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(71) Applicant: **ILLINOIS TOOL WORKS INC.** [US/US]; 155 Harlem Avenue, Glenview, IL 60025 (US).

(72) Inventors: **RANCICH, Michael Joseph**; c/o Illinois Tool Works Inc., 155 Harlem Avenue, Glenview, IL 60025 (US). **JOHNSON, Taylor Kelly**; c/o Illinois Tool Works Inc., 155 Harlem Avenue, Glenview, IL 60025 (US).

(74) Agent: **ERICKSON, Kevin D.** et al.; Pauley Erickson & Swanson, 10 Executive Court, Suite 3, South Barrington, IL 60010 (US).

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— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
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(54) Title: SOUNDPROOFING MEMBRANE

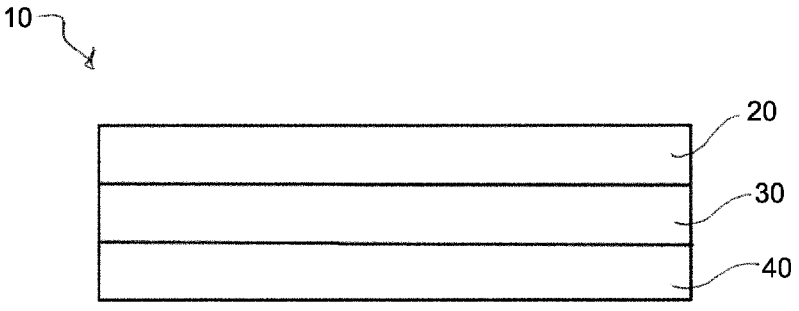


FIG. 1

(57) Abstract: A sound reduction membrane and a composite that includes a sound reduction material or equivalent and the membrane laminated as a composite face structure to the sound reduction material. The composite face structure includes an outer fabric layer, a central film layer, and an inner adhesive layer, wherein the central film layer and the inner adhesive layer include distinct materials having distinct properties. The composite face structure is thermally laminated to one side of the sound reduction material along the inner adhesive layer.

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SOUNDPROOFING MEMBRANE

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This invention relates generally to a sound reduction membrane and composite particularly suited for soundproofing floors or other surfaces while providing enhanced tile adhesion, liquid water, and water vapor barrier, and/or crack isolation.

DESCRIPTION OF PRIOR ART

Currently, where there is a need for sound reduction as well as water vapor barrier and/or surface crack isolation, a separate material layer for each function is applied at the installation site. Therefore, there exists a need for a sound reduction material that adds relatively little additional weight to materials and installations, is easy to transport, handle and install, and provides the benefits of water- or water vapor-proofing and crack isolation, as well as providing for tile adhesion useful for further top-surface installation.

SUMMARY OF THE INVENTION

The present invention is directed to a structural membrane for use in sound reduction installations, and a sound reduction roll, panel or sheet including the membrane. The unitary membrane composition of this invention generally includes a strong film layer to provide structural crack isolation and/or high barrier to liquid and gaseous water penetration, all with less installation steps as compared to the prior art. As used herein “sound reduction” or “soundproofing” generally refers to preventing, either partially or fully, sound transmission, such as by sound dampening, sound absorption, sound deflection, or other means.

The invention includes a multilayer membrane composition for use in a sound reduction composite having a sound reduction material. The multilayer membrane composition of embodiments of this invention includes an outer fabric layer, preferably a non-woven fabric, a central film layer, and preferably an inner adhesive layer. The adhesive layer is configured to adhere (e.g., by thermal laminating) the multilayer composition to the sound reduction material to incorporate mechanical strength and barrier properties to the sound reduction material.

