US 20240000244A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2024/0000244 A1**

Nelson et al. (43) **Pub. Date: Jan. 4, 2024**

(54) **ACOUSTICALLY TRANSPARENT PILLOW**

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(21) Appl. No.: **18/296,324**

(22) Filed: **Apr. 5, 2023**

Related U.S. Application Data

(60) Provisional application No. 63/357,830, filed on Jul. 1, 2022.

Publication Classification

(51) **Int. Cl.**

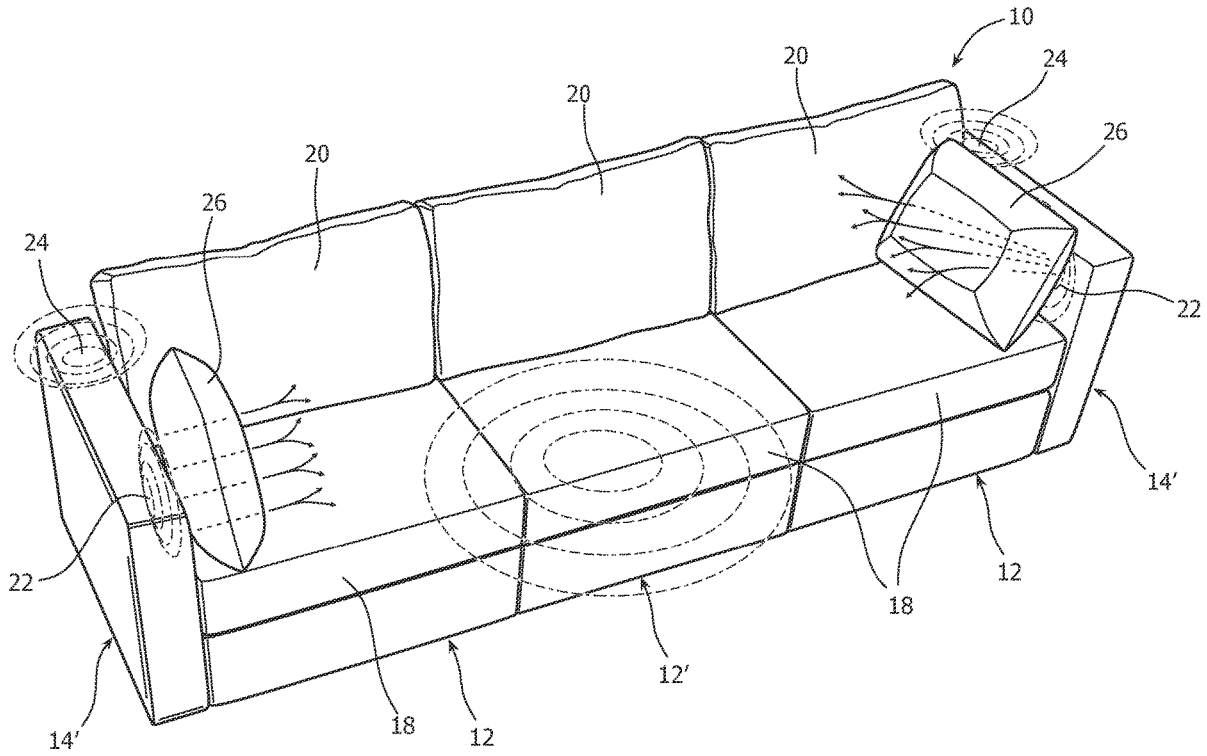
A47G 9/10	(2006.01)
A47C 7/72	(2006.01)

(52) **U.S. Cl.**

CPC ***A47G 9/10*** (2013.01); ***A47C 7/727*** (2018.08); *A47G 2009/1018* (2013.01)

(57) **ABSTRACT**

An acoustically transparent pillow for use with a furniture assembly where one or more speakers are embedded in the armrest(s) or other components of the furniture system. The pillow can be positioned (e.g., for decoration or comfort) over the armrest speaker, with minimal effect to the sound emitted from said speaker, even where the pillow is positioned over where sound is emitted from the speaker. Pillows may similarly be positioned in other locations relative to other speakers embedded in the furniture system, providing desired decorative esthetics or comfort, while providing minimal interference with the sound from the speaker system embedded in the furniture assembly. Such a pillow may include a fabric envelope and a fill material, where at least portions of the fabric envelope and the fill material comprise acoustically transparent materials (e.g., acoustically transparent fabric, and acoustically transparent fill material, such as a highly porous, reticulated foam).



