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SOUND ATTENUATING HELMET

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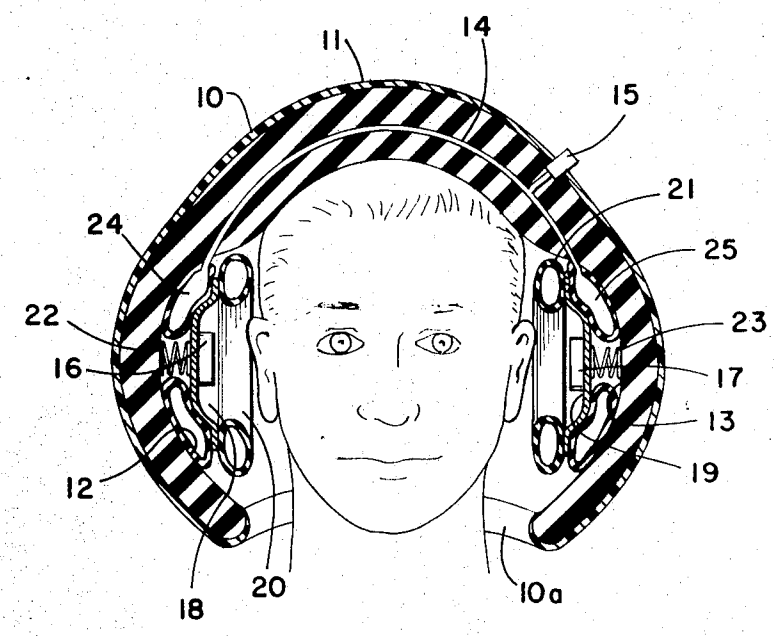

FIG. 1

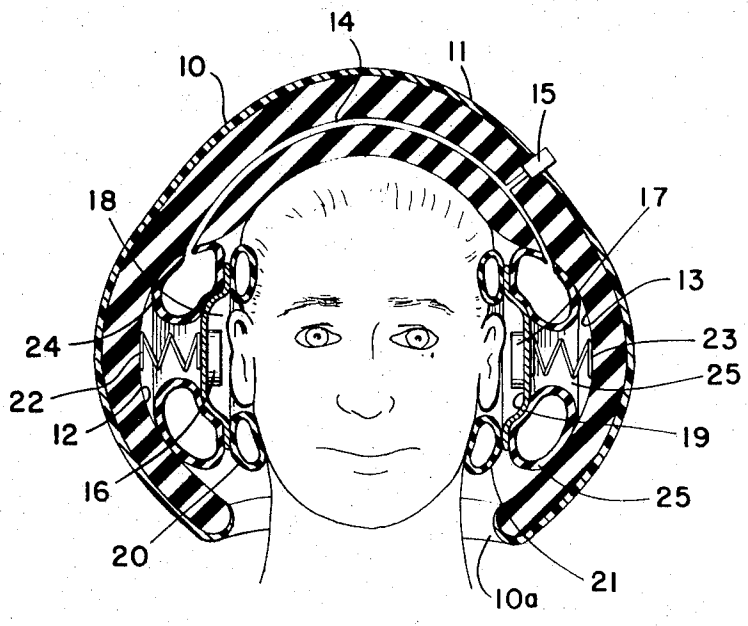

FIG. 2

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SOUND ATTENUATING HELMET

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ABSTRACT OF THE DISCLOSURE

A helmet having a rigid, outer protective shell lined with a cushioning sound attenuating layer configured to conform to the shape of wearer's head is provided with a pair of cup-shaped recesses, slightly larger than, and laterally spaced from, a wearer's ears. An electroacoustic transducer, hereinafter referred to as an acoustic speaker, carrying an annular cushioning pad is normally maintained in a retracted position within each recess by a deflated, toroidal-shaped sac to permit effortless donning and removal of the helmet. By simply inflating each toroidal-shaped sac, the acoustic speaker and annular cushion are laterally displaced to snugly fit against a wearer's head to shut out airborne noise. By being separated from the helmet by the air filled toroidal-shaped sac, an acoustic decoupling from the helmet results to eliminate helmet transferred noise.

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

Crash helmets, or similar protective helmets, having a cushioning lining long have had universal application. Donning and removing these helmets have always been an arduous task since their composition, to ensure protection from shock, necessarily calls for a minimal, structural flexure. When a dual function helmet is required, that is, a helmet providing protection from shock, as well as providing a supporting structure for acoustic speakers, another complication arises since experience has shown that speakers, or earphones, clamping down on the ears for prologned periods are extremly uncomfortable. Attenuation of airborne noise and helmetborne noise is also a problem especially where accurate recognition or close attention to sounds emanating from the acoustic speakers is required.

