April 21, 1970 J. AILEO 3,506,980

SEAL FOR EARCUP OR THE LIKE

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Fig. 1.

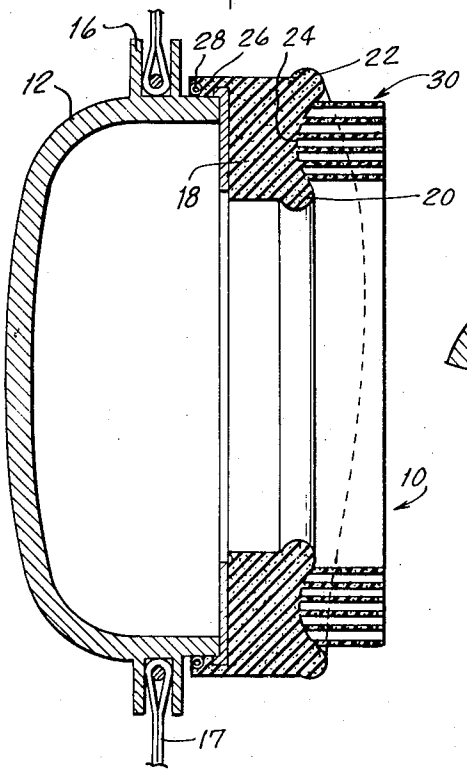


Fig. 6.

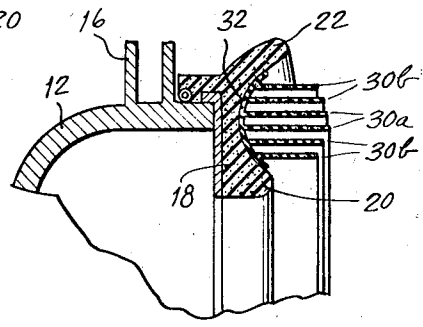
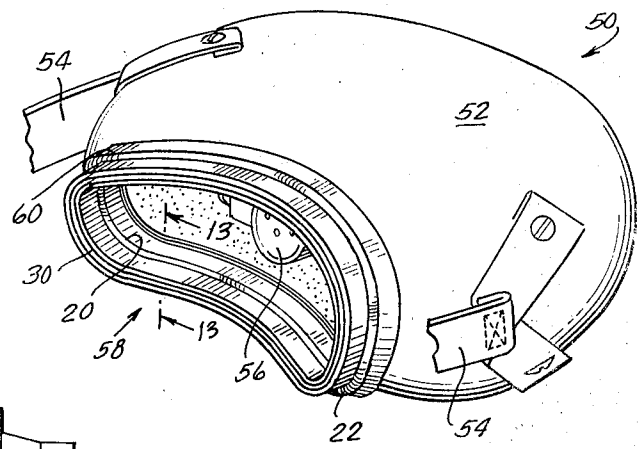


Fig. 12.



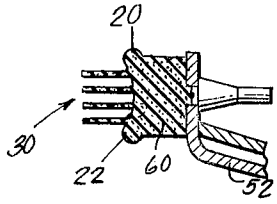


Fig. 13.

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SEAL FOR EARCUP OR THE LIKE

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Fig. 2.

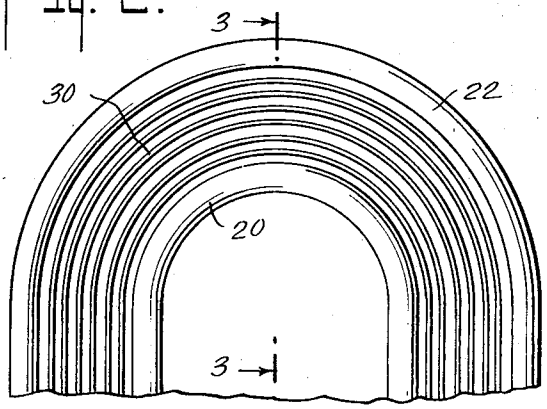


Fig. 3.

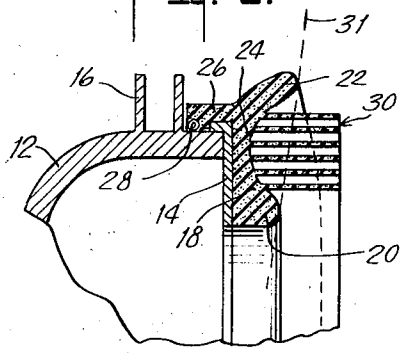


Fig. 8.