The membrane is useful in sound reduction installations for floors or other surfaces, while also providing enhanced surface/decorative cladding (e.g., tile) adhesion, liquid

water and water vapor barrier, and crack isolation or bridging (e.g., covering and preventing propagation of existing or future subfloor cracks into the floor covering). These improvements are provided by a unitary multilayer membrane lamination composition incorporating a structural film such as a VALERON® film, which can be thermally laminated or otherwise adhered to a crumb rubber or other sound reduction material to form a sound reduction composite. This saves the installer time as multiple material layer installations are not required. The sound reduction composite including the multilayer membrane would, for example, typically be bonded to the floor of a multi-story building with adhesive. The finished (upper) floor covering can be bonded to the fabric surface of the membrane with additional application of a suitable adhesive (e.g., thin set adhesive in the case of tile).

In some instances, when the water and water vapor barrier is needed closer to the concrete subfloor, the sound reduction composite can be installed with the nonwoven to the surface and the sound reduction material up. While this may reduce the performance of the product somewhat, it will still provide effective soundproofing, water and water vapor barrier and crack isolation. A membrane of this invention can also be adhered to both sides of the sound reduction material.

A preferred version of the membrane contains a thermal laminating layer as the adhesive layer, but other methods of laminating to the sound reduction material can be used, such as laminating and pressure sensitive adhesives. The multilayer membrane can also be installed to the sound reduction material in the field, but this eliminates some of the saved installation time.

A potential benefit of the sound reduction membrane is that it prevents penetration of the adhesive used to bond the flooring material into the top surface of the sound reduction material. In porous materials this is believed to improve the sound reduction performance of the installation.

The invention further includes a moisture resistant sound reduction composite. The composite includes a multilayer face structure laminated to a surface of a sound reduction material. The multilayer face structure includes an outer fabric layer, a central film layer, and an inner adhesive layer. The central film layer and the inner adhesive layer are distinct materials having distinct properties. The composite face structure is laminated to the surface of the sound reduction material along the inner adhesive layer.

The invention further includes a method of imparting structural (e.g., crack isolation) and barrier properties to a sound reduction roll, panel or sheet. The method includes

a step of thermal laminating an independent and unitary multilayer membrane composition to a separate sound reduction roll, panel or sheet, the multilayer membrane composition including an outer fabric layer, a central film layer, and an inner adhesive layer. The adhesive layer is configured to adhere the multilayer composition to the sound reduction roll, panel or sheet, thereby incorporating the mechanical strength and barrier properties of the membrane to the sound reduction roll, panel or sheet.

BRIEF DESCRIPTION OF THE DRAWINGS

The above-mentioned and other features and objects of this invention will be better understood from the following detailed description taken in conjunction with the drawings wherein:

Fig. 1 shows a schematic of a sound reduction membrane, according to an embodiment of this invention;

Fig. 2 shows a schematic of a sound reduction structure including the membrane of Fig. 1, according to an embodiment of this invention;

Fig. 3 shows a schematic of a sound reduction membrane, according to an embodiment of this invention; and

Fig. 4 shows a schematic of a sound reduction structure including the membrane of Fig. 3, according to an embodiment of this invention.

The above-described drawings are schematic and therefore not to scale.

DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 shows a membrane 10, such as referred to generally herein as a sound reduction or soundproofing membrane, according to one embodiment of this invention for sound reduction installations. The membrane 10 is a standalone, unitary multilayer membrane composition including a fabric layer 20, a central film layer 30, and preferably an adhesive layer 40. Each layer of the multilayer composition 10 is laminated or extrusion coated to an adjacent layer. For example, the adhesive layer 40 is desirably extrusion coated or otherwise adhered into a unitary film with the central film layer 30.

In Fig. 2, the membrane 10 is laminated as a composite face structure or facer to a surface of any suitable sound reduction material 50 to form a moisture resistant, sound reduction composite 60. Exemplary sound reduction materials 50 include rolls, panels or sheets formed of rubber (e.g., crumb rubbers), foam, cork, or open cell insulation. The composite

face structure 10 may be adhered, such as by thermal laminating via layer 40, to one side of the crumb rubber or other sound reduction material 50, as shown in Fig. 2. Alternatively, the composite face structure 10 may be adhered or thermally laminated to each side of the sound reduction material 50.

