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SUSPENSION FOR EAR ENCLOSURE INSIDE A PROTECTIVE HELMET

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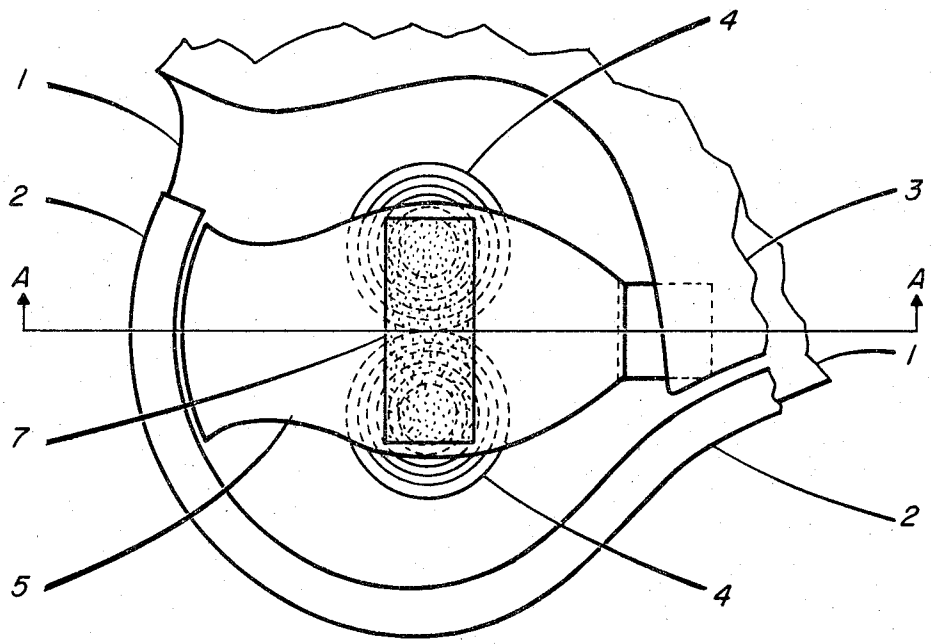

FIG. 1

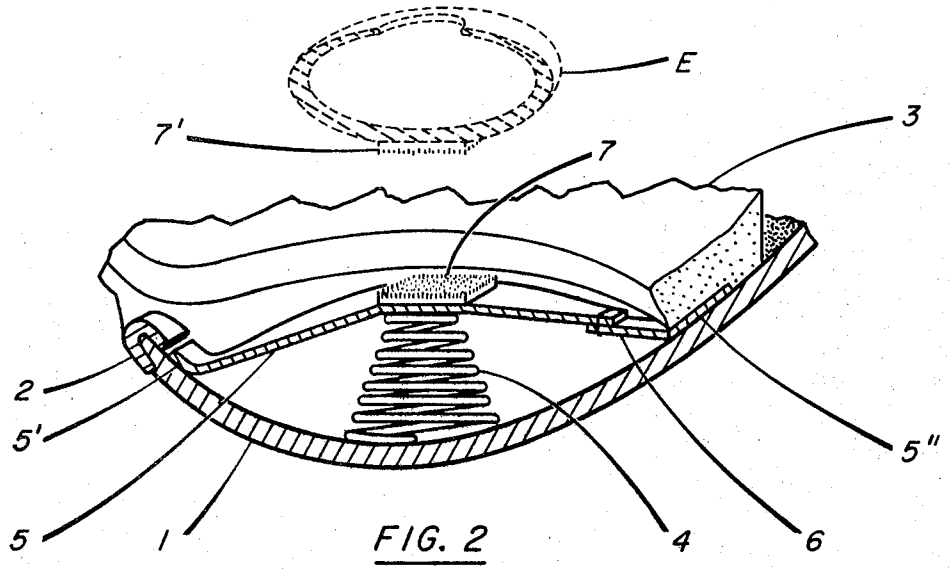

FIG. 2

INVENTOR.
CLAYTON H. ALLEN
BY Rines and Rines
ATTORNEYS

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Clayton H. Allen, Wellesley, Mass., assignor to Bolt Beranek and Newman Inc., Cambridge, Mass., a corporation of Massachusetts

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ABSTRACT OF THE DISCLOSURE

This disclosure deals with novel suspensions within protective helmets and the like for detachably-supporting ear enclosures such as ear muffs, earphones, and the like, said suspension including a strap overlying a spring and having cooperative fastening means for a detachable ear enclosure.

The present invention relates to ear enclosure suspensions for protective helmets and the like.

Protective, hard helmets are used by construction and military personnel and others to prevent injury due to impacts. In noisy environments, ear protection is also required. Such ear protection is frequently provided by an ear muff or earphone which completely encloses each ear and is sealed around the ear by means of a cushion that deforms to fit the head under the influence of a static force urging the enclosure toward the head. In a protective helmet, the static force is frequently provided by a spring suspension means acting between the hard helmet and the ear enclosure.

While such spring suspension devices are in common use, they are deficient in several respects. Generally, such spring arrangements are bulky and require a significant amount of space under the hard helmet in which to operate. This necessarily increases the size and the inertia of the protective helmet. Some suspensions include arms and hinge joints which in themselves constitute hazardous protrusions that can injure the wearer if severe impact is encountered. Hinged supporting structures are sometimes designed to straddle the ear enclosure and provide a maximum of unrestricted movement for drawing the ear enclosure away from the head. Although a hinged suspension feels highly compliant and might be expected to provide vibration isolation between the ear enclosure and the helmet, the friction in the hinge serves rigidly to connect the hinged members for all vibratory forces which do not exceed the Coulomb friction of the hinge. Since vibratory forces which are large enough to cause potentially damaging noise levels in an ear enclosure still do not exceed the Coulomb friction of the hinge joint, the hinged support structure effectively provides no isolation between the helmet and ear enclosures. Because the helmet is large, moreover, it can be driven more effectively than the ear enclosure by airborne sound; and, indeed, these sound-induced vibrations are often amplified by resonances in the hard helmet itself. It is, therefore, extremely essential to have good vibration isolation between the helmet and ear enclosures.