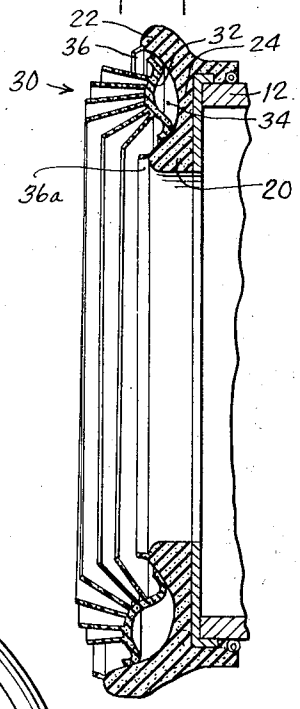


Fig. 7.

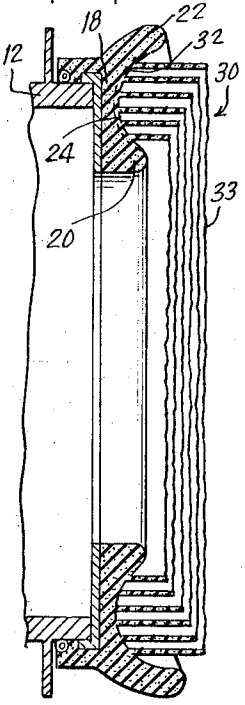
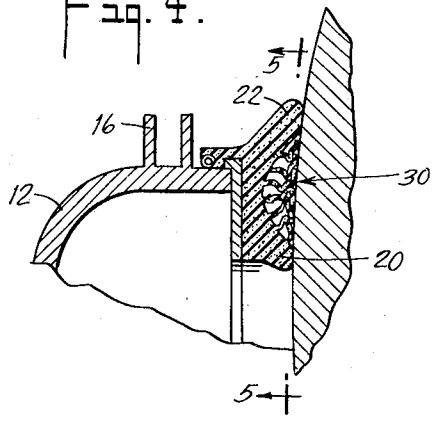


Fig. 4.



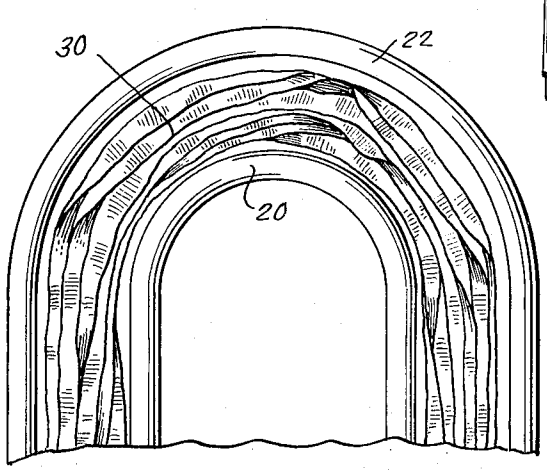


Fig. 5.

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SEAL FOR EARCUP OR THE LIKE

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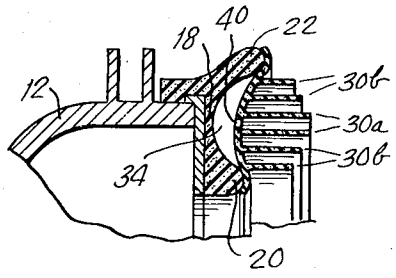


Fig. 9.

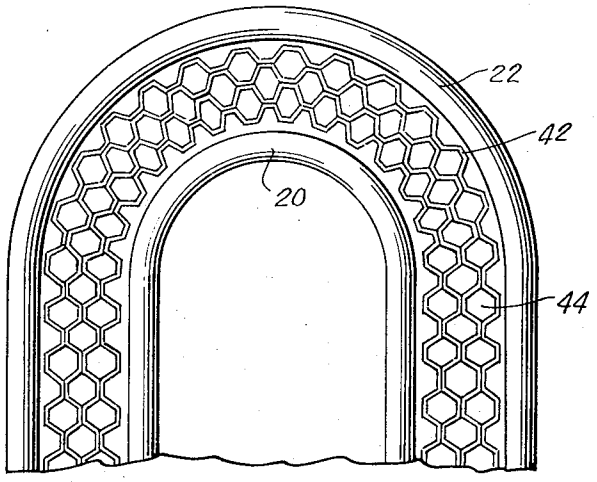


Fig. 10.