The composite face structure 10 may be separately manufactured and then subsequently adhered to the sound reduction material 50 in a later operation or may be fabricated in process with the sound reduction material 50.

As shown in Fig. 2, the outer layer of the composite face structure 10 is the outer fabric layer 20. As used herein, the "outer" layer refers to a layer of the sound reduction membrane 10 that is the outermost layer and promotes the mechanical and/or chemical bond used for further surface covering adhesion. The fabric layer 20 is preferably suitable for bonding of either a tile or similar surface coverings such as wood, laminate, and vinyl floor coverings. Suitable fabric materials include woven materials and non-woven materials (e.g., webs, meshes, and perforated films). One preferred embodiment of the non-woven fabric layer is a polypropylene, polyester, or polyethylene terephthalate (PET) point bond nonwoven material. A preferred weight range is approximately 0.5 to 2 oz/yd^2, desirably about 0.8 to 1.2 oz/yd^2, and preferably about 0.9 oz/yd^2, although other weight ranges may be appropriate depending on the installation needs.

As used herein, the term "central" film layer 30 does not necessarily require that the central film layer 30 is a numerically or spatially central layer, only that it is not an outer, exposed layer of the composite face structure 10. Cross laminated polyolefin films are suitable for the central film layer 30. Specifically, the central film layer 30 preferably comprises a proprietary VALERON film layer. VALERON film preferably comprises a high-density polyethylene (HDPE) that is oriented and cross-laminated. Preferably two plies of film are crossed at approximately 90 degrees to each other and laminated with a thin layer, for example, 0.5 mil, of polyethylene. A thicker central film layer 30 may be configured with four oriented plies and three laminating layers. In total, a preferred thickness of the central film layer 30 within the composite face structure 10 is approximately 2 to 8.6 mils thick, desirably about 2 to 5 mils thick, and more desirably about 3 mils thick, particularly for HDPE-based films. Other exemplary central film layers include, without limitation, polyolefin-based machine-direction orientation (MDO), polyethylene terephthalate-based oriented films (e.g., BOPET), and other biaxially oriented films.

The composite face structure 10 further includes an inner adhesive layer 40. As used herein the term "inner" means a layer of material that is adjacent to the sound reduction material 50 and/or between the central film layer 30 and the sound reduction material 50. The adhesive layer 40 is desirably embodied as a thermal laminating layer, preferably including a copolymer resin such as ethylene-methacrylate (EMA), or in an alternative embodiment, an ethylene-vinyl acetate (EVA). A suitable EMA includes approximately 20% methacrylate and a density of 0.941 g/cm^3. In addition, a suitable EMA includes a melt index of 6 grams/10 minutes and is an extrusion coating grade. The inner copolymer adhesive layer 40 is approximately 0.5 to 2 mils in thickness, desirably about 0.5 to 1.23 mils, and preferably about 1.0 mil. The adhesive layer copolymer content can vary from 6% to 24% (by weight), and preferably about 20%.

In embodiments of this invention, the thermal laminating layer 40 is extrusion coated, extrusion laminated or adhesive laminated to the cross-laminated film. The thermal laminating layer 40 provides high bond between the nonwoven/cross laminated film composite and the sound reduction layer. Additional adhesives can also be used to connect the central film layer to the sound reduction material, such as laminating adhesives, spray adhesives, roll-on adhesives, or pressure sensitive adhesives.

When thermal lamination is used it is preferred that this layer has a low melting/softening point to allow strong bonds to the sound proofing material without melting or distortion of the other layers of the face structure 10.

In embodiments of this invention, as illustrated in Figs. 3 and 4, the membrane composition or face structure 10 may further include an upper adhesive layer 70 positioned between the central film layer 30 and the outer fabric layer 20. This upper layer 70 can be any suitable material, such as the adhesives discussed above or polyethylene homo- or co-polymers. In embodiments, the homo- or co-polymer layer 70 is preferably approximately 0.5 to 1.5 mil in thickness. The. The copolymer can be or be blended with low density polyethylene (LDPE) to provide better extrusion laminating performance with improved adhesion. Additionally, EMA copolymers, polyethylene copolymers and EMA/LDPE blends can be used to provide better adhesion to polyester point bond nonwovens.