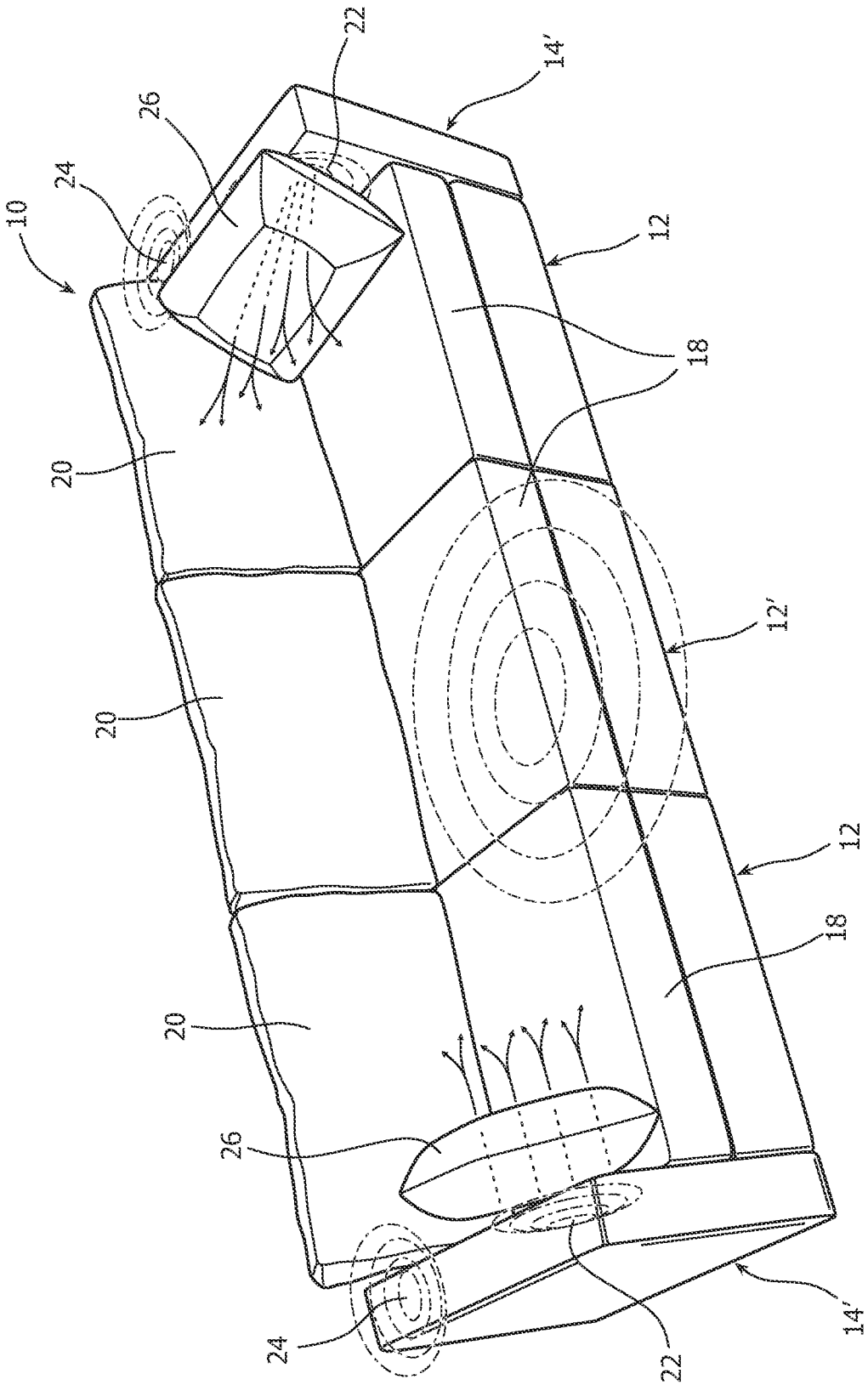


FIG. 1

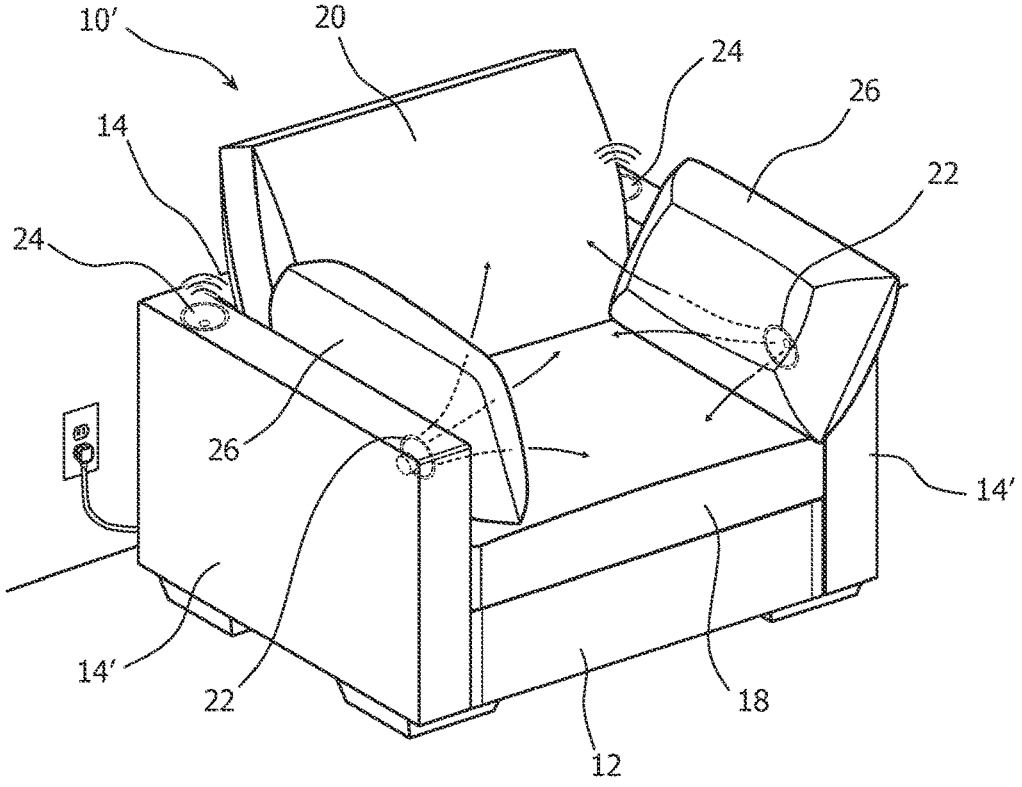


FIG. 2

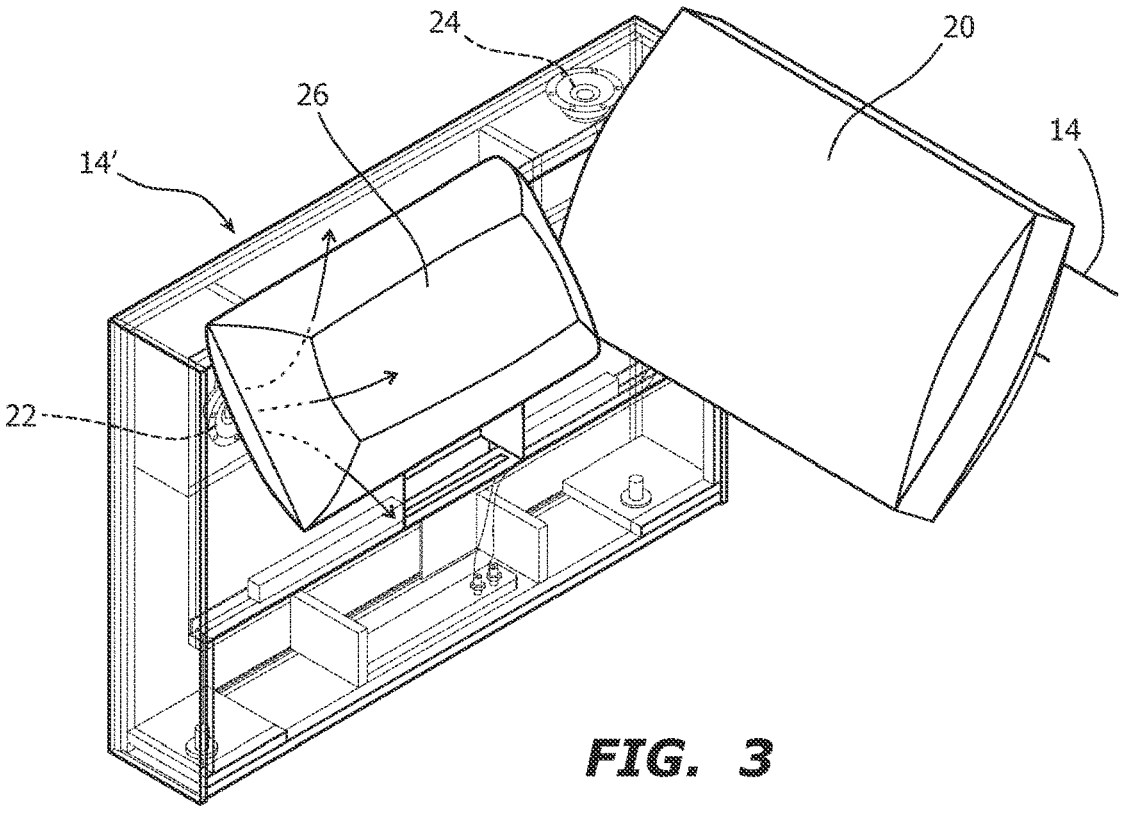


FIG. 3

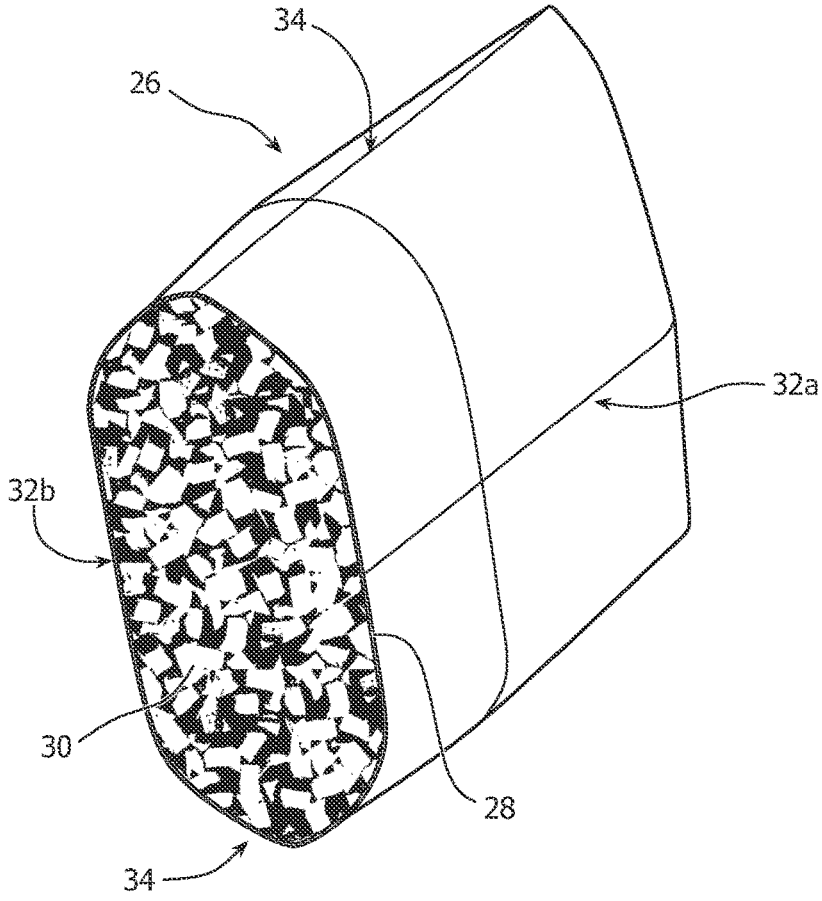


FIG. 4A

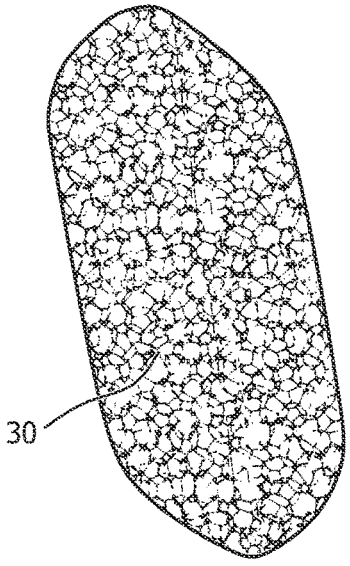


FIG. 4B

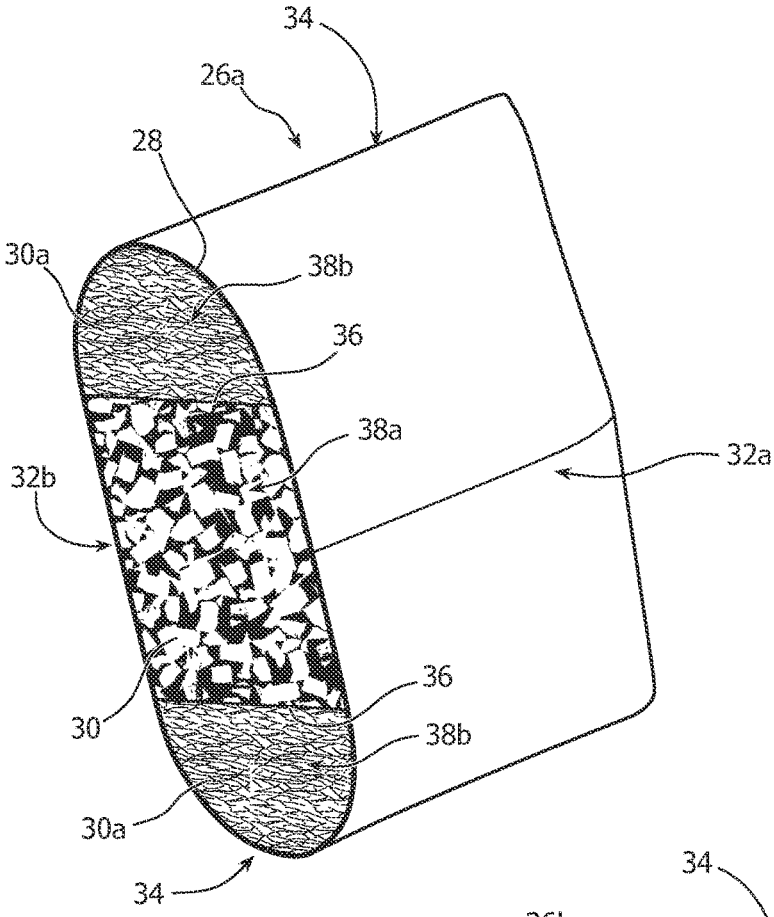

34
26a
28
30a
38b
36
38a
32a
32b
36
30
38b
30a
34

FIG. 5

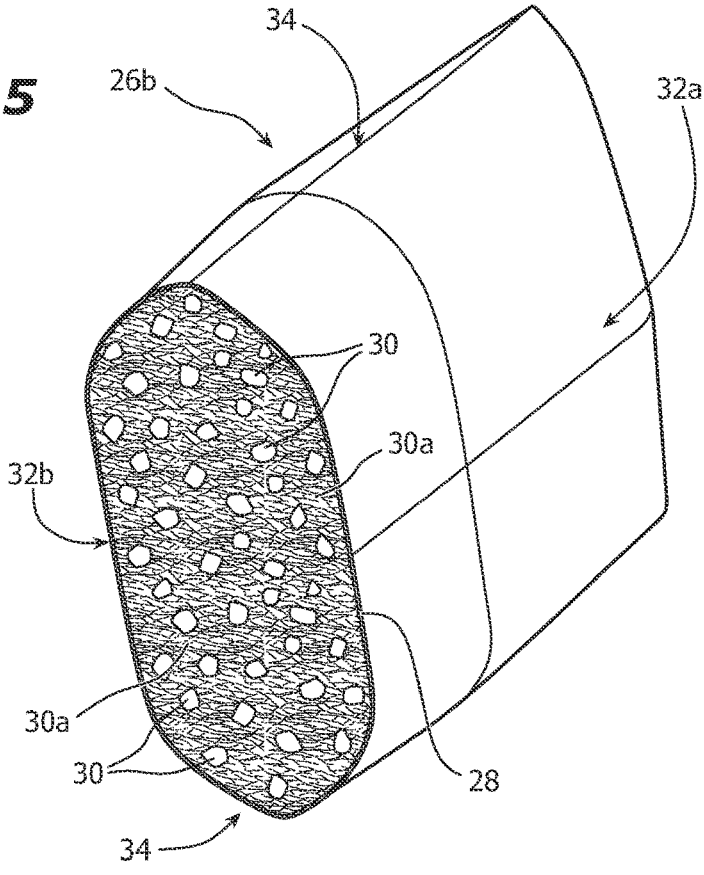

34
26b
32a
30
30a
32b
30a
30
28
34

FIG. 6

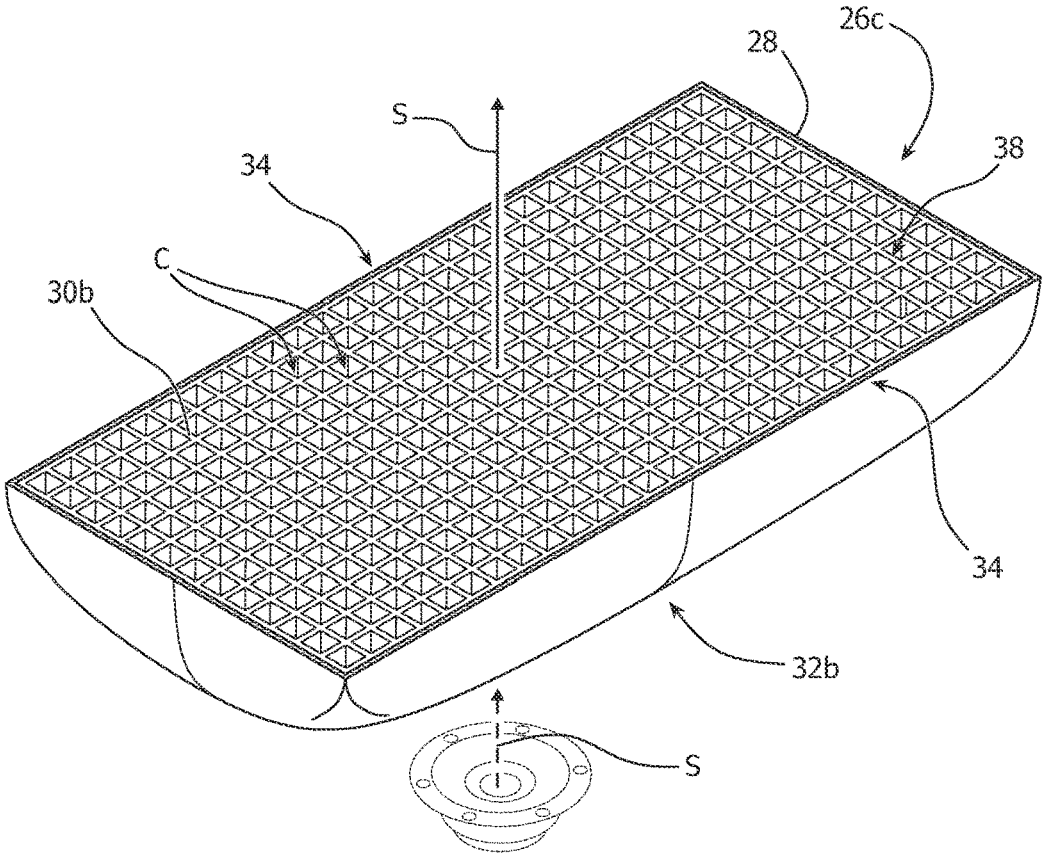


FIG. 7A

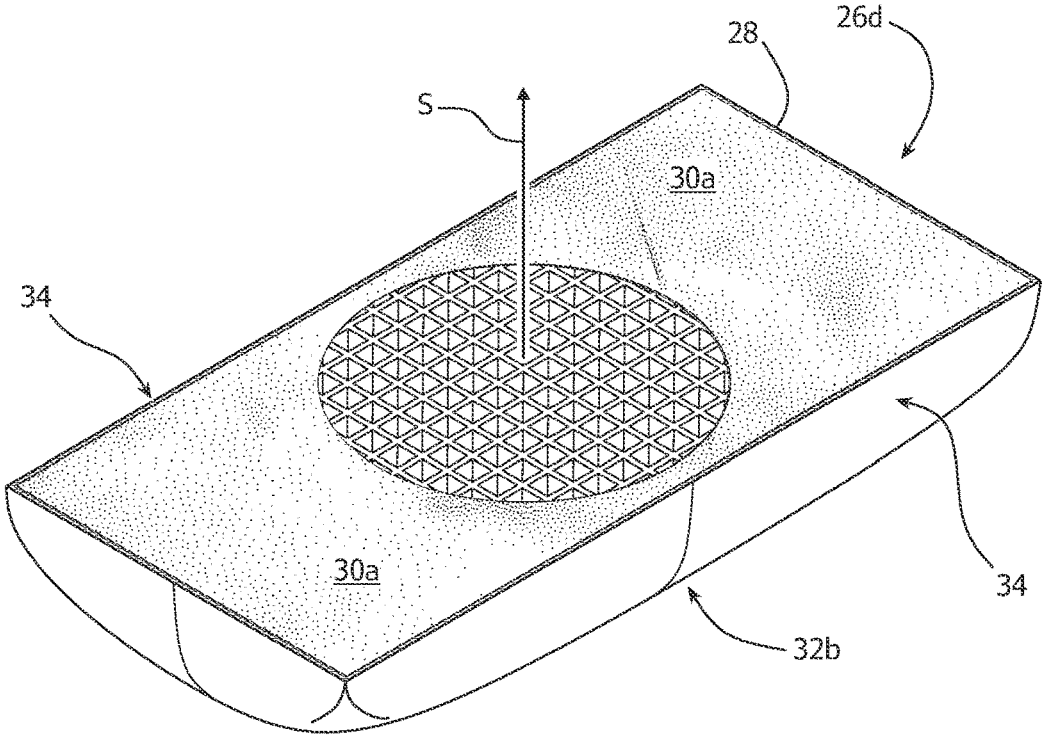


FIG. 7B

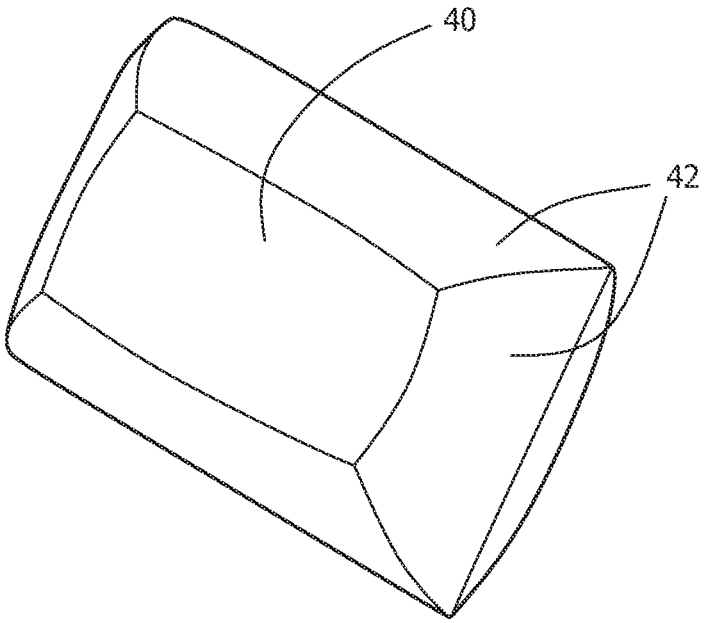


FIG. 8

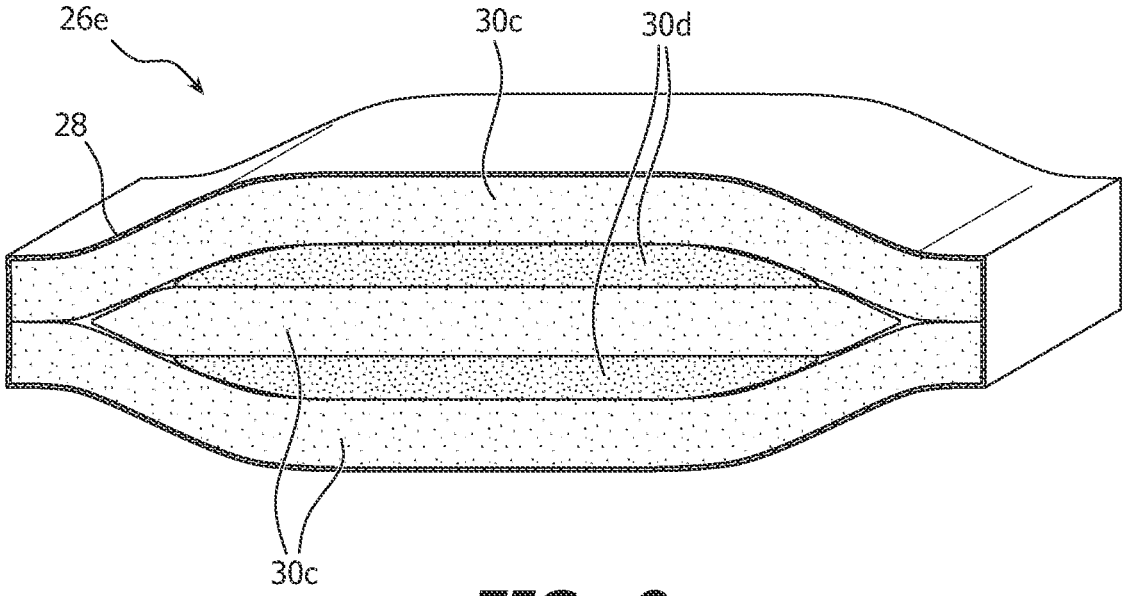


FIG. 9

ACOUSTICALLY TRANSPARENT PILLOW

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of and priority to U.S. Provisional Patent Application No. 63/357,830 filed Jul. 1, 2022, which is herein incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

1. The Field of the Invention

