April 21, 1970 K. C. STEWART ET AL 3,506,981

NOISE ABSORBING EARMUFFS

Filed May 29, 1968

Fig. 1.

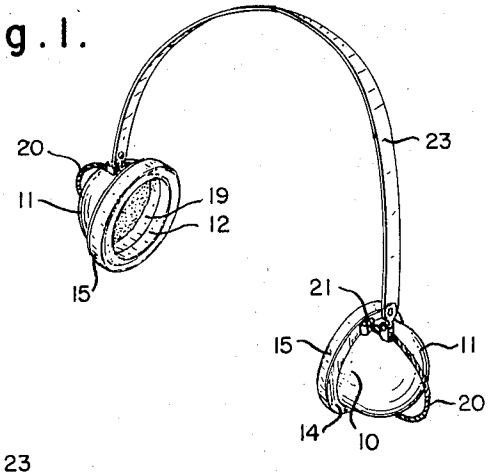


Fig. 2.

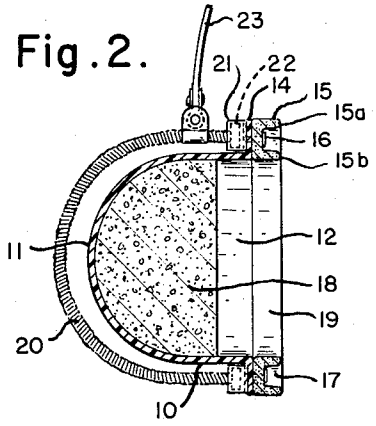


Fig. 3.

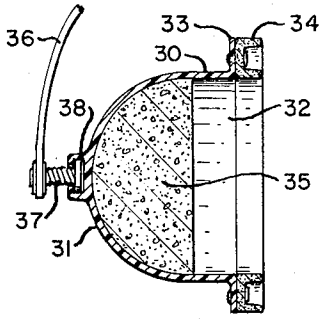


Fig. 4.

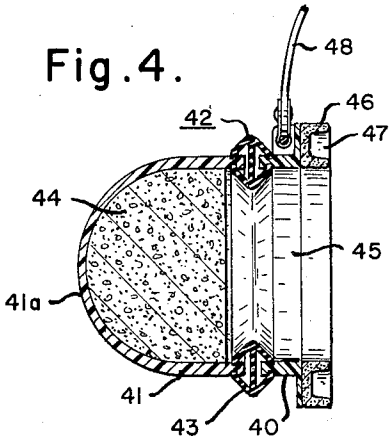
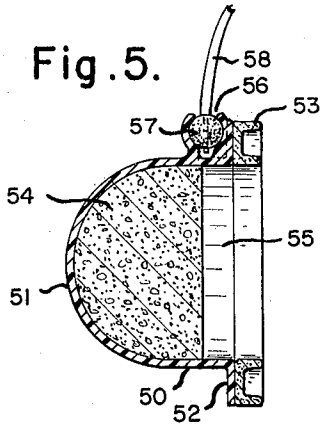


Fig. 5.



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NOISE ABSORBING EARMUFFS

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U.S. Cl. 2—209 4 Claims

ABSTRACT OF THE DISCLOSURE

A noise attenuating earmuff structure is provided comprising a pair of muffs connected together by a headband by a compliant means, said earmuffs including a cylindrical portion open at one end and closed at the other by a hemispheric member and containing an acoustical attenuating material.

This invention relates to noise absorbing earmuffs and particularly to a pair of spaced earmuffs isolated from a common headband by a connecting resilient member.

Earmuffs for noise suppression and absorption are. commonly used in various occupations where the noise level is high, e.g. at airports, particularly near jet engines and jet prop engines. A completely satisfactory earmuff has not heretofore been produced. So far as we have been able to ascertain, all of the earmuffs presently available suffer from a common defect, namely that they cannot reduce the noise level to a point where it is not annoying. We have found that this minimum level below which prior art earmuffs have been unable to go is the result of a combination of three factors which are (1) failure to isolate the portion of the earmuffs which contact the wearer's head from the headband, (2) failure of the muff to seal at its edge against the head of the wearer and (3) inadequacy of sound absorbing material in the muff.

We have discovered a noise absorbing earmuff structure which solves these problems of the prior art and makes possible the substantially complete elimination of noise passage into the ear of the wearer. We have found that one of the important factors in reducing noise level through such earmuffs is the isolation of that portion of the muff which contacts the wearer's head from the headband by means of a compliant member. We have also found that the provision of an acoustic filter between the muff and the wearer's head markedly improves the noise reduction. We have also found that noise reduction can be improved by the design and configuration of each earmuff and the filler thereon. We have found that each of the foregoing mentioned improvements taken alone will markedly increase the noise attenuation of earmuffs and that combined together they provide a noise attenuating earmuff which is vastly superior to any now known to us.