While in the foregoing specification this invention has been described in relation to certain preferred embodiments thereof, and many details have been set forth for purpose of illustration, it will be apparent to those skilled in the art that the subject invention

is susceptible to additional embodiments and that certain of the details described herein can be varied considerably without departing from the basic principles of the invention.

CLAIMS:

1. In a sound reduction covering having a sound reduction material, the improvement comprising a multilayer composition including an outer fabric layer, a central film layer, and an inner adhesive layer, the adhesive layer configured to adhere the multilayer composition to the sound reduction material, thereby incorporating mechanical strength and barrier properties to the sound reduction material.

2. In the sound reduction covering of Claim 1, wherein each layer of the multilayer composition is extrusion or adhesive laminated or extrusion coated to an adjacent layer.

3. In the sound reduction covering of Claim 1, wherein the adhesive layer is extrusion coated into a unitary film with the central film layer.

4. In the sound reduction covering of Claim 1, wherein the outer fabric layer is approximately 0.5 to 2 oz/yd^2, preferably about 0.9 oz/yd^2.

5. In the sound reduction layer of Claim 1, wherein the central film layer is a strength layer comprising a cross-laminated film.

6. In the sound reduction covering of Claim 1, wherein the central film layer comprises a high-density polyethylene film imparting properties of strength, liquid water and water vapor barrier, and crack isolation.

7. In the sound reduction covering of Claim 1, wherein the adhesive layer comprises an inner copolymer layer adapted for thermal lamination to the sound reduction material.

8. In the sound reduction covering of Claim 7, wherein the inner copolymer layer comprises an ethylene methyl acrylate (EMA) copolymer having an acrylate content of around 20%.

9. In the sound reduction covering of Claim 7, wherein the inner copolymer layer has a thickness of about 0.5 mil to 2.0 mil, and preferably about 1.0 mil.

10. In the sound reduction covering of Claim 1, further comprising a homopolymer or copolymer layer positioned between the central film layer and the outer non-woven fabric layer.

11. A moisture resistant sound reduction composite, comprising:

a sound reduction material;

a multilayer face structure laminated to a surface of the sound reduction material, the multilayer face structure including:

an outer fabric layer, preferably an outer non-woven fabric layer;

a central film layer; and

an inner adhesive layer, wherein the central film layer and the inner adhesive layer comprise distinct materials having distinct properties; and

wherein the composite face structure is laminated to the surface of the sound reduction material along the inner adhesive layer.

12. The sound reduction composite of Claim 11, wherein the sound reduction material comprises rolls, panels or sheets formed of rubber, foam, cork, or open cell insulation.

13. The sound reduction composite of Claim 11, wherein each layer of the multilayer face structure is laminated or extrusion coated to an adjacent layer.

14. The sound reduction composite of Claim 11, wherein the inner adhesive layer is extrusion coated into a unitary film with the central film layer.

15. The sound reduction composite of Claim 11, wherein the outer non-woven fabric layer is approximately 0.5 to 2 oz/yd^2, preferably about 0.9 oz/yd^2.

16. The sound reduction composite of Claim 11, wherein the central film layer is a strength layer comprising a cross-laminated film.

17. The sound reduction composite of Claim 16, wherein the central film layer comprises a high-density polyethylene film imparting strength, liquid water and water vapor barrier, and crack isolation properties.

18. The sound reduction composite of Claim 11, wherein the inner adhesive layer comprises an ethylene methyl acrylate (EMA) copolymer having an acrylate content of around 20%.

19. The sound reduction composite of Claim 18, wherein the inner adhesive layer has a thickness of about 0.5 mil to 2.0 mil, and preferably about 1.0 mil.