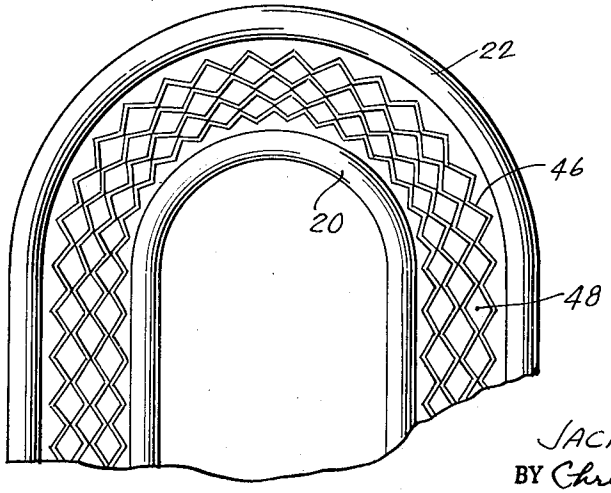


Fig. 11.

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United States Patent Office 3,506,980
Patented Apr. 21, 1970

3,506,980

SEAL FOR EARCUP OR THE LIKE

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Continuation-in-part of application Ser. No. 730,264, May 20, 1968. This application Dec. 26, 1968, Ser. No. 786,978

Int. Cl. A42b 1/06

U.S. Cl. 2—209 16 Claims

ABSTRACT OF THE DISCLOSURE

A resilient annular head-engaging seal for attachment to the rim of an earcup or like cup-shaped structure adapted to be pressed against a portion of the human head to enclose such head portion, the seal having at least one annular flange projecting toward and engageable with the head surface upon pressure of the cup against the head, and at least one thin flexible annular fin disposed inwardly of but extending generally parallel to the flange and projecting toward the head surface for engagement therewith. The seal may have inner and outer head-engaging annular flanges defining an annular channel between them, and a plurality of thin flexible annular fins disposed in this channel and projecting therefrom toward the head, the height of the fins being sufficient so that their edges engage and fold against the head surface when the cup is pressed against the head.

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of the copending application of applicant herein, Ser. No. 730,264, filed May 20, 1968, for Sound Attenuating Earcups.

BACKGROUND OF THE INVENTION

This invention relates to seals for protective or like structures adapted to enclose a limited portion of the human face or head, and more particularly to seals adapted to be carried on the rim of a head portion enclosing structure for engagement with the wearer's head surface to provide sealing contact between the enclosing structure and the head. In an important specific aspect, the invention is directed to a sound-attenuating seal for an earcup or like structure for shielding a head or face portion, such as the ear, from ambient noise.

Sound attenuating earcup devices are commonly worn by personnel working in environments where protection of the ears from ambient noise is necessary. In many such environments a protective helmet is also highly desirable. Consequently, it is desirable for the earcups to be adaptable for wear either with a safety helmet or with some other suitable supporting structure. Whether the supporting structure is a helmet or not, it is usually provided with some means for pressing the earcup against the wearer's head. A resilient sealing pad is mounted on the rim of the earcup, so as to engage firmly and resiliently the human head in the area about the ear. The pressing means and the resilient pad are intended to cooperate in closing all leakage paths by which external sound waves might reach the wearer's ear.

Certain persons have duties to perform in environments subject to high intensity sounds, e.g., in the vicinity of jet engines. As the engine power outputs become greater, the sound intensities encountered increase, creating a demand for more effective sound attenuating devices.

The attempts to meet this demand have in the past taken one or both of two directions. One direction has

been to increase the force of the pressing means to close more completely the sound leakage paths. The other direction has been to increase the mass, volume, or flexibility of the resilient pad on the rim of the earcup. Increasing the force of the pressing means necessarily detracts from the comfort of the wearer, and thereby tempts him to remove the earcups under conditions which may be dangerous to his hearing. Increasing the mass or volume of the pad also detracts from the wearer's comfort.