[0002] The present invention generally relates to pillows having acoustically transparent characteristics, for use with furniture systems, e.g., furniture seating systems including built-in speakers.

2. The Relevant Technology

[0003] Speaker systems are widely used for home, business, social activities, entertainment and for practical, commercial, and household uses. Unfortunately, speaker systems take up a great deal of space in a home, office, or business environment, and even if small, they are often unsightly. Moreover, wiring and cabling associated with such systems is also unsightly and cumbersome.

[0004] Furniture also tends to take up a great deal of space in a home, office or business environment. When sitting on furniture, it is often desirable to listen to music, watch TV, or watch a movie in a home theater environment, or employ one or more electronic components. Recently, Applicant has developed improved furniture systems that include speakers embedded into furniture seating systems (e.g., chairs, sofas, etc.). With such innovation, there is a need for associated accessories that would improve the listening and seating experience.

BRIEF SUMMARY

[0005] An embodiment of the present disclosure is directed to an acoustically transparent pillow, e.g., for use with a furniture system, e.g., that provides seating to one or more users, where the furniture system includes one or more speakers embedded (e.g., hidden) in the components of the furniture system. For example, in an embodiment, the furniture system may include a speaker (e.g., a front channel speaker) within an armrest of the furniture system. The provided acoustically transparent pillow may be a decorative or comfortable pillow for use with the furniture system, e.g., positionable over where sound is emitted from the embedded speaker, in a way that minimizes any negative muffling or dampening of the audible frequency sound waves emitted from the speaker, even when the pillow is positioned over such speaker.

