Sept. 2, 1958 E. M. BECKER 2,850,012

EAR PLUG

Filed June 20, 1957

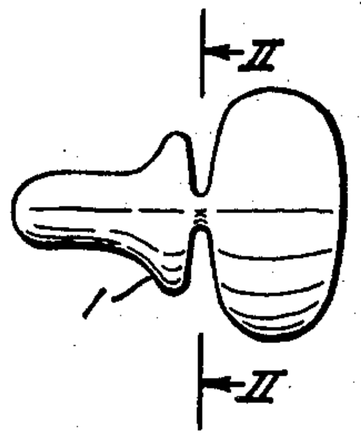

Fig. 1

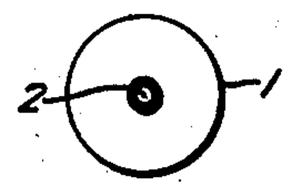

Fig. 2

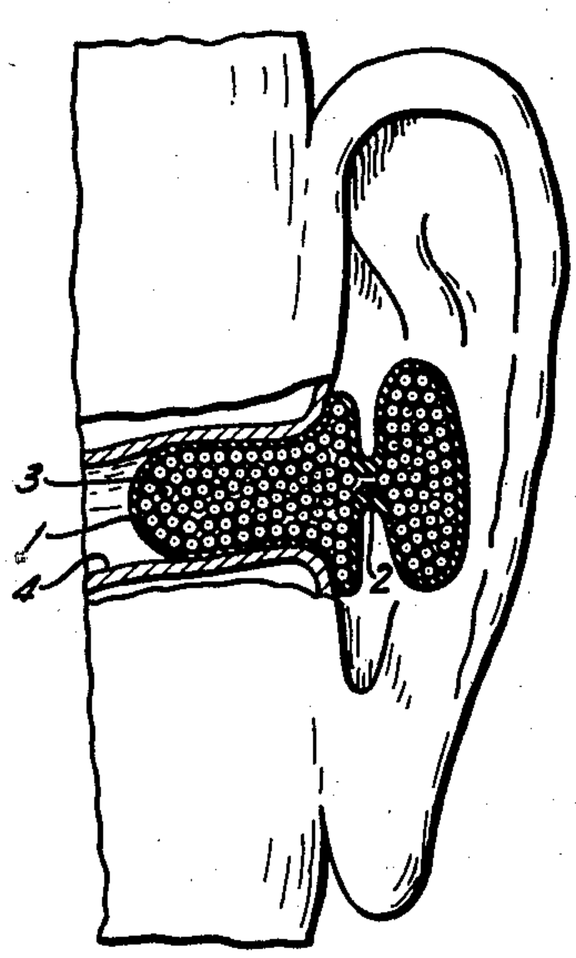

Fig. 3

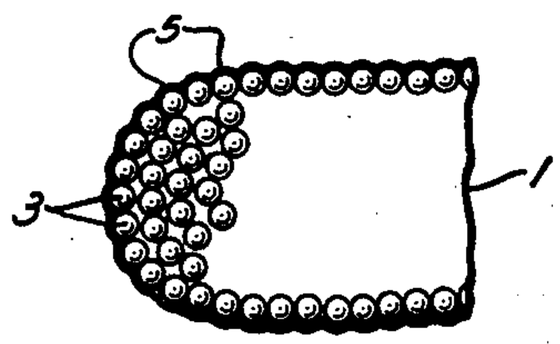

Fig. 4

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EAR PLUG

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4 Claims. (Cl. 128—152)

This invention relates to ear plugs, and more particularly to those used for protecting the ears from objectionable noise.

Many forms of ear plugs have been proposed and used. One of the best types known consists of a tubular elastic bladder filled either with a liquid or a gas. The bladder is inserted in the ear and then mechanical pressure is applied to its projecting part to cause the fluid in the bladder to expand it inside the ear and press the side wall against the wall of the ear canal. Since a fluid will distribute pressure equally to all surfaces of the bladder, the latter is caused to conform to the irregular shape of the canal. One objection to such ear plugs, however, is that it is difficult to confine the fluid in the bladder, and another disadvantage is that the fluid body itself forms a fairly good conductor of sound and thereby partly defeats the purpose of the plug.

It is among the objects of this invention to provide an ear plug, which can be expanded in the ear without the use of a fluid, which will conform to the shape of the ear canal and form a good seal, which will exert a substantially uniform pressure over the surface of the ear canal, which will not transmit sound as readily as a fluid, which is extremely simple in construction, and which can be readily inserted in and removed from the ear.

In accordance with this invention, a tubular elastic bladder is filled with small spheres. The bladder has a reduced diameter portion that forms a small opening between its opposite end portions. The inner end portion of the bladder, which is to be inserted in the ear canal, has a very thin side wall. The outer end portion is adapted to be squeezed by the fingers to force some of the spheres through the opening and into the inner end portion in order to expand and press the side wall of the bladder firmly against the wall of the ear canal. For best results, the spheres should be approximately 1/32 inch in diameter.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which—

Fig. 1 is a side view of my ear plug;

Fig. 2 is a cross section taken on the line II—II of Fig. 1;

Fig. 3 is a longitudinal section through the plug after it has been inserted in an ear; and

Fig. 4 is an enlarged fragmentary longitudinal section of the inner end portion of the plug.