Resilient annular face or head-engaging seals may also be employed with other structures for enclosing a portion of the face or head. As one example, to enable clear voice communication under conditions of high ambient noise, it is sometimes desirable to enclose a portable microphone in a sound-attenuating housing which is pressed against and surrounds the mouth area of the user. A resilient face-engaging pad may be mounted on the rim of such a housing to serve a purpose similar to that of the above-mentioned earcup seal, namely to provide sound-attenuating sealing contact between the housing and the user's head. In addition, resilient seals may be employed with masks or goggles to seal the wearer's eyes, nose and/or mouth from exposure to harmful gases or vapors. As in the case of earcup seals, it is desirable in each of the foregoing instances to achieve superior sealing efficacy with minimum discomfort to the user or wearer.

In the above-identified copending application there is described a sound-attenunating seal for an earcup, comprising a resilient pad including an elliptically annular base having one side adapted for attachment to the rim of an earcup shell, and a flange on the base adapted to engage the wearer's head, the flange projecting from the base in a direction away from the aforementioned one side and radially outward with respect to the axis of the shell, so that the flange is deflected from its unstressed position when in engagement with the wearers' head, this deflection being effective to stress a position of the pad in tension, the tension-stressed position being effective to hold the flange firmly but lightly against the wearer's head. Preferably, the pad has a second flange spaced radially inwardly from the first-mentioned flange with respect to the axis of the shell; the second flange projects from the base in a direction away from the aforementioned one side and radially inward with respect to the shell axis, the flanges defining between them a channel which is the portion of the pad that is stressed in tension as mentioned above. It is also preferred that the channel and flanges have smooth, rounded contours and that the first (outer) flange be shaped to conform to the head of a wearer. The described structure is found to provide a comfortable yet highly effective sound-attenuating seal when mounted on an earcup that is pressed relatively lightly against the wearer's head.

SUMMARY OF THE INVENTION

The present invention broadly contemplates the provision, in a resilient annular seal of the type described in the above-identified copending application, of at least one thin flexible annular fin, disposed radially inwardly of the first flange with respect to the geometric center of the seal but generally parallel to that flange, and projecting from the seal away from the aforementioned one side of the base for a distance sufficient so that it engages the wearer's head when the first flange engages the head. It is to be understood that the geometric center of the seal is a point located at the geometric center of the annulus defined by the seal, such point lying approximately on the axis of the earcup shell in embodiments of the invention designed for use with an earcup. Also, it is to

be understood that by the term "thin flexible fin" as used herein is meant an upright bladelike member having an extent in the direction toward the wearer's head which is large in relation to the thickness of the fin, and resiliently bendable along its free edge in response to light pressure, but sufficiently stiff to substantially retain its upright position in the absence of such pressure.

In preferred embodiments, the seal of the invention includes a plurality of such fins, disposed in more or less closely spaced relation to each other between the outer and inner (i.e. first and second) flanges of the seal. When the seal is pressed against the head, the edges of the fins fold or crumple against the head surface, so as to provide a tortuous, sound-attenuating path for sound waves which may pass the flanges; each fin constitutes a sound-attenuating barrier and, as thus folded or crumpled, cooperates with the base and flanges of the seal, the head surface, and other fins to define between the shell and head plural small air spaces.

In this way, provision of thin fins in accordance with the present invention affords aspecially advantageous sealing action, as for attenuation of sound, yet with comfort to the wearer and without adding excessive mass or volume to the seal.

The fins may be formed integrally with (or bonded to) the seal base and flanges, or may be formed integrally with (or bonded to) a separate flexible base plate of annular configuration conforming to the annular shape of the seal. If a base plate is used, its rear surface may be bonded to the channel portion of the seal throughout its extent, or the base plate may be in effect suspended across the channel (to create an annular air gap between plate and channel that further aids in sound attenuation), being bonded along its edges to the first and second flanges of the seal. For assured contact with the wearer's head, the fins project above the slope of a line drawn between the first and second flanges; they may all project to the same height above such slope, or the central ones of an array of parallel fins may project to a greater height than those fins of the array which are closest to the two flanges. Also, the fins may be either parallel to each other or arranged so as to have spaced lateral contact with each other to form a hexagonal or like pattern. In a further modification, thin fins may extend along the crests of one or both flanges to afford assured sealing at points at which the flanges may encounter localized depressions in the wearer's head.

