Dec. 27, 1949 M. C. ROSENBLATT 2,492,183

ACOUSTIC DEVICE

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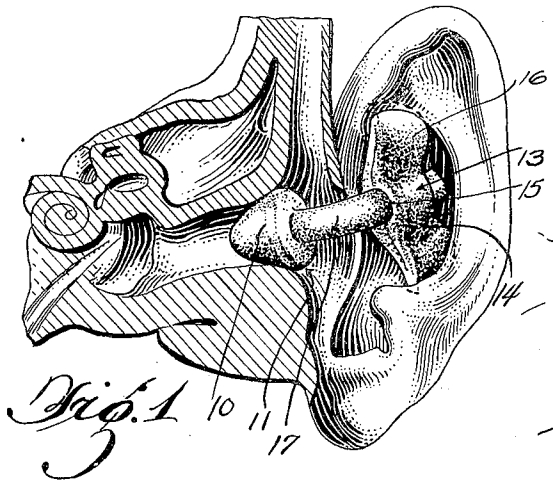


Fig. 1

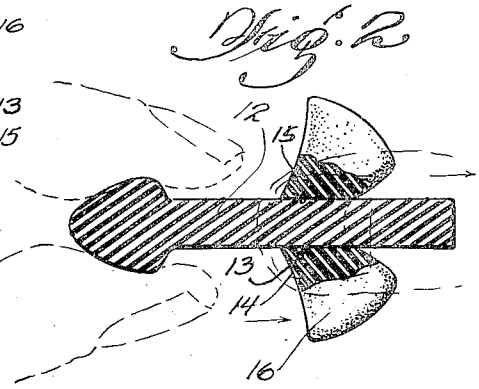


Fig. 2

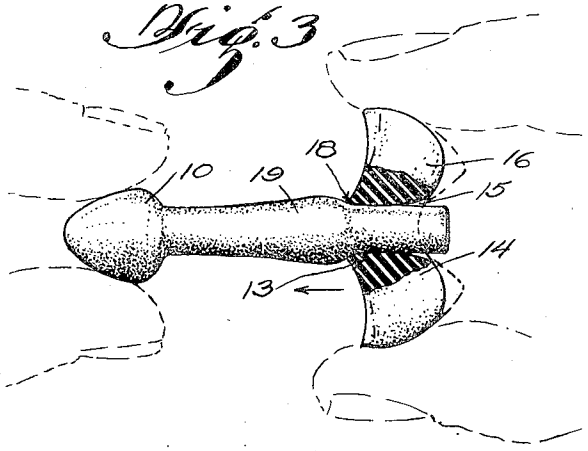


Fig. 3

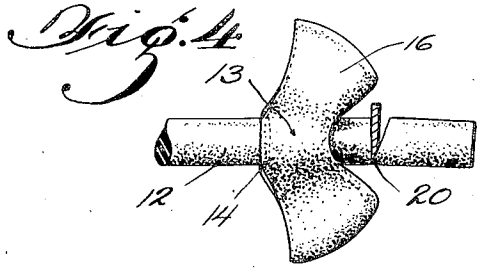


Fig. 4

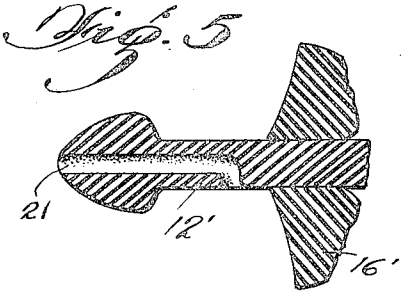


Fig. 5

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ACOUSTIC DEVICE

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6 Claims. (Cl. 128—152)

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The invention described herein, if patented, may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

The invention relates to a plug for the external orifice of the ear canal.

It is an object of the invention to provide a soft rubber plug which is adjustably self-supporting in the ear.

It is a further object of the invention to provide a novel adjusting means for adapting the device to different sized ears.

It is a further object of the invention to provide a flexible ear plug having one end engaging the entrance to the ear canal and the other end engaging the ear crescent.

It is a further object of the invention to provide an adjustable support capable of general use, and able to resist a considerable amount of compressive force.

While the ear canal is more or less opposite the ear crescent in the human ear, it enters the head at an angle of 25° or more to a line between the entrance to the canal and the anti-helix or crescent of the external ear. The flexibility of the stem of the ear plug comprising my invention effects a tight sealing of the entrance by the tip of the plug and a firm engagement of the crescent by the anchor because the stem can be bowed outwardly in an arc of 50 or 60 degrees between the canal entrance and the crescent.

The flexibility of the stem also increases its frictional resistance to the sliding movement of the anchor when compressive forces are applied at opposite ends of the device because the stem expands under such pressure. This feature has utility in any field where a light adjustable support is needed.

Further objects of the invention will appear from a consideration of the following description taken in connection with the accompanying drawing, in which:

Figure 1 is a vertical sectional view of a human ear taken longitudinally of the ear canal showing the ear plug in place;

Figure 2 is a longitudinal sectional view of the ear plug showing the proper method of adjustment by a pulling action;

Figure 3 is a plan view of the plug showing its response to compressive force;

And Figure 4 is a plan view of the plug showing the surplus material of the stem being severed after a desired adjustment has been made; and

Figure 5 is a detailed sectional view of a modification.