[0006] Such an acoustically transparent pillow may include a fabric envelope, wherein at least a portion of the fabric envelope is acoustically transparent, and a fill material contained within the fabric envelope, wherein at least a portion of the fill material is acoustically transparent. While at least a portion of the fabric envelope may be formed from an acoustically transparent fabric material, it will be appreciated that in another embodiment, the fabric material may be the same or similar upholstery fabrics such as those used to upholster the furniture system, that are not acoustically transparent. Examples of such are described in one or more of Applicant's U.S. Pat. Nos. 10,212,519; 10,979,241; 11,172,301; 10,972,838; 11,178,846; and pending application Ser. No. 17/348,088, each of which is herein incorporated by reference in its entirety. For example, any attenuation through a non-acoustically transparent fabric cover (and/or the fabric fill) could be accommodated for in a similar manner as described in the above referenced patents and applications.

[0007] In an embodiment, when the fabric envelope is filled with the fill material, the fabric envelope includes two major general planar faces connected to one another (e.g., either directly or indirectly) around a periphery of the pillow, wherein the acoustically transparent portions of the fabric envelope and fill material are aligned with one another, to provide an acoustically transparent pathway through the pillow, from where sound is emitted from the furniture system (e.g., in the inside face of the armrest), through the first major planar face of the pillow, through the fill material of the pillow, and out the second major planar face of the pillow.

[0008] Another embodiment is directed to an acoustically transparent pillow for use in a furniture seating system that includes a speaker embedded (e.g., in an armrest) of the furniture system (e.g., a furniture seating system), the pillow comprising a fabric envelope, where at least a portion of the fabric envelope can be acoustically transparent, and a fill material contained within the fabric envelope, wherein at least a portion of the fill material is acoustically transparent. The pillow is such that when the fabric envelope is filled with the fill material, the fabric envelope includes two major general planar faces connected to one another around a periphery of the pillow, wherein the acoustically transparent portion of the envelope and the fill material are aligned with one another, to provide an acoustically transparent pathway through the pillow, from the speaker (e.g., embedded in the armrest) of the furniture system, through the first major face of the envelope, and out the second major face of the envelope of the pillow, allowing sound from the embedded speaker to pass through the pillow in an acoustically transparent manner.

[0009] In an embodiment, the fill material may include an acoustically transparent reticulated foam.

[0010] In an embodiment, the fill material (e.g., reticulated foam) may have a porosity value of 100 pores per inch (ppi) or less, 80 ppi or less, 50 ppi or less, 30 ppi or less, 20 ppi or less, or 10 ppi or less (e.g., from 10 ppi to 90 ppi, or from 30 ppi to 70 ppi, from 40 ppi to 60 ppi, or from 10 ppi to 50 ppi).

[0011] In an embodiment, the fill material is foam that is provided as a plurality of pieces of foam (e.g., small pieces of reticulated low density foam), rather than as relatively large monolithic pieces. For example, such individual pieces may account for no more than 1%, or no more than 0.1% by volume of the cavity filled by the fill material.

[0012] In an embodiment, the foam fill material may be shredded or cut (e.g., shredded or cut reticulated foam).

[0013] In an embodiment, the acoustically transparent portion of the fill material is aligned with a central portion of the pillow.

[0014] In an embodiment, the acoustically transparent portion of the fabric envelope is provided on the major faces of the pillow.

[0015] In an embodiment, the pillow can further include a non-acoustically transparent fill material, and a fabric, foam,

fiber, or other separator secured to an interior of the fabric envelope for defining a central compartment in which the acoustically transparent fill material is housed, and one or more peripheral compartments, in which the non-acoustically transparent fill material is housed.

[0016] It will be apparent that in an embodiment, the pillow does not include any rigid skeleton or other rigid components, but is soft and conformable throughout.

[0017] Additional features and advantages of exemplary implementations of the invention will be set forth in the description which follows, and in part will be obvious from the description, or may be learned by the practice of such exemplary implementations. The features and advantages of such implementations may be realized and obtained by means of the instruments and combinations particularly pointed out in the appended claims. These and other features will become more fully apparent from the following description and appended claims or may be learned by the practice of such exemplary implementations as set forth hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] To further clarify the above and other advantages and features of the present invention, a more particular description of the invention will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. It is appreciated that these drawings depict only illustrated embodiments of the invention and are therefore not to be considered limiting of its scope. The invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

[0019] FIG. **1** illustrates a furniture assembly (e.g., a sofa) for use with a transparent pillow according to the present invention, where the furniture assembly has one or more speakers embedded within the frame assembly of the components of the furniture assembly.

[0020] FIG. **2** illustrates another furniture assembly (e.g., a chair) for use with a transparent pillow according to the present invention, where the furniture assembly has one or more speakers embedded within the frame assembly of the components of the furniture assembly.

[0021] FIG. **3** illustrates an upright member that can be used with the furniture assemblies of FIGS. **1-2**, with one or more speakers embedded therein, shown with an acoustically transparent pillow according to the present invention, positioned over one of the speakers, permitting transmission of sound from the embedded speaker in an acoustically transparent manner.

[0022] FIG. **4**A illustrates a cross-section through an exemplary pillow according to an embodiment of the present invention.

[0023] FIG. **4**B schematically illustrates an exemplary reticulated foam structure, which can be used as a fill material for at least some of the pillow according to the present invention.

[0024] FIG. **5** illustrates a cross-section through another exemplary pillow according to an embodiment of the present invention.

[0025] FIG. **6** illustrates a cross-section through another exemplary pillow according to an embodiment of the present invention.

[0026] FIG. **7**A illustrates a cross-section through another exemplary pillow according to an embodiment of the present invention.

[0027] FIG. **7**B illustrates a cross-section through another exemplary pillow according to an embodiment of the present invention.

[0028] FIG. **8** illustrates a perspective or isometric view of another exemplary pillow according to the present invention, showing how the fabric envelope may include multiple different fabrics, e.g., with an acoustically transparent fabric over a central portion of the major faces of the pillow, and a non-acoustically transparent upholstery fabric over a peripheral portion of the pillow.

[0029] FIG. **9** illustrates another exemplary pillow according to an embodiment of the present invention, including multiple differently configured foam layers therein.

DETAILED DESCRIPTION

[0030] One or more specific embodiments of the present disclosure will be described below. In an effort to provide a concise description of these embodiments, some features of an actual embodiment may be described in the specification. It should be appreciated that in the development of any such actual embodiment, as in any engineering or design project, numerous embodiment-specific decisions will be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which may vary from one embodiment to another. It should further be appreciated that such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure.

[0031] One or more embodiments of the present disclosure may generally relate to an acoustically transparent pillow, e.g., for use with a furniture system that provides seating to one or more users, where the furniture system includes one or more speakers embedded (e.g., hidden) in the components of the furniture system. For example, in an embodiment, the furniture system may include a speaker (e.g., a front channel speaker) within an armrest of the furniture system. The provided acoustically transparent pillow may be a decorative or comfortable pillow for use with the furniture system, e.g., positionable over where sound is emitted from the embedded speaker, in a way that minimizes any negative muffling or dampening of the audible frequency sound waves emitted from the speaker, even when the pillow is positioned over such speaker. For example, by "acoustically transparent", the sound waves at any given audible frequency or band of such frequencies may be dampened by no more than 10 dB, no more than 6 dB, no more than 3 dB, no more than 2 dB, or no more than 1 dB.

[0032] Such an acoustically transparent pillow may include a fabric envelope, wherein at least a portion of the fabric envelope is acoustically transparent, and a fill material is contained within the fabric envelope, wherein at least a portion of the fill material is acoustically transparent. While at least a portion of the fabric envelope may be formed from an acoustically transparent fabric material, it will be appreciated that in another embodiment, the fabric material may be the same or similar upholstery fabrics such as those used to upholster the furniture system, that are not acoustically transparent and any attenuation through such a non-acoustically transparent fabric cover (and/or the fabric fill) could be accommodated for in a similar manner as described in

Applicant's patents and applications describing "tuning through upholstery fabric", already incorporated herein by reference.