While the invention has been described as embodied in structures adapted for use with an earcup, it may also be embodied in seals for use with other cup-shaped or like devices for surrounding and enclosing portions of the human head, such as microphone housings, masks, and goggles, to seal the enclosed head or face portion against ambient sounds and/or noxious fumes, gases or vapors. In this regard it may be explained that the term "annular seal" as herein employed refers to a closed-ring seal whether of annular, elliptical, or other (e.g. irregular) shape.

In addition, the invention contemplates the provision of structures for enclosing a portion of a human head, including a rigid cup-shaped shell having an opening with an annular rim and a seal of the type described above mounted on the rim.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational sectional view of a sound-attenuating earcup structure incorporating a seal embodying the present invention in a particular form;

FIG. 2 is a fragmentary elevational view of the seal of FIG. 1, looking from the seal side of the earcup;

FIG. 3 is a fragmentary sectional elevational view taken on line 3—3 of FIG. 2;

FIG. 4 is a view similar to FIG. 3, but showing the seal engaging the head of a wearer;

FIG. 5 is a view taken on line 5—5 of FIG. 4;

FIG. 6 is a fragmentary sectional view of a modified form of seal embodying the invention, taken along the line 3—3 of FIG. 2;

FIG. 7 is a sectional view of another modified form of seal embodying the invention;

FIG. 8 is a sectional view of a further modified form of seal embodying the invention;

FIG. 9 is a fragmentary sectional view of yet another modified form of seal embodying the invention;

FIG. 10 is a fragmentary elevational view of a still further modified form of seal embodying the invention;

FIG. 11 is a fragmentary elevational view of another modified form of seal embodying the invention;

FIG. 12 is a perspective view of a sound-attenuating microphone housing having a seal embodying the invention; and

FIG. 13 is a fragmentary sectional view taken on line 13—13 of FIG. 12.

DETAILED DESCRIPTION

Referring first to FIGS. 1 through 5, the invention in the form there shown is illustrated as embodied in a seal **10** for a sound-attenuating earcup. This earcup may be supported by means disclosed in my copending application, Ser. No. 686,500, filed Nov. 29, 1967, and is intended to be biased lightly against the head of the wearer. For example, the biasing means may be that disclosed in said copending application. It will be understood, of course that this is simply one convenient way of biasing the earcup and is not to be taken as a limitation on the present invention.

The earcup comprises a rigid cup-shaped shell **12**, constructed of plastic or other suitable material. The open end of the shell is provided with an inwardly extending flange **14**, which may be either an integral part of the shell or a separate element suitably attached to the rim of the shell, as, for example, by bonding. This flange serves to provide a broader base than the rim of the shell for supporting the seal **10**. An outwardly extending pair of spaced peripheral flanges **16** on the earcup shell **12** define a channel for receiving a shield **17** on which the shell is supported.

The seal **10** is a resilient pad, and is elliptically annular in shape like the rim of the earcup shell **12**, so as to encircle the ear of the wearer. It is fabricated of a softly resilient, preferably moldable material, such as a sponge plastic. While many of the sponge rubbers are suitable for the present invention, it is presently preferred to use a resilient sponge silicone. The term "sponge plastic" as used in this specification is intended to be a generic term inclusive of sponge rubbers and sponge silicones, as well as other sponge plastic materials. The seal may be molded in accordance with known procedures for molding such materials.

As seen in cross-section, the seal **10** comprises a base **18** adapted for attachment, such as by bonding, to the flange **14** of the shell **12**, and divergent inner and outer head-engaging flanges **20** and **22**. Each of the flanges **20** and **22** terminates in a smoothly curved surface for comfortable engagement with the head of the wearer. The flanges **20** and **22** define a broad, smoothly curved channel **24** between them, and respectively extend beyond the inner and outer peripheral walls of the base **18**, so that when the flanges are pushed into engagement with the wearer's head, as shown in FIG. 4, the material at the bottom of the channel is stretched and thereby stressed in tension. This tension tends to pull the flanges into a more firm engagement with the head and thus greatly improves the effectiveness of the seal against external sounds without increasing the wearer's discomfort. A total biasing force acting against the earcup on the order of 6 to 8 ounces is sufficient to achieve this sealing effect, and as the force is spread around the entire periphery of both flanges **20** and **22**, the pressure felt by the wearer is extremely light.