Such attenuation of the ambient airborne noise was provided in the present inventor's previously issued patent, No. 2,901,751, issued Sept. 1, 1959 for a "Noise Attenuator." In that invention, a pair of circumaural toroidal members was inflated to shut out ambient airborne noise. However, a basic problem remains. Sound transmitted from the hard outer shell of the helmet still reaches the wearer's ears, which sound level approaches prohibitive levels when transmitted to, for example, a sonar operator in a helicopter.

SUMMARY OF THE INVENTION

The present invention is directed to providing a helmet, including an impact-resistant outer shell, lined with a cushioning, sound attenuating layer configured to conform to the shape of a wearer's head and provided with a pair of cavities laterally displaced from a wearer's ears. Internally supported in each of the cavities, an acoustic speaker carrying a pliable, annular element sized to encircle a wearer's ear in a cushioning relationship against his head is selectively, laterally displaceable by an inflatable toroidal sac. The sac is carried between each of the speakers and the inner wall of each cavity to hold the speaker and annular member in a normally retracted position allowing unimpeded donning and removal of the helmet. Upon being selectively valved to a source of pressurized gas, each sac is inflated and laterally displaces each acoustic speaker and pliable, annular element to snugly fit about a wearer's ear to shut out airborne noice, and to further separate the speaker element from the helmet effecting an acoustic decoupling from the helmet to eliminate helmet transmitted noise.

An object of the invention is to provide a protective noise attenuating helmet permitting unrestricted ease in donning and removal.

Yet another object is to provide a helmet that, when worn over prolonged periods of time, produces minimal irritation or discomfort to a wearer.

A further object is to provide a helmet having a capability for selectively shutting out noise.

An ultimate object is to provide a helmet that blocks airborne and helmet transmitted noise from a sonar operator's ears.

These and other objects of the invention will become readily apparent from the ensuing description when taken with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a frontal, cross-sectional view of the invention with the speaker-pliable annular element combinations in a normally retracted position.

FIG. 2 is a frontal, cross-sectional view of the speaker-pliable annular element combinations in a laterally extended position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, the sectional depictions of a preferred form of the invention include a tough, outer shell **10** forming the outer protective element of a conventional crash helmet. As in all crash helmets, the shell is one of any number of lightweight materials having sufficient strength.

Within the shell, a cushioning sound attenuating lining **11** forms a layer, contiguously fitted to the internal dimensions of the helmet, and shaped to conform to a wearer's head. The only discrepancy from the contiguous fitting lies in the regions generally defined as being laterally spaced from a wearer's ears where two essentially cup-shaped cavities **12** and **13** are formed, each being lined with the sound attenuating lining. A lower opening **10***a* cooperating with a frontal opening, not shown in the cross-sectional representations, is sufficiently large to permit an unimpeded donning and removal of the helmet. The manners of forming the shell and the inner cushioning sound attenuating layer, their interconnection, and their shock and sound attenuation characteristics are well established within the state-of-the-art, there being numerous contemporary models, commercially available, constructed according to the described design.

A traverse duct **14** is provided in the sound attenuating liner and links an external source of pressurized fluid, most preferably a gas, through a fitting **15**. The fitting, permitting selective bidirectional gas flow, is configured to permit its connection to a low pressure compressed air line found in most aircraft, to a bicycle-type pump, to a hand syringe bulb-type pump, or with a length of tubing with which the helmet wearer blows air into the duct, the purpose of which will be explained below.

Within each of the cup-shaped cavities **12** and **13**, a speaker element **16** or **17** is mounted on a concave disk **18** or **19**. The speaker elements are conventional units widely employed to effect an electroacoustic transforma-

tion of signals representative of, for example, sonar signals or speech, and are, through suitable leads, not shown for the sake of simplicity, linked to appropriate driving circuitry.

In most contemporary units, the speakers are held against a wearer's ears to achieve a maximum sound transfer. The disadvantage of this mounting technique resides in the fact that considerable discomfort and pain are suffered especially when they are worn with a conventional spring-biased headset over prolonged periods.