[0033] While the present disclosure will describe particular implementations of apparatus, systems, and methods for enhancing a user's experience with seating furniture systems, it should be understood that the apparatus, systems, and methods described herein may be applicable to other uses as well. Additionally, elements described in relation to any embodiments depicted and/or described herein may be combinable with elements described in relation to any other embodiment depicted and/or described herein.

[0034] Generally, now referring to the drawings in detail wherein like reference numerals are used to designate like elements, structures, or components, there is shown one or more embodiments of the present disclosure that provides apparatus, systems, and methods providing a pillow with acoustically transparent characteristics for at least a portion of the components of such pillow. The apparatus, systems, and methods permit a user of the furniture system to use such a pillow, even where it may cover a speaker that is embedded in the furniture system, while minimizing any negative effects that placement of such pillow over the speaker may otherwise have.

[0035] For example, FIG. **1** shows a furniture assembly **10** (e.g., a sofa). Such a sofa may be a modular furniture assembly, where the assembly **10** is assembled by the user, by attaching one or more bases **12**, **12'** and upright members **14**, **14'** to one another. The illustrated sofa furniture assembly **10** includes two non audio-enhanced bases **12**, an audio-enhanced base (e.g., including a subwoofer embedded therein) **12'**, two audio-enhanced upright members **14'** (e.g., each including a front channel speaker **22** and a surround speaker **24**), as well as additional non audio-enhanced upright members **14** (which are hidden behind back pillows **20**), in FIG. **1**. Seat cushions **18** are also provided over bases **12** and **12'** as shown. Details of such a furniture assembly are described in Applicant's patents and applications, already incorporated by reference.

[0036] As shown in FIG. **1**, a pillow **26** according to the present invention is provided for use with such a furniture assembly **10**. Pillow **26** is specifically configured so as to allow the pillow to be placed directly over speaker **22** (which is embedded in the furniture assembly, oriented so as to fire sound through the upholstery that covers the exterior surface of upright member **14'**). With such positioning of the pillow, this would normally result in significant muffling and dampening of the sound being emitted from such speaker. Such is of course problematic, as it interferes with the ability to understand dialog or hear music or other sounds of a soundtrack while watching a movie, muffles sound while watching television, muffles the sound while listening to music, etc. At the same time, placement as shown, in the corner of the furniture assembly, between the backrest pillow **20** and the upright member **14'**, in particular with the pillow **26** positioned up against upright member **14'** is very desirable from a comfort perspective, where a user seated on the right seat cushion **12** may wish to lean on or against pillow **26**, while seated in this position.

[0037] The present invention provides pillow **26** with improved acoustic transparency, so as to allow the user to position the pillow as shown, e.g., even leaning thereon, while minimizing any negative affects associated with such pillow **26** being positioned over speaker **22**.

[0038] FIG. **2** shows a similar furniture assembly **10'** which is configured as a chair, similarly formed from the same modular components **12'**, **14'** and **14**, with embedded speakers **22** and **24** within upright members **14'**. As shown, pillow **26** is particularly configured so as to include acoustically transparent characteristics as described herein, so as to allow a user to still clearly hear and understand dialog, music, and other sounds emitted from speakers **22**, even where such speakers **22** may be physically covered by pillows **26**. FIG. **3** illustrates upright member **14'** in a phantom configuration, showing various possible internal components present therein, including the possible mounting of speakers **22** and **24**. As shown, speaker **22** may be mounted in a top front corner of the major generally planar face of upright member **14'**, with the speaker mounted so as to fire inwardly, towards the seating position. In this mounting configuration, a user may naturally wish to place a pillow over such a speaker, e.g., between the seat cushion **18** and the inside major generally planar surface of the upright member, either for increased seating comfort, or for decorative purposes. As is apparent, such positioning of a pillow would place the pillow directly over speaker **22**, embedded and hidden within the furniture assembly. Providing a pillow as described herein, with acoustically transparent properties allows such placement, while minimizing or eliminating the effects such placement may have on intelligibility and clarity of sound being emitted from such speaker (e.g., intelligibility of dialog in a movie, watching TV, listening to music, etc., as well as clarity of the sound from such a soundtrack, music, TV program, etc.).

[0039] As shown in FIG. **4**A, the pillow **26** includes a fabric envelope **28** that is filled with a fill material **30**. Fabric envelope **28** includes two major general planar faces **32***a* and **32***b* connected to one another (e.g., either directly or indirectly) around a periphery **34** of the pillow. At least a portion of fabric envelope **28** may be formed from an acoustically transparent fabric material, e.g., where attenuation of audible soundwave frequencies is minimal. By way of example, such acoustically transparent fabric materials are available or can be fabricated, although such materials are not typically used in manufacture of décor or other pillows. In an example, the selected acoustically transparent fabric material may have an attenuation (dB drop) associated with sound of a given frequency passing through such fabric, initially at a given dB level (e.g., initially at 45 dB, 50 dB, 55 dB, 60 dB, 65 dB, 70 dB, 75 dB, 80 dB, 85 dB, 90 dB, or 95 dB), where attenuation of the dB level once having passed through such fabric is less than 10 dB, less than 6 dB, less than 3 dB, less than 5 dB, less than 4 dB, less than 3 dB, less than 2 dB, or less than 1 dB. The frequencies where such minimal attenuation is provided can be across the audible spectrum, or a portion of the audible spectrum, e.g., a frequency band from about 20 Hz to about 20 kHz, from about 20 Hz to about 50 Hz, from about 50 Hz to about 100 Hz, from about 100 Hz to about 200 Hz, from about 200 Hz to about 400 Hz, from about 400 Hz to about 1 kHz, from about 1 kHz to about 2 kHz, from about 2 kHz to about 4 kHz, from about 4 kHz to about 8 kHz, from about 8 kHz to about 16 kHz, from about 16 kHz to about 20 kHz, or any combination of the foregoing frequency bands. Attenuation values of less than 10 dB, less than 6 dB, less than 5 dB, less than 4 dB, less than 3 dB, less than 2 dB, or less than 1 dB are specifically contemplated for each of the above frequency bands and sound levels. By way of example, typical

upholstery materials used as fabric coverings in a typical decorative pillow will attenuate a sound level, particularly at the relatively higher frequencies, by more than 3 dB, more than 6 dB, more than 10 dB, or even more than 20-30 dB (e.g., some tested pillows dampened some frequencies by 30 dB or more). The presently contemplated acoustically transparent fabric envelope (or portion of the fabric envelope that is acoustically transparent) may ensure less attenuation, as noted above, across any combination of the above noted audible spectrum ranges (e.g., from 20 Hz to 20 kHz, even more particularly from 100 Hz to 20 kHz, from 500 Hz to 16 kHz or from 1000 Hz to 16 kHz. Many adults may not reliably hear sounds over 20 kHz, or even over 16 kHz. Relatively low frequency sounds (e.g., less than 500 Hz) may pass through most fabrics (even upholstery fabrics) with minimal attenuation, although at higher frequencies (e.g., particularly 1 kHz and higher) attenuation through non-acoustically transparent fabrics can be significant (e.g., 1 dB or more, 3 dB or more, 6 dB or more, 10 dB or more, 20 dB or more, even 30 dB or more, for example). Providing the pillow **26** with an acoustically transparent fabric envelope for at least the generally planar major faces **32***a* and **32***b* of the pillow is greatly advantageous, particularly where this is paired with specific selections and positioning of fill material to also ensure that sound is able to pass through the pillow as a whole (from one major face **32***b* to the other major face **32***a*) with little or no attenuation at the frequency bands and sound volumes as noted above. Suitable acoustically transparent fabric materials can be determined using appropriate testing (e.g., measuring attenuation of sound through the fabric) as will be appreciated by those of skill in the art. Suitable acoustically transparent fabric materials for the envelope **28** may be characterized by an open or loose weave. Suitable acoustically transparent materials may be available from various manufacturers, e.g., Guilford of Maine (Grand Rapids, MI), or the like.