The seal **10** is provided with a flap **26** which overlies the outer edge of the flange **14** and the outer rim of the shell **12** so as to hold the seal in place on the shell. Within the flap **26**, preferably at its innermost cup-engaging surface, there is molded a coil spring **28**, which has an unstressed length smaller than the periphery of the earcup and hence is effective to hold the seal firmly in position on the shell. This spring **28** may extend continuously around the periphery of the seal **10** or an embedded wire may be employed in place of one or more portions of the spring, with a spring connecting the ends of the wire.

In order to conform to the head of the wearer, the head-engaging surface of the seal may be contoured. This is accomplished by molding the outer flange **22** to follow the average surface of a human head along a path encircling the ear. The inner flange **20** is preferably shorter than the outer flange **22** (i.e. in elevation above the flange **14**) and its tip may lie in a single plane; the inner flange may even be omitted in some constructions.

The features of the earcup seal thus far described are shown and claimed in applicant's aforementioned copending application Ser. No. 730,264, and afford an earcup seal which is not only more comfortable to the wearer of the earcup than previous pad structures but is also more effective in attenuating external sounds.

In accordance with the present invention, the seal structure of FIGS. 1–5 further includes a plurality of thin, resiliently flexible annular fiins **30** which project from the channel **24** between the inner and outer flanges **20** and **22**, and extend generally perpendicular to the wearer's head. These thin fins are higher than the flanges **20** and **22**, i.e. in elevation above flange **14**; hence they are first to engage the wearer's head (before flanges **20** and **22** engage the head) when the device is used. As shown in FIGS. 4 and 5, the thin fins are easily bendable so that they fold and accommodate themselves to the head contours when the earcup is in place on the wearer's head. Each thin fin acts as a sound-attenuating barrier and in conjunction with the flanges **20** and **22** serves to further reduce the transmission of external sound or vapor to the vital openings in the head. While a single thin fin **30** presents some advantages as a barrier, it is preferable to use a plurality of thin fins, as shown.

More particularly, in the embodiment of FIGS. 1–5, plurality of elliptically annular fins **30** (e.g. six fins) are shown interposed between the inner and outer flanges **20** and **22** and extending in spaced substantially parallel (i.e. concentric) relation to each other and to these flanges. The fins in the seal of FIGS. 1–5 are fabricated of the same material as the seal base and flanges (e.g. a silicone), for example by molding, and are formed integrally with or bonded directly to the base **18**, projecting upwardly from the surface of the channel **24**. When the earcup is in use, pressed against the wearer's head with the seal engaging the head, the free edges of the fins **30** fold over against the surface of the head in a more or less overlapping manner substantially throughout the annular extent of the seal so as to divide the air space defined between the head and the seal flanges and channel into plural small irregular air spaces.

While the fins **30** are shown in FIGS. 1–5 as projecting very substantially above the flanges **20** and **22** (i.e. in elevation above the earcup flange **14**) in one specific example of an effective seal embodying the invention, the fins project for a distance of approximately one-eighth inch above a line **31** extending radially (with respect to the axis of shell **12**) from the crest of the inner flange **20** to the crest of the outer flange **22**. Alternatively, as shown in FIG. 6, those fins **30*a*** which are centrally disposed with respect to the seal flanges **20** and **22** may be higher than the fins **30*b*** respectively adjacent to the two seal flanges, being arranged (for example) so that the free edges of the array of fins, as seen in the cross-sectional view of FIG. 6, lie along a curve that is convex in the direction facing the wearer. In either case, the fins should project above the aforementioned line **31** defined by the crests of the two seal flanges, for assured sealing contact with the wearer's head (i.e. so that the free edge of each fin is in substantially continuous contact with the head throughout the full annular extent of the seal when the seal is in place); and it is preferred that the fins respectively closest to the inner and outer seal flanges **20** and **22** be spaced sufficiently from, and be sufficiently low in relation to, the respectively adjacent flanges so that they do not tend to fold over the crests of the flanges when the cup is pressed against the wearer's head, as such folding might create sound-transmission passages or spaces between the flanges and the wearer's head.

FIGS. 7, 8 and 9 illustrate further modified embodiments of the invention, again arranged for use with an earcup shell **12**, wherein the plural parallel annular fins **30** are connected to a flexible and relatively thin base sheet **32**, which is somewhat thicker than the fins and may (like the fins themselves) be fabricated of the same material as the seal base and flanges, e.g. a silicone. The base sheet **32** in these embodiments is elliptically annular in shape, conforming generally to the configuration of the seal base **18**, and the fins **30** (formed integrally with or bonded to the base sheet) project toward the wearer's head from the front major surface of the base sheet, in generally perpendicular relation to that surface.

