cavity. In addition, it has been found that previously developed pads have been so designed that they cannot be placed over the ear simply and quickly by a direct thrust at right angles to the ear. These pads are designed with undercut or recessed cavities

in the aft portion in order that the aft portion of the helix of the ear may be slipped within the cavity. Thus it is necessary to bring the pad toward, but behind, the ear and subsequently bring it forward in order to allow that portion of the helix of the ear to fit within the cavity. Such a procedure is inefficient and awkward.

It is accordingly an object of the present invention to provide an ear pad which may be worn for a considerable length of time without excessive discomfort or fatigue resulting to the wearer.

It is a further object of the present invention to provide such a pad which is suitable for use in connection with radio equipment.

Yet a further object of the present invention is to provide a pad for use with radio equipment which will at once avoid the disadvantages of a headphone in contact with the ear but will at the same time provide a satisfactory insulation of the aural cavity from exterior noises and will allow a clear understanding of signals and messages being transmitted through the headphone associated with the pad.

Still another object of the invention is the provision of an ear pad structure which simplifies the step of placing the pad on the ear.

A further object is the provision of an aperture in the pad directly over the opening to the inner ear.

These and other objects of the present invention, which will be apparent from a reading of the following disclosure, are achieved in the case of the present invention by utilizing the principle of a truncated semi-ellipsoidal device designed to surround the ear and contact the head of the user adjacent the marginal portion of the ear. The present invention, however, provides for an important and critical modification of the interior cavity defined by said device in that, instead of the previously employed cavity which merely conformed in shape to the exterior shape of the pad, there is provided herein an internal cavity with built-up areas designed to render it substantially ear shaped or shaped in a manner conforming substantially to the shape of that portion of the human ear which projects or rises from the human head. The present invention further provides for increasing the thickness of the shell at the head-contacting rim portion thereof, and also provides for a passage directly over the inner ear opening portion thereof. These expedients result in a reduction of the internal volume of the ear-receiving cavity of the pad with the unexpected result of surprisingly improved word intelligibility. In addition to this reduction of interior volume, the increase in thickness of the shell at the head-contacting portion thereof has resulted first in an improved acoustical insulation of the aural cavity as well as a greater distribution of any stresses attending the wearing of the pads with a resultant increase in comfort to the wearer. The invention also provides for a gradually decreasing area of the cavity toward the interior of the pad, without the usual undercut or recessed portion heretofore provided in similar devices in which the aft portion of the helix of the ear fits. This permits a simpler procedure for the placing of the pad on the ear without the necessity of inserting the helix in a separate movement.

The invention thus generally described may be more clearly understood from a study of the following detailed disclosure in connection with which reference may be had to the appended drawings, in which:

Figure 1 is an elevation of a conventional headset employed in connection with radio equipment showing the manner of association of the same with the human head.

Figure 2 is an exploded view in perspective of the individual components of the ear pad, illustrating their relationship.

Figure 3 is an elevational view of the complete ear pad.

Figure 4 is a section of the pad assembly taken along lines 4—4 of Figure 3.

Figure 5 is another section of the pad assembly taken along lines 5—5 of Figure 3.

Figure 6 is another section of the pad assembly taken along lines 6—6 of Figure 3.

Referring now to Figure 1, a conventional headset referred to generally by the numeral **10** consists of radio connections **11** and **12** which are wired by conduits **13** and **13***a* to supply a signal to receivers **14** and **14***a*. The receivers are provided with flange portions, integral or otherwise affixed thereto, such as **15** and **15***a* which provide a base for receiving and supporting the pads **16** and **16***a* of the type used in one preferred embodiment of the present invention. The pad thus described may be incorporated in a headpiece such as a helmet or may merely be fastened to a head-spanning clamp such as **17** for holding the pads and the receivers associated therewith against the human head **18**.

It is to be understood that the manner in which the pad of the present invention is fastened to or held against the head is not material to the invention. Furthermore, the invention is not limited to the association of the pad with radio equipment since the pads may also be conveniently employed for heat as well as sound insulation purposes. In the latter category also will fall sound insulating pads which are not intended to provide for any audible signal but are merely to prevent the wearer from hearing annoying or fatiguing noises. Nonetheless, the pads according to the present invention do have particular utility when they are associated with radio receiving equipment, in that they provide a satisfactory insulation of the audio signal from exterior noises and at the same time do not interfere with the word intelligibility of the transmitted message.

Referring now to Figure 2, the improved ear pad assembly consists of a pad **19** and a supporting shell or rigid member **20**. The pad is made of a semi-elastic or elastomeric composition of the type which is relatively soft and comfortable to the touch while at the same time may be deformed with relatively little force, yet recovers from the deformation slowly. The use of cellular or microporous compositions is especially preferred and has been found to improve the acoustical insulating properties of the pad. More specifically, the materials contemplated are foamed rubbers, synthetic rubbers such as polymers and copolymers of chloroprene, butadiene, styrene and acrylonitrile; and plastics such as polyamide, polyvinyl, and polyurethane resins. In contrast to the pad **19** the supporting shell **20** is of the same general type of material but is so composed as to be considerably more rigid than the pad. Example of the material that might be used for the shell is polyurethane foam compounded to be substantially rigid while a soft, flexible and elastic form of polyurethane foam may be used for the pad **19**.