[0040] In an embodiment, the entire fabric envelope **28** may be formed from such an acoustically transparent fabric material. In another embodiment (see FIG. **8**), patches of fabric **40** that generally provide coverage for the major faces **32***a* and **32***b* may be formed of such an acoustically transparent fabric material, while the peripheral portions (e.g., **34**) may be formed from a fabric material **42** that is not necessarily acoustically transparent. The fill material within the pillow **26** of FIG. **8** may be of any embodiment as described herein, or otherwise. For example, the interior fill could be configured as shown in FIG. **5** or **7**B, with acoustically transparent fill material axially aligned with the acoustically transparent patch of fabric **40**.

[0041] The fill material **30** shown in FIG. **4**A may also be acoustically transparent (e.g., exhibiting minimal attenuation (e.g., less than 10, 6, 3, 2, or 1 dB) in sound level, at the above identified dB levels and frequency bands. In an embodiment, such an acoustically transparent fill material is a reticulated foam. Such a reticulated foam or other suitable fill material can have a relatively high void volume (e.g., at least 90%, at least 95%, at least 96%, or at least 97% void volume). Such a reticulated foam or other suitable fill material can have a porosity value of 100 pores per inch (ppi) or less. In an embodiment, such a material can have a porosity value of 80 ppi or less, 70 ppi or less, 50 ppi or less, 30 ppi or less, 20 ppi or less, or 10 ppi or less (e.g., from 10 ppi to 90 ppi, or from 30 ppi to 70 ppi, from 40 ppi to 60 ppi, from 10 ppi to 50 ppi) Such a foam with a very open structure is relatively transparent to sound waves having frequencies and sound levels as contemplated herein, so as to make it suitable for use as an acoustically transparent fill material.

[0042] In an embodiment, the fill material **30** is foam that is provided as a plurality of pieces of foam (e.g., small pieces of reticulated low density, high void fraction foam), rather than as relatively large monolithic pieces. For example, individual pieces of foam within the cavity defined by the fabric envelope and filled by the fill material may account for no more than 0.01%, no more than 0.1%, or no more than 1%, by volume of the cavity filled by the fill material. Stated another way, the pillow may be filled with at least hundreds, thousands, or tens of thousands of such very small pieces of acoustically transparent foam material. In an embodiment, individual pieces of foam may measure no more than about 2 cm, no more than about 1.5 cm, no more than about 1 cm, or no more than about 0.5 cm on a longest side or dimension. In an embodiment, the foam fill material **30** may be shredded or cut (e.g., shredded or cut reticulated foam). FIG. **4**B schematically illustrates an exemplary low density, high void fraction reticulated foam structure.

[0043] Many reticulated foams may have a relatively "stiff" feel to them, as compared to other types of foams (e.g., higher density foams). Various steps can be taken to minimize the stiff feel of such a foam material, if needed. For example, providing such a reticulated foam in very small pieces can help with minimizing the stiff feel. Another way to minimize the stiffness may be to fill the cavity within the pillow with a blend of reticulated or other types of foam materials (e.g., one or more of a lower porosity) and one or more with a higher porosity). The percentage of such foams in such a blend may range from 5% to 95%, such as 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%, 50%, 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, or 95% by volume. Ranges for any of such materials may be defined between any such percentages (e.g., 5-95%, or 20-80%, etc.). Where the blend includes both an acoustically transparent foam material, and a foam material that is not acoustically transparent (i.e., it provides a dB attenuation of greater than a threshold value, such as 3 dB at a given sound level, such as 80 dB, in a given audible frequency band, such as 1 kHz to 16 kHz, or any other testing values as described herein), the blend may be such that the acoustically transparent foam material is included in the blend in an amount of at least 50%, at least 55%, at least 60%, at least 65%, or at least 75% by volume of the blend, or cavity being filled. In an embodiment, stiffness may be minimized by providing the foam fill material in a variety of sizes (e.g., the foam fill material need not be all of a uniform size, but may be provided by blending together a variety of different sizes of foam pieces. In an embodiment, stiffness may be minimized by simply selecting a foam material that provides both high porosity (high void fraction), while also providing a very soft feel, where such materials are available.

[0044] FIG. **5** illustrates another embodiment, of a pillow **26***a*, that similarly includes a fabric envelope **28** that defines an internal cavity in which fill materials are provided. As with the pillow **26** of FIG. **4**A, the fabric envelope of pillow **26***a* can similarly comprise an acoustically transparent fabric material. One difference relative to pillow **26***a* compared to pillow **26** of FIG. **4**A is that pillow **26***a* is shown as being filled with both acoustically transparent fill material **30** (e.g., reticulated foam, with very high void fraction, as described

above) as well as another fill material **30***a*, which may not necessarily be acoustically transparent. For example, portions of the pillow **26***a* may also contain non-transparent materials **30***a* such as cotton, polyester fibers, latex, memory foam, wool or other more typical pillow fill materials in order to better maintain the soft and conformable feel of a typical pillow. As shown, pockets or cavities within the pillow **26***a* (formed with an internal fabric or other separator **36** sewn to the outer shell **28**) may be created in order to keep the acoustically transparent foam **30** in a specific location (e.g., centrally positioned within the pillow) while allowing non-transparent foam fill **30***a* to be in the remaining portions. For example, pillow **26***a* is shown as including a central cavity portion **38***a*, filled with the acoustically transparent foam fill material, while peripheral cavity portion(s) **38***b* are provided around the peripheral portion of the pillow. Thus, such a pillow can include an acoustically transparent fill material **30**, as well as a non-acoustically transparent fill material **30***a*, and a fabric or other separator **36** secured to an interior of the fabric envelope **28** for defining a central compartment **38***a* in which the acoustically transparent fill material **30** is housed, and one or more peripheral compartments **38***b*, in which the non-acoustically transparent fill material **30***a* is housed.

[0045] While such different fill materials are shown as provided within separate cavities in FIG. **5**, it will be appreciated that in another embodiment, such different materials can be dispersed together, within the same cavity, with softer materials (e.g., like filling **30***a* dispersed evenly throughout the acoustically transparent foam material **30**, to help balance comfort with acoustic transparency. An example of such a pillow **26***b* is shown in FIG. **6**. In such an embodiment, the acoustically transparent fill material **30** may account for at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, or at least 75% by volume of the fill material (i.e., at least 50% of the volume of the cavity is filled with the acoustically transparent fill material **30**).

[0046] In an embodiment such as that shown in FIG. **5** or **8**, an acoustically transparent pathway is provided through a central portion of the pillow, for example, where sound can enter the pillow from speaker **22**, through the portion of the fabric cover **28** at major face **32***b* that covers central cavity **38***a*, passes through acoustically transparent foam fill **30**, and exits the pillow (where it is heard by the user) through the portion of fabric cover **28** on the opposite side of cavity **38***a*, which fabric covers the other major face **32***a*. Referring to FIG. **8**, such sound may pass through the central portion of the pillow **26** (e.g., corresponding to acoustically transparent patch **40**).

[0047] FIG. **7**A illustrates another embodiment of an acoustically transparent pillow **26***c*, where the fill within the pillow includes elastic polymers, foams, or similar materials (e.g., as used in some memory foam mattresses) with patterned cutouts that are aligned axially with the direction of the sound waves. For example, as shown in FIG. **7**A, pillow **26***c* includes a fabric envelope **28** where the interior of the pillow cavity **38** is at least partially filled with such a patterned polymer or foam material **30***b*, where the individual cutouts C or openings are axially aligned with the direction of sound S being emitted from the speaker (e.g., speaker **22**). Such a configuration provides open tunnels through which such sound can pass (cutouts, openings or channels C), from one major face **32***b* to the opposite major face **32***a*, with minimal interference from the polymer or foam material **30***b*, because such sound simply passes through the empty channels that may extend all or a substantial portion of the distance between the fabric envelope **28** covering the major faces **32***a* and **32***b*.

[0048] FIG. **7**B shows a similar embodiment of a pillow **26***d*, but in which the polymer or foam material **30***b* is present only within a central portion of the pillow, surrounded by other foam material **30***a* (where foam material **30***a* may not necessarily be acoustically transparent).