In the embodiment of FIG. 7, the entire back surface of the base sheet **32** is continuously bonded to the surface of the channel **24** of the seal so that the fins **30**, as before, in effect project from the seal base **18** toward the wearer's head. It may be noted that in FIG. 7 the fins are shown as progressively increasing in height in a direction outward from the axis of the shell **12**. Also, in FIG. 7, the free edges **33** of the fins are shown as being uneven rather than smooth. The uneven edges of these fins tend to cause the fins to lie desirably flat against the wearer's head rather than forming wrinkles.

In the embodiment of FIG. 8, the base sheet **32** is shown as bonded only along its opposite side edges to the respective seal flanges **20** and **22**, at localities partway up the side walls of these flanges within the channel **24** but below the crests of the flanges, so that the crests of the flanges project above the base sheet. The central portion of the base sheet is thus free, and cooperates with the channel **24** to define (i.e. between the channel and base sheet) a closed air pocket **34**, which aids in sound attenuation; one or more small openings (not shown in FIG. 8) may be made in the base sheet to vent the pocket **34** for purposes of pressure equalization, especially if the base sheet is relatively thick and/or stiff. Preferably, the width of the base sheet between its attached edges (i.e. the width of the free portion of the base sheet) is somewhat greater than the transverse distance across the channel **24** between the localities of attachment of the channel surface to these edges; and preferably, also, the width of this free portion of the base sheet is such that the sheet will be somewhat stressed in tension when the earcup is pressed against the wearer's head as an aid in holding the fins firmly against the head.

In this or other embodiments of the invention, such as those already described, a further elliptically annular thin flexible fin **36** may be formed on or bonded to the crest of the outer seal flange **22** (as shown in FIG. 8), extending entirely around the flange crest and projecting therefrom toward the wearer's head. This fin **36** aids in forming a secure seal between the flange and the head especially at regions of localized bony depressions of the head to which the flange may not fully conform even when pressed against the head. A similar thin flexible annular fin **36*a*** (also shown in FIG. 8) may be formed on or bonded to the crest of the inner seal flange **20**, for the same purpose of aiding in providing a complete seal between the inner flange and the head.

A further arrangement of the base sheet **32** is shown in FIG. 9. This arrangement is generally similar to that of FIG. 8, except that in the seal of FIG. 9 the side edges of the base sheet are respectively bonded to the crests of the seal flanges **20** and **22**, a closed air pocket **34** again being formed between the free central portion of the base sheet and the channel **24**. Pressure equalization apertures **40** for this air pocket may be provided in the base sheet.

The fins of the invention may be locally bent, waved or partially folded transversely of their length and a plurality of fins so shaped may be disposed to cooperate to define a honeycomb or grid pattern, with portions or fold edges of adjacent fins touching or bonded together. Two examples of such arrangement are shown in FIGS. 10 and 11. FIG. 10 illustrates a seal having a plurality of thin flexible annular fins **42** generally similar to the fins **30** of the embodiments of the invention described above, and extending in generally parallel relation to the inner and outer seal flanges **20** and **22**, but regularly bent transversely of their length so as to cooperate to form a honeycomb pattern defining hexagonal air spaces **44** between the fins. In FIG. 11, the fins **46** are so bent as to cooperate to form a grid pattern defining diamond-shaped air spaces **48** between them.

Although the seal of the invention has been described as arranged for use with an earcup, it may also be employed with other types of structures adapted to enclose a portion of the head or face, for sound attenuation or other sealing purposes. For example, in FIG. 12 there is shown a microphone housing **50** comprising a cup-shaped rigid sound-attenuating shell **52** having straps **54** adapted for connection to a supporting structure (e.g. a helmet) on a wearer's head to position the housing in front of the wearer's mouth. The shell **52** contains a microphone **56**, and has an opening **58** defined by an annular rim shaped to surround the wearer's mouth, the shell serving to enclose the mouth area and thus to shield the microphone against ambient noise. Secured to the rim of opening **58** is a resilient annular seal **60** embodying the present invention and corresponding generally to the seal **10** of FIGS. 1–5 but shaped to conform to the microphone housing rim rather than to an earcup rim, as shown in FIG. 13. Like the seal **10**, the seal **60** includes a plurality of thin flexible annular fins **30** extending between and generally parallel to inner and outer seal flanges **20** and **22** for engagement with the wearer's face, to provide a sound-attenuating seal, when the housing **50** is pressed lightly against the face as by means of the straps **54**.