As shown in Figures 2 to 6 the pad **19** has a generally truncated semi-ellipsoidal exterior shape terminating in a head-contacting rim **21** which is substantially elliptical when viewed as in Figure 3. This rim is of a greater thickness than the remainder of the pad in order to provide a greater mass of acoustically insulated material. The insulating effect is further enhanced by the width of this rim and further provides for insulating by an increased width and mass of the rim at the portion **22** which would lie adjacent the tragus of the ear. From the exterior of the cavity at the rim, the cross-sectional area of the cavity decreases constantly from a maximum at the rim to a minimum at **24**, which is the point farthest from said rim (as best shown in Figure 4). By "exterior" is meant that portion of the cavity closest to the rim in contrast to the interior of the cavity meaning

that portion farthest from the rim. The forward portion **23** of the cavity decreases more gradually than the aft portion, which rises almost at right angles to the rim of the cavity in order to accommodate the aft portion of the helix of the ear. It is thus possible to place the pad directly over the ear in a motion at right angles to the head in order to accommodate the ear with a minimum of discomfort or distortion of the ear. At the same time the interior volume of the cavity is such that there is no excess volume, resulting in an improvement in word intelligibility when the pad is employed for audio signals. In order to provide a passage for the sound waves from the audio receiver **14**, an opening **25** is provided passing through the entire depth of the pad and is located in the interior wall **23** of the cavity. The opening **25** is so located that when the pad is placed over the ear the opening is in direct line with the passage from the outer ear to the inner ear in order to provide a highly efficient transmitting means.

The supporting shell **20** has a semi-ellipsoidal shape **27** which conforms exactly to the outer surface **26** of the pad in order that they may be placed in juxtaposition with each other for permanent bonding. The shell may be adhered to the pad along the mating surface **26** and **27** by means of suitable adhesives or such mechanical means as rivets or the like. Although the method of forming the shell **20** is not contemplated within the scope of my invention, it may be specifically suggested that true mating surfaces be achieved between it and the pad by using the same mold to form both members, as is well known in the field of molding the type of material being herein used.

An opening **28** in the shell is provided to align perfectly with the opening **25** in the pad, the opening passing completely through the shell to provide a continuous passage through both members. The outer surface of the shell includes a boss **29** in which is found a recess **30** conforming in shape to the receiver **14**. The receiver may be placed within the recess and affixed to flange **15** by screws, bolts, or other conventional means so that the diaphragm of the receiver will transmit its waves through the openings **28** and **25** into the ear.

Although specific details of the invention have been described, these details are considered exemplary and are not intended in any way to limit the scope of the invention. Modifications in these details may be made without departing from the spirit of the invention. For example, if the device is to be used for heat or sound insulation purposes, the openings **28** and **25** will be unnecessary.

We claim:

1. A receiving headset for audio signals comprising an acoustically insulating cushioning pad and a supporting member attached thereto, said pad having a head-contacting rim defining a cavity conforming in shape to that portion of the ear which projects from the head, the portion of the rim adapted to be placed adjacent the tragus of the ear having a substantially greater width than the remainder of the rim.

2. A receiving headset for audio signals comprising a pad of acoustically insulating cushioning material and a supporting member attached thereto, said pad having a head-contacting rim defining a cavity conforming in shape to that portion of the ear which projects from the head, the portion of the rim adapted to be placed adjacent the tragus of the ear having a substantially greater mass of material than the remainder of the rim.

3. A receiving headset for audio signals comprising an acoustically insulating cushioning pad and a supporting shell attached thereto, said pad having a head-contacting rim defining a cavity therein conforming in shape to that portion of the ear which projects from the head, the cross-sectional area of said cavity decreasing from a

maximum at said rim to a minimum at a point farthest from said rim.

4. A receiving headset for audio signals comprising a pad of acoustically insulating cushioning material and a supporting shell attached thereto, said pad having a head-contacting rim defining a cavity therein conforming in shape to that portion of the ear which projects from the head, the cross-sectional area of said cavity decreasing from a maximum at said rim to a minimum at a point farthest from said rim, and openings in said pad and shell in alignment with each other and the passage of the outer to the inner ear.

5. A receiving headset for audio signals comprising a pad of acoustically insulating cushioning material having a generally truncated semi-ellipsoidal exterior surface and a supporting shell of the same type of material having an interior surface conforming to and attached to the exterior surface of said pad, said pad having a head-contacting rim defining a cavity therein conforming in shape to that portion of the ear which projects from the head, the cross-sectional area of said cavity decreasing from said rim to a point farthest from said rim, the portion of the rim adapted to be placed adjacent the tragus of the ear having a substantially greater width than the remainder of the rim.

6. A receiving headset for audio signals comprising a pad of acoustically insulating cushioning material having a generally truncated semi-ellipsoidal exterior surface and a supporting shell of the same type of material having an interior surface conforming to and attached to the exterior surface of said pad, said pad having a head-contacting rim defining a cavity therein conforming in shape to that portion of the ear which projects from the head, the cross-sectional area of said cavity decreasing from a maximum at said rim to a minimum at a point farthest from said rim, the portion of the rim adapted to be placed adjacent the tragus of the ear having a substantially greater width than the remainder of the rim; openings in said pad and shell in alignment with each other and the passage of the outer to the inner ear, and an audio receiver affixed to and adjacent the opening in the shell to permit audible signals to be transmitted to the ear.

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