[0049] FIG. **9** illustrates another embodiment of an acoustically transparent pillow **26***e*, including a fabric envelope **28** where the fill within the pillow includes a plurality of foam or other fill layers **30***c*, **30***d*, where different layers (e.g., **30***c* versus **30***d*) include different density, porosity or softness characteristics, to provide a desired feel and shape, while also providing acoustic transparency to at least select portions of the pillow (e.g., a center portion of the pillow, for positioning over the embedded speaker location). For example, in an embodiment, foam layers **30***c* may be formed from a foam with relatively lower porosity, that is relatively soft, while the foam layers labeled **30***d* may be relatively less soft (more stiff), higher porosity foam.

[0050] It will be apparent that in the various disclosed embodiments, the pillow does not include any rigid skeleton or other rigid components, but is soft and conformable throughout, so as to function and appear as any other decorative pillow typically used on a chair or couch.

[0051] While the present invention is described principally in the context of an acoustically transparent pillow for use with a couch or similar furniture having embedded speakers, it will be apparent that the invention is not limited to such, but extends to other articles, that would similarly be soft and conformable, where such article covers one or more speakers, but is acoustically transparent, so as to not provide any substantial impedance to the sound transmitted from a hidden, embedded speaker (e.g., whether in a chair, couch or other piece of furniture, such as frameless furniture (e.g., Applicant's SAC), a bed, mattress, or the like.

[0052] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the invention. Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms, such as those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant work.

[0053] The articles "a," "an," and "the" are intended to mean that there are one or more of the elements in the preceding descriptions. The terms "comprising," "including," and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements. Additionally, it should be understood that references to "one embodiment" or "an embodiment" of the present disclosure are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features. Numbers, percentages, ratios, or other values stated herein are intended to include that value, and also other values that are "about" or "approximately" the stated value, as would be appreciated by one of ordinary skill in the art encompassed by embodiments of the present disclosure. A stated value should therefore be interpreted broadly enough to encompass values

that are at least close enough to the stated value to perform a desired function or achieve a desired result. The stated values include at least the variation to be expected in a suitable manufacturing or production process, and may include values that are within 10%, within 5%, within 1%, within 0.1%, or within 0.01% of a stated value. As used herein, the term "between" includes any referenced endpoints. For example, "between 2 and 10" includes both **2** and **10**.

[0054] A user having ordinary skill in the art should realize in view of the present disclosure that equivalent constructions do not depart from the spirit and scope of the present disclosure, and that various changes, substitutions, and alterations may be made to embodiments disclosed herein without departing from the spirit and scope of the present disclosure. Equivalent constructions, including functional "means-plus-function" clauses are intended to cover the structures described herein as performing the recited function, including both structural equivalents that operate in the same manner, and equivalent structures that provide the same function. It is the express intention of the applicant not to invoke means-plus-function or other functional claiming for any claim except for those in which the words 'means for' appear together with an associated function. Each addition, deletion, and modification to the embodiments that falls within the meaning and scope of the claims is to be embraced by the claims.

[0055] The terms "approximately," "about," and "substantially" as used herein represent an amount close to the stated amount that still performs a desired function or achieves a desired result. For example, the terms "approximately," "about," and "substantially" may refer to an amount that is within 10% of, within 5% of, within 1% of, within 0.1% of, and within 0.01% of a stated amount. Further, it should be understood that any directions or reference frames in the preceding description are merely relative directions or movements. For example, any references to "up" and "down" or "above" or "below" are merely descriptive of the relative position or movement of the related elements, when in a given orientation.

[0056] The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

1. An acoustically transparent pillow comprising:

a fabric envelope; and

a fill material contained within the fabric envelope, wherein at least a portion of the fill material is acoustically transparent.

2. The acoustically transparent pillow of claim **1**, wherein at least a portion of the fabric envelope is acoustically transparent.

3. The acoustically transparent pillow of claim **1**, wherein the fill material includes an acoustically transparent reticulated foam.

4. The acoustically transparent pillow of claim **3**, wherein the reticulated foam fill material has a void fraction of 90% or more.

5. The acoustically transparent pillow of claim **3**, wherein the reticulated foam fill material has a porosity value of 100 pores per inch (ppi) or less.

6. The acoustically transparent pillow of claim **3**, wherein the reticulated foam fill material is provided as a plurality of pieces of reticulated foam, rather than as a monolithic piece.

7. The acoustically transparent pillow of claim **6**, wherein the reticulated foam fill material is shredded or cut.

8. The acoustically transparent pillow of claim **6**, wherein the reticulated foam fill material is provided in multiple layers.

9. The acoustically transparent pillow of claim **1**, wherein the acoustically transparent portion of the fill material is aligned with a central portion of the pillow.

10. The acoustically transparent pillow of claim **9**, wherein at least a portion of the fabric envelope is acoustically transparent, and wherein the acoustically transparent portion of the fabric envelope is provided on major faces of the pillow.

11. The acoustically transparent pillow of claim **1**, wherein the pillow further comprises a non-acoustically transparent fill material, the pillow further comprising a separator secured to an interior of the fabric envelope for defining a central compartment in which the acoustically transparent fill material is housed, and one or more peripheral compartments, in which the non-acoustically transparent fill material is housed.

12. An acoustically transparent pillow comprising:

a fabric envelope, wherein at least a portion of the fabric envelope is acoustically transparent; and

a fill material contained within the fabric envelope, wherein at least a portion of the fill material is acoustically transparent;

wherein when the fabric envelope is filled with the fill material, the fabric envelope includes two major generally planar faces connected to one another around a periphery of the pillow, wherein the acoustically transparent portion of the fabric envelope and acoustically transparent portion of the fill material are aligned with one another, to provide an acoustically transparent pathway through the pillow, from the first major planar face to the second major planar face.

13. The acoustically transparent pillow of claim **12**, wherein the first and second major planar faces are indirectly connected to one another around the periphery of the pillow, through one or more edge faces of the fabric envelope disposed between the first and second major planar faces.

14. The acoustically transparent pillow of claim **12**, wherein the pillow further comprises a non-acoustically transparent fill material, the pillow further comprising a separator secured to an interior of the fabric envelope for defining a central compartment in which the acoustically transparent fill material is housed, and one or more peripheral compartments, in which the non-acoustically transparent fill material is housed.

15. The acoustically transparent pillow of claim **12**, wherein the fill material includes an acoustically transparent reticulated foam.

16. The acoustically transparent pillow of claim **15**, wherein the reticulated foam fill material is provided as a plurality of pieces of reticulated foam, rather than as a monolithic piece.

17. An acoustically transparent pillow for use with a furniture system that includes a speaker embedded in an armrest or other location within the furniture system, the pillow comprising:

a fabric envelope, wherein at least a portion of the fabric envelope is acoustically transparent; and

a fill material contained within the fabric envelope, wherein at least a portion of the fill material is acoustically transparent;

wherein when the fabric envelope is filled with the fill material, the fabric envelope includes two major generally planar faces connected to one another around a periphery of the pillow, wherein the acoustically transparent portion of the fabric envelope and acoustically transparent portion of the fill material are aligned with one another, to provide an acoustically transparent pathway through the pillow, from the speaker embedded in the furniture system, through the first major planar face of the fabric envelope, through the acoustically transparent fill material within the fabric envelope, and out the second major planar face of the fabric envelope of the pillow, allowing sound from the embedded speaker to pass through the pillow in an acoustically transparent manner.

18. The acoustically transparent pillow of claim **17**, wherein the first and second major planar faces are indirectly connected to one another around the periphery of the pillow, through one or more edge faces of the fabric envelope disposed between the first and second major planar faces.

19. The acoustically transparent pillow of claim **17**, wherein the pillow further comprises a non-acoustically transparent fill material, the pillow further comprising a separator secured to an interior of the fabric envelope for defining a central compartment in which the acoustically transparent fill material is housed, and one or more peripheral compartments, in which the non-acoustically transparent fill material is housed.

20. The acoustically transparent pillow of claim **17**, wherein the fill material includes an acoustically transparent reticulated foam.

21. The acoustically transparent pillow of claim **20**, wherein the reticulated foam fill material is provided as a plurality of pieces of reticulated foam, rather than as a monolithic piece.

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