Some of the suspensions for ear enclosures use simple springs. These offer good vibration isolation but tend to be difficult to adjust to the proper position for best accommodation of individual wearers; and, even when properly adjusted, the spring supports in current use tend to be unstable and do not hold the ear enclosures in the correct position over the ears or do not retain good adjustment when the helmet is removed and reworn.

Other spring devices require holding fixtures that limit the effective movement of the ear enclosure or require excessive enlargement of the protective helmet. Such

spring devices, in addition, are designed to give a preassigned nominal static force on the ear enclosure when worn by a person with a standard head size, but may give less force than required for some persons with small head size, and excessively high force for others.

An object of the invention, accordingly, is to provide a new and improved support for an ear enclosure that shall not be subject to the above disadvantages and limitations. To the contrary, the structure of the invention uses a minimum of space and weight, yields a high degree of vibration isolation between the ear enclosure and the helmet, avoids potential mechanical hazards to the wearer in the event of external impact against the helmet, provides a maximum of accommodation for individual wearers by employing a long spring so as to achieve little change in static force over the normal movement encountered in service, provides ease in adjusting or readjusting the position of the enclosure to fit the wearer's ear location, enables accurate retention of the position of the ear enclosure when the helmet is removed and reworn, and eliminates or reduces potential vibrational short circuit of the suspension by accidental contact between the ear enclosure and the helmet.

A further object is to provide a novel helmet ear enclosure of more general utility, as well.

Other advantages of this suspension will be explained hereinafter and are more particularly delineated in the appended claims.

The invention will now be described in connection with the accompanying drawings, FIG. 1 of which is a top elevation of a preferred suspension assembly looking from the center of the helmet toward the right side; and FIG. 2 is a partially sectionalized view of the right side of the helmet and mounting assembly, the section being taken horizontally through the center of the suspension system, as indicated by the section line A—A in FIG. 1, and the view being directed from below the helmet at a position slightly behind the vertical centerline of the suspension.

Referring to the drawings, the hard helmet or hat is illustrated at **1**, having a peripheral rubber edge **2** and containing a crushable lining **3** as of polystyrene or similar foam plastic. In accordance with the invention, springs **4** are secured to the side walls of the helmet, preferably tapering inwardly away from the helmet walls and contacting a retaining strap **5** as of leather or nylon or similar material. The strap **5** is securely attached or bonded at the forward end to the helmet shell or wall, as by cement at **5'**, FIG. 2; and it is extensibly, elastically attached to the helmet at its other or rearward end through a stitched or other connection to an elastic band **6**, said elastic band is securely attached or bonded at the rearward end to the helmet shell or wall as by cement at **5''**. The strap **5** intermediately is provided with an attaching pad **7**, as of nylon loops and hooks, such as commercially marketed under the name "Velcro," for cooperating with a mating pad **7'** carried by the ear enclosure E (shown dotted) to enable ready adjustable attachment to and removal from the strap **5**.

The coils of the pair of spiral coil springs **4** nest within each other so that when fully compressed the spring height is equal only to the diameter of the spring wire; but the fully extended coil height being large compared with the amount of movement necessary to accommodate variations in head sizes to be served by a particular helmet size. Thus, the total variation of spring force encountered for various head sizes is maintained at a small fraction of the design value of the static force. The spring coils **4** may be provided with suitable vibration damping means, such as visco-elastic coating or the like (not shown) to prevent objectionable buildup of vibration amplitudes in the springs, and the consequent transmission of vibrational energy from the helmet to the ear enclosure at discrete

frequencies. The springs 4 are retained in proper alignment between the helmet 1 and the strap 5 which serves not only to position the inward end of the springs, but limits the extension of these spiral springs 4 to a small fraction of their uncompressed height—a value which will accommodate all head sizes to be served by a given helmet size. The strap carries a fastening means 7 for adjustably, yet securely, fastening the strap 5 to the outer surface of the hard shell of the ear enclosure E. The ear enclosure E may be provided with drawstrings (not shown) which pass on each side of the strap and through small holes in the helmet to serve in the conventional way as a means to lift the ear enclosure away from the head for the purpose of hearing external commands or other sounds when ambient noise levels are sufficiently low, or for the purpose of facilitating the donning or doffing of the helmet.

Further modifications will also occur to those skilled in this art, and all such are considered to fall within the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A suspension for an ear enclosure and the like comprising, in combination with a helmet, spring means fastened to the inner side wall of the helmet and extendnig

therefrom, a retaining strap securely attached to the helmet at one end and extensibly elastically attached to the helment at the other end and with its intermediate portion passing over and compressing said spring means, and means on the intermediate portion of the strap on the opposite face to the spring means for removably and adjustably attaching an ear enclosure to said strap.

2. A suspension as claimed in claim 1 and in which the said attaching means comprises hook and loop patch means.

3. A suspension as claimed in claim 1 and in which the spring means comprises tapered coil spring means contacting the opposite side of the strap from the attaching means.

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ALFRED R. GUEST, Primary Examiner