Preferably we provide a pair of muffs connected together by a headband, each of said muffs including a cylindrical body portion open at one end and closed by a hemispherical portion at the other end, an acoustical attenuating material in each said cylinder having portion at the open end adapted to receive a wearer's ear, a resilient member surrounding the open end adapted to bear on a wearer's head and compliant means separating said body portion and said headband. Preferably the cylinder body is longer than the radius of the hemispherical cap. The compliant material separating the headband and the open end of the cylinder is preferably a resilient member such as an elastomer mass or a spring. The resilient member surrounding the open end of the cylinder is preferably a channel shaped resilient member, the legs of which channel contact the wearer's face and form a cavity therebetween which provides an acoustical seal. Preferably each of the muffs is freely movable with respect to the headband so

that the band may be used over the head or behind the head as desired by the wearer.

In the foregoing general description of our invention we have set out certain objects, advantages and purposes to be attained thereby. Other objects, purposes and advantages of this invention will be apparent from a consideration of the following description and the accompanying drawings in which:

FIGURE 1 is an isometric view of a pair of earmuffs and connecting headband according to our invention;

FIGURE 2 is a section through a preferred embodiment of noise attenuating earmuff structure according to FIGURE 1 of our invention;

FIGURE 3 is a section through a second embodiment of noise attenuating earmuff structure according to our invention;

FIGURE 4 is a section through a third embodiment of noise attenuating earmuff structure according to our invention; and

FIGURE 5 is a section through a fourth embodiment of noise attenuating earmuff structure according to our invention.

Referring to the drawings and particularly to FIGURE 1 we have illustrated a pair of earmuffs having a cylindrical body portion **10** closed at one end by a hemispherical cap **11** and open at the other end **12** to fit over a wearer's ear. A radially outstanding flange **14** surrounds the open end **12** and is provided with a resilient channel member **15** cemented thereto or removably held in place by a snap ring **16** engaging flange **14**. The legs **15***a* and **15***b* of the channel member **15** engage the head of the wearer and form an annular void **17** therebetween which acts as an acoustical filter. The interior of the body portion is filled with a foamed noise attenuation mass **18** leaving only an ear receiving void **19** at the opening of the body portion. The noise attenuation mass **18** is preferably a foamed elastomer mass of low volume stiffness. A compliant member **20** in the form of a wound spring member extends over the cap **11** and is frictionally movable in a trackway **21** on flange **14** by means of friction rollers **22** on each end of said spring member. A headband **23** is connected to each of two such spring members and muffs to form a complete noise attenuating earmuff structure.

In the embodiment shown in FIGURE 3 we have illustrated a pair of earmuffs each having a cylindrical body portion **30** which is shorter in length than that of FIGURE 1 and somewhat less effective but still far superior than the prior art structures. Again one end of the body portion **30** is closed by a hemispherical cap **31** at one end and open at the other end **32** to receive the ear of a wearer. The open end **32** is provided with a radially outwardly extending flange **33** carrying a resilient channel member **34** identical with member **15** of FIGURE 1. The body portion interior is filled with a porous noise attenuation mass **35** of low volume stiffness. Each of the earmuffs is connected to a headband **36** by means of a coil spring **37** which acts as the compliant means separating the headband from the earmuff. The spring **37** is rotatable in socket **38** in each of the hemispherical caps **31** so that the headband can be rotated to various positions on the wearer's head without removing the earmuffs.

In FIGURE 4 we have illustrated a third embodiment in which a cylindrical head engaging portion **40** is connected at one end to a main body **41** and cap **41***a* by means of a compliant member **42** in the form of an elastomer ring (rubber, neoprene, butyl rubber, etc.) **43**. The interior of the body portion **41** and cap **41***a* are filled with a porous mass of low volume stiffness **44** as in FIGURES 1 and 2 leaving only a void **45** to receive the wearer's ear. A head engaging channel member **46** is attached to the open end of the head engaging portion **40**.

The channel member **46** is the same as member **15** of FIGURE 1 and operates in the same fashion to form a noise attenuating void **47**. The head engaging portions **40** are connected by a headband **48**.

In FIGURE 5 we have illustrated a fourth embodiment of our invention in which a cylindrical body portion **50** is closed at one end by a cap **51** and is provided at the other end with an outwardly extending radial flange **52** carrying a head engaging sealing member **53** substantially identical with that identified by the numeral **15** in FIGURE 1. The body portion is substantially filled with a porous mass **54** of low volume stiffness with only a void **55** at the open end to receive a wearer's ear. The body portion is provided with a generally spherical socket **56** receiving a foam sphere **57** on one end of a headband **58**. The sphere **57** acts as a compliant member to insulate the headband from the body portion.

We claim:

1. A noise attenuating earmuff structure comprising a pair of muffs, a headband connecting said muffs, each of said muffs including a cylindrical body portion open at one end, a hemispherical portion at the other end of said body closing said body, an acoustical attenuating material in each said cylinder having a portion at the open end adapted to receive a wearer's ear, a resilient member surrounding the open end adapted to bear on a wearer's head and compliant means spacing said body portion from said headband.

2. An earmuff structure as claimed in claim **1** wherein the compliant means is a spring.

3. An earmuff structure as claimed in claim **1** wherein the compliant means is a resilient member.

4. An earmuff structure as claimed in claim **1** wherein the resilient member surrounding the open end is in the form of a channel opening away from the body portion.

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