Referring to Figs. 1 and 2 of the drawings, the side wall of my ear plug is formed by an elastic bladder **1** that is elongated in one direction and circular in a transverse plane, so that it has a generally tubular shape. Of course, the bladder is completely sealed. It is formed from suitable elastic material, such as rubber. Most of the wall of the bladder is extremely thin, resembling a membrane. The central portion of the bladder is reduced materially in diameter, by folding it inward, to separate the bladder into an inner end portion and an outer end portion connected by a small hole **2**. To help the bladder hold its shape and to prevent the hole from being enlarged appreciably when pressure is applied to the bladder, it is preferred to make the inwardly folded portion of the side wall around the opening thicker than the rest of the wall of the bladder, as shown in Fig. 3. The wall of the outer portion of the bladder can be thicker than the inner portion, but generally they will have about the same thickness. In accordance with this invention the bladder is filled with small hard spheres **3** that will retain their shape under any pressure to which they will be subjected in use. Normally, the opening **2** that connects the opposite ends of the bladder is smaller in diameter than the spheres, to keep them in their respective positions unless finger pressure is exerted on one end or the other of the bladder.

To use this ear plug, the inner end portion is squeezed to reduce its size and is inserted in the ear canal **4**. Then the outer portion is squeezed between the fingers to force some of the spheres in it inward through opening **2** and into the inner portion. As these spheres enter the inner portion, they cause it to expand. Enough are forced inward in this manner to expand the bladder firmly against the wall of the ear canal, as shown in Fig. 2. The spheres act like a fluid, in that they transmit pressure uniformly in all directions, so the bladder will conform to the shape of the canal. This will hold the plug securely in place and also form a seal. The bladder being filled with spherical objects instead of a fluid, it is much easier to retain the spheres in the bladder. Also, since the spheres do not form a homogeneous body like a fluid, but a heterogeneous body containing innumerable air spaces between the spheres, the bladder filling does not transmit sound as readily as a fluid would.

Another advantage of this invention is that, as shown in Fig. 4, the pressure of the spheres against the membrane-like wall of the bladder give its outer side an irregular surface, which provides a better seal than if that surface were smooth. Apparently, the irregular surface produces an irregular sound path between the plug and the skin, which helps dissipate any sound moving in that path.

For best results, the sphere should be about 1/32 inch in diameter. This is because such spheres will produce a large number of very small areas **5** of high unit pressure, but at the saime time the plug will have a low unit pressure over a relatively large area. If larger spheres are used, the ear plug is likely to be uncomfortable to wear because there will be fewer pressure points between the plug and the wall of the ear canal, and so the pressure at each point will be greater. With spheres about 1/32 inch in diameter, the plug can be worn for long periods of time without discomfort. If smaller spheres are used, the irregular surface effect is reduced considerably because the surface approaches smoothness.

In order to remove the plug from the ear, all that is necessary is to pull it out. The portion of the plug inside the ear will stretch and thereby become reduced in diameter so that it will slip out easily. Before the plug can be inserted in the ear again, the inner portion of the plug should be squeezed in order to force spheres out into the outer portion to reduce the diameter of the inner portion. Due to the two cavity construction of the ear plug with its restricting elastic orifice between the cavities, the spheres tend to stay in one or the other cavity. The only time that the spheres move through the central opening is when external pressure is applied to either one end or the other of the plug.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims,

the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. An ear plug comprising a tubular elastic bladder filled with small spheres, the bladder having a reduced diameter portion forming a small elastic opening between the opposite end portions of the bladder, the inner end portion of the bladder being adapted to be inserted in the ear canal and having a very thin side wall, and the outer end portion being adapted to be squeezed by the fingers to force some of said spheres through said opening and into said inner end portion to press the side wall of the bladder firmly against the canal wall to keep out objectionable noise.

2. An ear plug according to claim 1, in which said opening normally is smaller than the individual spheres, whereby to resist movement of the spheres therethrough.

3. An ear plug comprising a tubular elastic bladder filled with small spheres, the side wall of the bladder

near its outer end being folded inward to form at the center of the bladder a small passage between the outer and inner end portions of the bladder, said inwardly folded portion of the side wall being thicker than the side walls of said end portions, the inner end portion of the bladder being adapted to be inserted in the ear canal and having a very thin side wall, and the outer end portion being adapted to be squeezed by the fingers to force some of said spheres through said opening and into said inner end portion to press the side wall of the bladder firmly against the canal wall to keep out objectionable noise.

4. An ear plug comprising a tubular elastic bladder filled with small spheres about $\frac{1}{32}$ inch in diameter, the bladder being adapted to be partially inserted in the ear canal with said spheres holding the side wall of the bladder firmly against the canal wall to keep out objectionable noise.

No references cited.