Such pain and discomfort are largely eliminated in the instant invention by including a pair of annular-shaped, pliable elements **20** and **21**, each carried on the peripheral rim of one of the concave disks **18** or **19**, respectively. The pliable elements are shown as hollow rings, which alternately are fluid, gel, or plastic foam filled, although a sponge rubber ring is optionally employed, the primary design considerations being that they must ensure operator comfort while shutting out ambient noise.

The purpose of the pliable, annular elements is twofold. The first being to maintain the speaker element in a position only slightly removed from the ear of a monitoring operator; the second, and perhaps more important reason, being to shut out airborne noise from reaching the operator's ear which would otherwise mask information signals.

If the pliable, annular elements are maintained in an extended position against a wearer's head with the speaker elements in close proximity to the wearer's ears, as is the case with some conventional helmets, donning and removal of these helmets are difficult since the annular elements and speakers tend to block the paths traveled by a wearer's ears as he dons and removes the helmet.

To eliminate this difficulty, the helmet includes two elastic or small metallic biasing springs **22** or **23**, held in tension, which pull both the speaker element-annular element combinations away from the wearer's head in a normally retracted position within the cavities **12** or **13**, respectively.

After the helmet is put on, acoustic decoupling from airborne and helmetborne noise is effected by connecting one of the external sources of pressurized gas, enumerated above, to fitting **15**. The gas is fed through the fitting, through the traverse duct, and to a pair of normally collapsed, toroidal-shaped sacs **24** and **25**, each disposed between a separate one of the concave disks **18** or **19** and the inner surface of one of the cup-shaped cavities **12** or **13**. The toroidal-shaped sacs are formed from a material which has a low sound transfer characteristic and tends to dampen or nullify impinging acoustic energy. Rubber or thin plastic sacs have been found to be quite adequate since they withstand repeated expansion and collapse when vented by the suitable gas source.

As the pressurized gas is passed to each of the toroidal-shaped sacs, they expand and cause a converging inward lateral displacement of the speaker element-annular element element combinations to force the annular elements snugly about a wearer's ear and to bring the speaker elements in close proximity to the wearer's ear, note FIG. 2. Airborne noise is thus effectively shut out and information signals are monitored with minimal discomfort to an operator. In addition, helmetborne noise, that noise transferred directly from the helmet due to a high intensity external noise source such as that found aboard a helicopter, is also blocked since the inflated, pliable, toroidal-shaped sacs acoustically decouple the speaker elements from the helmet and thusly block impinging sound.

Venting the source of pressurized air to remove the pressure within the toroidal-shaped sacs permits the biasing springs **22** and **23** to retract the speaker element-annular element combinations into the cup-shaped cavities, see FIG. 1, for increased comfort or for removal of the helmet. This also enhances direct hearing and face-to-face communications in lower noise environments. When a period of acoustic surveillance is again required, feeding pressurized air through the fitting and traverse duct inflates the toroidal-shaped sacs ensuring ambient noise-free monitoring of the speakers.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings, and, it is therefore understood that within the scope of the disclosed inventive concept, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In a helmet including an impact resistant outer shell lined with a cushioning, sound attenuating layer configured to conform to the shape of a wearer's head and to define two cavities, each disposed on opposite internal surfaces of greater area than and laterally spaced from a wearer's ear, an improvement therein is provided comprising:

an acoustic speaker means disposed in each cavity;

a pliable annular element mounted on a peripheral rim of each said speaker means sized to encircle a wearer's ear in a cushioning relationship against his head;

an inflatable member carried between each said speaker means and an inner wall of each said cavity, the combination of said speaker means, said annular element, and said inflatable member sized to be contained in said cavity in a normally retracted position allowing unimpeded donning and removal; and

a pressurized fluid source connected to said inflatable member, so that upon venting said source, said inflatable member laterally displaces said pliable annular element to snugly fit about the wearer's ear shutting out airborne noise and to separate said speaker element from said helmet effecting an acoustic decoupling to eliminate helmet transferred noise.

2. A helmet according to claim **1** in which each said inflatable member is a toroidal-shaped sac, each concentrically disposed with respect to each said pliable annular element.

3. A helmet according to claim **2** further including:

resilient biasing means joining each said speaker means to a separate said inner wall for maintaining said normally retracted position and extending upon said venting.

4. A helmet according to claim **3** further including:

a common duct linking both toroidal-shaped sacs to said pressurized fluid source permitting simultaneous inflation.

5. A helmet according to claim **4** in which said speaker means is a disk-shaped element orientating an acoustic projector immediately adjacent and directly into a wearer's ear.

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