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As shown in the drawing, the ear plug comprises a top or closure portion 10 adapted to engage the entrance 11 to the ear canal, a cylindrical stem 12 of uniform diameter and a movable ear-engaging portion or anchor 13 slidably engaged on the stem. The central part 14 of the anchor has a round bore 15 which fits snugly on the stem 12 when it is in unstressed condition. Wings 16 extend oppositely from the central part 14 and constitute means to engage the crescent of the ear. Their relation to the central part 14 is such that when direct pressure is applied to the wings 16 the bore 15 tends to close at the end nearer the tip, thus increasing the friction between the stem and the anchor.

The entire device is made of soft rubber, either natural or synthetic, which permits it to assume the arcuate shape shown at 17 in Figure 1. This provides a light and comfortable pressure exerted at the correct angle both at the entrance to the ear canal and at the crescent or anti-helix at the anchor end. It also accomplishes the automatic locking of the anchor 13 in the position required to fit the ear of the person using the device.

As shown in Figures 2 and 3, the anchor 13 fits the stem 12 slidably and can be moved along the stem easily in a direction away from the tip 10 if the tip is held in one hand and a pulling movement is applied to the anchor 13. However, if the tip 10 is held in one hand and the other hand pushes wings 16 of the anchor toward the tip, the bore of the anchor has a tendency to close at the end 18 and grip the stem 12, and the pressure against the tip 10, as transmitted through the stem, tends to expand the stem 12 as shown at 19 in Figure 3, thereby increasing the resistance to the motion of the anchor 13, and preventing movement of the anchor on the stem. The resistance produced to compressive force is sufficient to cause a practically permanent adjustment of the anchor on the stem as far as compressive force is concerned and thus an automatic and convenient adjustment to a particular ear is provided. After the adjustment has once been made, any surplus portion of the stem 12 can be cut off as shown at 20 in Figure 4, thus providing a plug which can be carried by the individual and slipped into the ear at any desired time without inconvenience or further adjustment.

It should be noted that the tip 10 does not go into the ear canal, it merely closes it off at the entrance 11. This seal is more effective than those obtained by devices which go into the ear canal itself. Such devices set up irritations and there is danger of infection and injury since the

ear canal becomes very tender directly beyond the entrance.

The plug is useful both as protection against sound in the case of soldiers, workers in heavy industries, or light sleepers, or to prevent the entry of water into the ears. A lubricant, such as petroleum jelly, may be used on the tip or head of my device, although this is of no great importance unless it is used as a swimmer's plug.

The adjustment of the plug should be made a little longer than the distance between the entrance to the ear canal and the crescent to produce the outward bowing of the stem 12 shown at 17 and enable the tip to engage the entrance to the ear canal at an inward angle or in alignment with the entrance. The device will also engage the crescent more firmly in a slightly bowed condition, and therefore stay in the ear better.

It will be obvious that the slidable connection between the anchor and stem is adapted to use in a variety of adjustable supports where a moderate resistance to compression is required, such as would be furnished by a rubber stem of sufficient softness and flexibility to respond to the compressive force by bulging, and hence prevent sliding motion of the anchor.

One example of such use would be as a support or fitting for hearing aids, small head phones, etc. A form of my invention especially adapted for such uses is shown in Figure 5. In this embodiment 12' represents the stem, 16' the anchor, and 21 a passage extending through the tip and stem and opening through the side of the stem at a point just ahead of the anchor when in its shortest position. At this point a clip would hold such a thing as a head phone to the device, the device serving as an ear fitting.

The tip 10 of my device is somewhat larger than ear plugs as ordinarily found in the art. This over-size tip engages only the entrance to the canal, forming an effective seal because the flexible, outwardly-bowed stem holds it at the proper angle. This avoids both the liklihood of irritating the canal and the necessity of making the device in a plurality of sizes, at least three sizes being necessary in the ordinary plug.

While the effectiveness of the grip of the anchor on the stem is increased by making both members of soft rubber, a satisfactory connection can be obtained with considerable variation in the degree of hardness of one of the elements. In the ear plug the use of soft rubber throughout contributes to the low cost and simplicity of the device, providing at the same time comfort at the points of engagement with the ear, bowing of the stem to give both resilient pressure and correct angles of engagement with the tragus and antihelix and sufficient deformation under pressure to lock the anchor on the stem. Though the cylindrical stem is convenient and effective, the stem could be made in other configurations, as flat or square.

Having thus described my invention, what I claim is:

1. An ear-engaging device comprising a tip and a cylindrical stem of uniform diameter, an anchor having a bore of substantially the same diameter mounted on the stem, said stem being laterally bendable under pressure and said anchor resisting movement along the stem when compressive force is applied to the anchor and one end of the stem, the distance between the tip and the anchor being slightly greater than the distance between the points to be engaged.

2. A sound-transmitting device adapted to be worn in the ear and comprising a tip, a stem, and a slidable anchor mounted on said stem, said anchor and said stem formed of a compressible material whereby pressure on the anchor and on one end of the stem expands the stem and prevents sliding motion of the anchor toward that end, said tip and stem having a sound transmitting passage.

3. An ear engaging device comprising an elongated member of resilient and compressible material, one end of said member adapted to engage the entrance to the ear canal and the other end to engage the crescent of the ear, said device being longer than the distance between the points to be engaged, whereby the elongated member assumes an outwardly-bowed position when in place, effectively sealing the entrance to the canal and locking the device in place.

4. An ear plug comprising an integral tip and stem of resilient and compressible material, and an anchor member of similar material slidable longitudinally of the stem.

5. An ear plug comprising an integral tip and stem of resilient and compressible material, an anchor member of similar material slidable longitudinally of the stem, and wings on the anchor member shaped to fit the crescent of the ear.

6. An ear plug comprising an integral tip and stem of resilient and compressible material, and an anchor member of similar material surrounding said stem and slidably and snugly engaging the same.

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