20. A method of imparting structural and barrier properties to a sound reduction roll, panel or sheet, the method comprising thermal laminating an independent and unitary multilayer composition to a separate sound reduction roll, panel or sheet, the multilayer composition including an outer fabric layer, preferably a nonwoven fabric layer, a central film layer, and preferably an inner adhesive layer, the adhesive layer configured to adhere the multilayer composition to the sound reduction roll, panel or sheet, thereby incorporating mechanical strength and barrier properties to the sound reduction roll, panel or sheet.

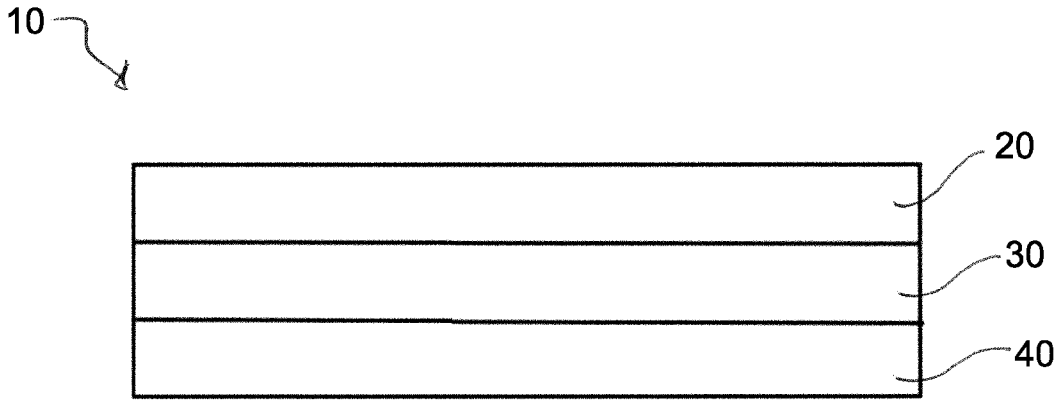


FIG. 1

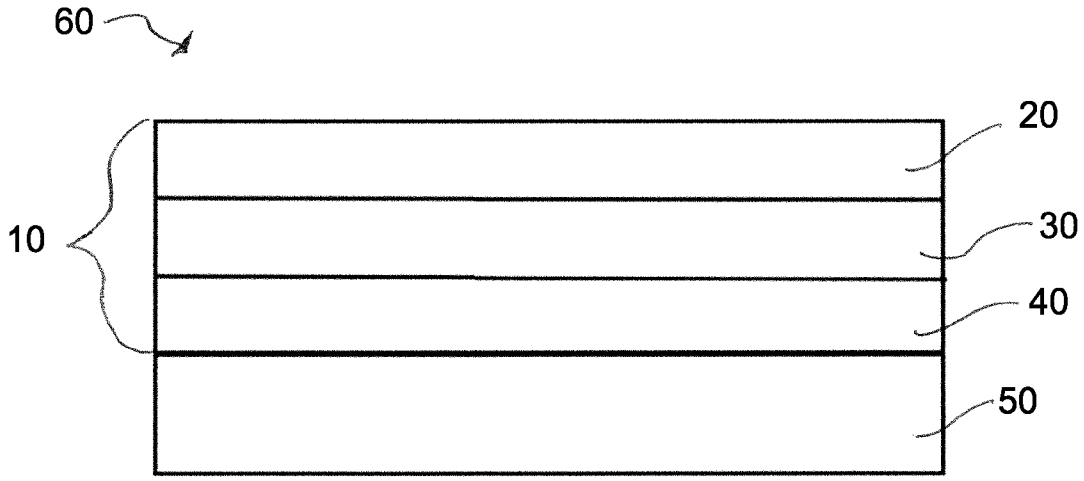


FIG. 2

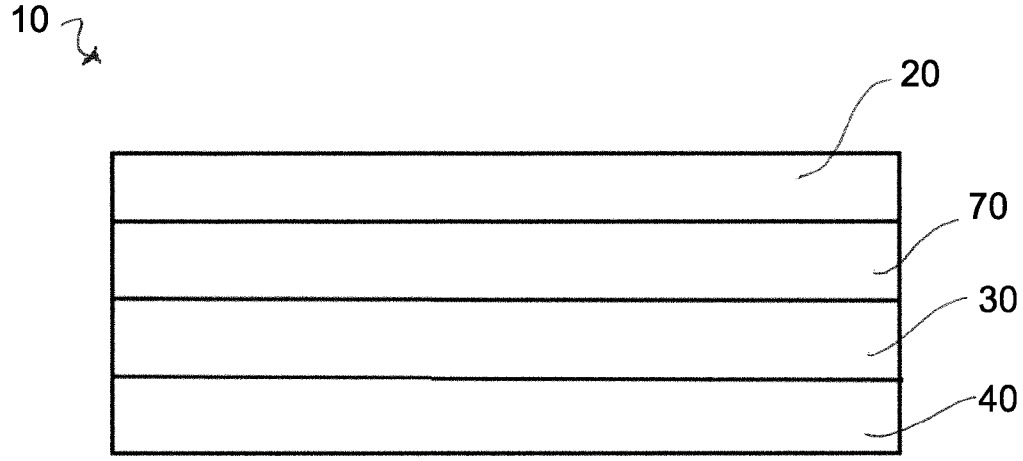


FIG. 3

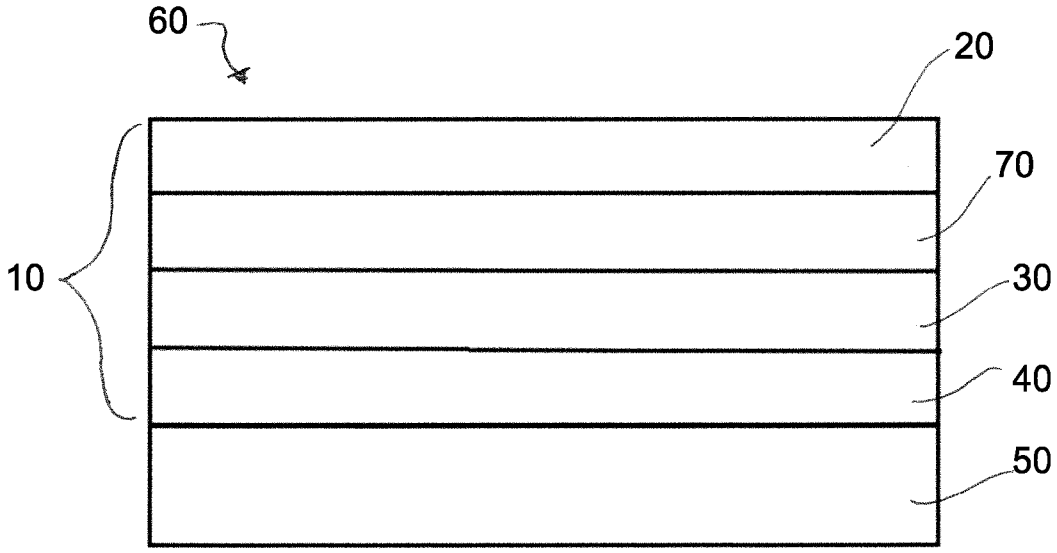


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2024/035776

A. CLASSIFICATION OF SUBJECT MATTER

INV. B32B27/12 B32B5/02 B32B5/18 B32B7/12 B32B27/06
B32B27/08 B32B27/32

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B32B C08J E04F G10K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2015/183383 A1 (PARK JUNG MIN [KR] ET AL) 2 July 2015 (2015-07-02) claims 1-3, 10 paragraphs [0042], [0057]	1-3, 11-14,20
X	WO 2022/219807 A1 (SHOWA DENKO MATERIALS CO LTD [JP]) 20 October 2022 (2022-10-20) figure 2 paragraphs [0020] - [0022], [0035] - [0046]	1,2,4,6, 7,9, 11-13, 15,20

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[x] Further documents are listed in the continuation of Box C.

[x] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance;; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Nowak, René

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2024/035776

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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