I claim:

1. A softly resilient seal adapted for attachment to the rim of a structure for enclosing a portion of the human head, and for engagement with the head of a wearer along an area surrounding the head portion to be enclosed, comprising:

(a) a resilient annular base having one side adapted for attachment to said structure rim; and

(b) a first resilient annular flange projecting from said base in a direction away from said one side and radially outward with respect to the geometric center of the seal, so that the flange is deflected from its unstressed position when in engagement with the wearer's head thus stressing a portion of the seal so that said portion is effective to hold the flange firmly but lightly against the wearer's head;

wherein the improvement comprises:

(c) and a second resilient annular flange spaced radially inwardly from the first flange with respect to the geometric center of the seal, said second flange projecting from the base in a direction away from said one side of said base and radially inward with respect to the geometric center of the seal, said flanges defining between them a channel which is the portion of said seal that is stressed when said seal is held against the head of the wearer, and

(d) at least one thin flexible annular fin projecting from said seal away from said one side of said base and disposed between said flanges in substantially parallel relation to said flanges.

2. A seal as defined in claim **1**, in which said fin projects beyond said one flange.

3. A seal as defined in claim **1**, including a plurality of parallel spaced thin fins.

4. A seal as defined in claim **1**, including at least one thin flexible annular fin projecting from the crest of said annular flange in a direction away from said one side of said base.

5. A seal as defined in claim **1**, including a plurality of spaced thin flexible annular fins projecting from said base away from said one side, disposed between said flanges and in substantially parallel relation thereto.

6. A seal as defined in claim **5**, wherein the outer edges of said fins project above a line extending radially with respect to the geometric center of the seal across the crests of said flanges.

7. A seal as defined in claim **6**, wherein at least a central one of said plurality of fins projects above the fins which are respectively adjacent to said flanges.

8. A seal as defined in claim **5**, including a flexible annular base plate, and wherein said plurality of fins are secured to the project from one surface of said base plate, said base plate being secured at least along its outer edges to said seal base.

9. A seal as defined in claim **8**, wherein the surface of the base plate opposite to said one base plate surface is secured throughout its extent to the surface of said channel.

10. A seal as defined in claim **8**, wherein said base plate is secured along its opposite side edges to said first-mentioned and second flanges respectively, the central portion of said base plate being spaced from said channel so as to define an enclosed air space between said base plate and said channel.

11. A seal as defined in claim **5**, wherein said fins are secured to and project from the surface of said channel.

12. A seal as defined in claim **5**, wherein said fins have free edges of irregular profile.

13. A seal as defined in claim **5**, wherein each of said fins is repeatedly bent transversely of its long dimension, the bent fins cooperating to form a grid pattern.

14. Structure for enclosing a portion of the human head, comprising:

(a) a rigid cup-shaped shell dimensioned to enclose a portion of the human head and having an opening with an annular rim dimensioned to surround the enclosed head portion; and

(b) a softly resilient seal adapted for attachment to said shell rim and for engagement with the head of a wearer along an area surrounding the head portion to be enclosed, said seal comprising:

(i) an annular base having one side adapted for attachment to said shell rim; and

(ii) a pair of annular flanges on said base adapted to engage the wearer's head, said flanges projecting from the base in diverging directions away from said one side, so as to define an annular channel between them, and so that said flanges are deflected from their respective unstressed positions when in engagement with the wearer's head, such deflection being effective to stress the channel of the seal in tension, said tension-stressed channel being effective to hold the flanges firmly but lightly against the wearer's head;

wherein the improvement comprises:

(iii) a plurality of thin flexible annular fins projecting from said base in a direction away from said one side and disposed between said flanges

in spaced relation substantially parallel to said flanges, said fins having free edges projecting beyond said flanges for engaging the wearer's head.

15. Structure as defined in claim **14**, wherein said shell is an earcup adapted to enclose the wearer's ear and wherein said rim is of elliptically annular configuration.

16. Structure as defined in claim **14**, wherein said shell is a microphone housing adapted to enclose the mouth area of the wearer and to contain a microphone.

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