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(54) **Titre : ADHESIVIFS SURFACIQUES POUR PANNEAUX DE CONSTRUCTION**
(54) **Title: SURFACE ADHESIVES FOR BUILDING BOARDS**

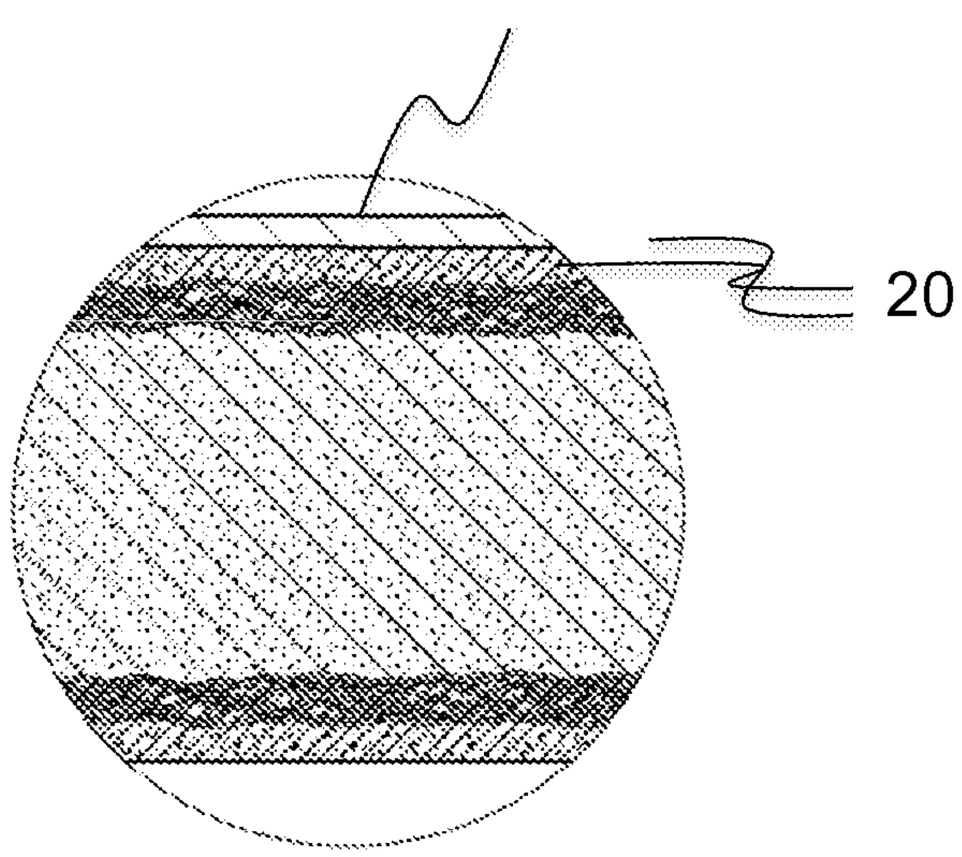

FIG. 3

(57) **Abrégé/Abstract:**
The present disclosure relates to performance enhancing surface coatings for building boards. More particularly, the disclosure relates to the using of building boards employing surface adhesives to eliminate the need for fasteners in holding building boards in place after installation.

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[Continued on next page]

(54) Title: SURFACE ADHESIVES FOR BUILDING BOARDS

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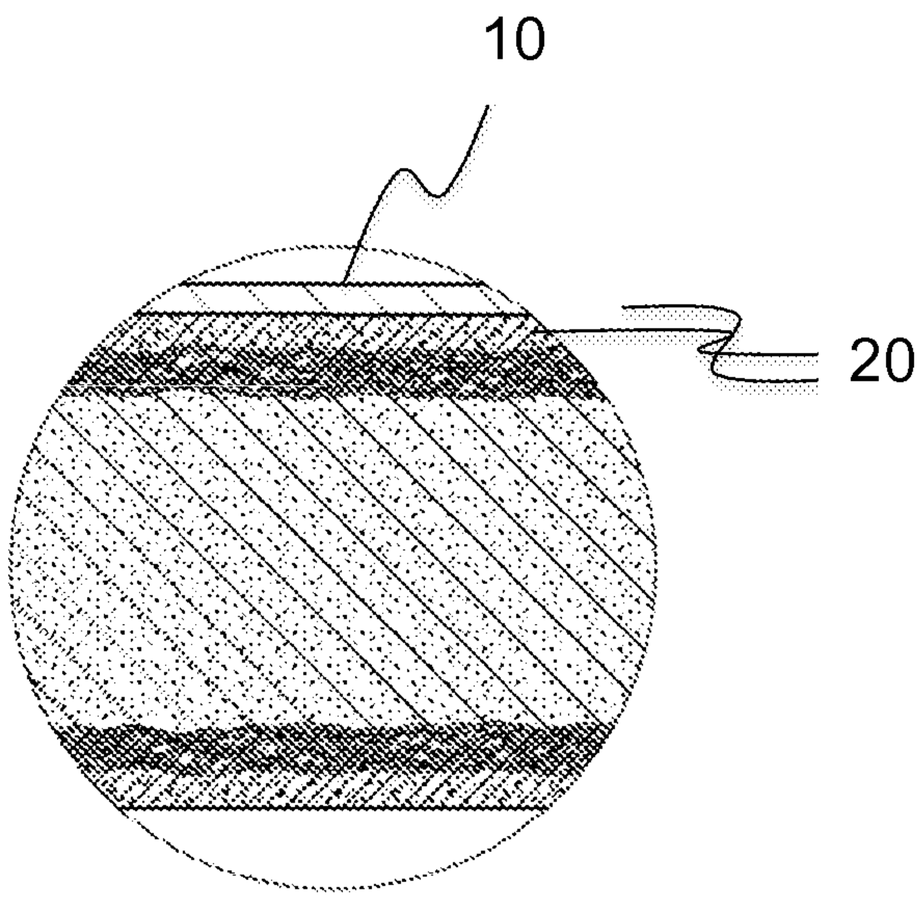

FIG. 3

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SURFACE ADHESIVES FOR BUILDING BOARDS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Application Ser. No. 61/926,524, filed Jan. 13, 2014, and entitled "Surface Adhesives for Building Boards," the contents of which are fully incorporated herein for all purposes.

TECHNICAL FIELD

[0002] This disclosure relates to surface adhesives for building boards. More particularly, this disclosure relates to building boards with an applied pressure sensitive adhesive.

BACKGROUND OF THE INVENTION

[0003] Building board, also known as wallboard, plasterboard, or drywall, is one of the most commonly used building components in the world today. Building board is frequently used within the interior or exterior of dwellings. One particularly popular form of building board is known as gypsum board. Gypsum board is constructed by depositing a layer of cementitious gypsum slurry between two opposing paper liners. Gypsum boards generally have a smooth external surface, a consistent thickness, and allow for the application of finishing enhancements, such as paint. One drawback of existing gypsum building boards is that it is often difficult to secure fasteners into the surface of the board. This complicates the task of hanging objects, such as pictures or shelving. It also poses problems for mounting the board on framing members. Gypsum board can also be used as a backing for tiles. Tile backing board is often used in high humidity environments such as bathrooms and pool areas. It is important for tile backing board to provide a firm hold on the tiles and at the same time be resistant to moisture.

[0004] One useful development is known as glass reinforced gypsum (GRG) board. An example of one such board is disclosed in U.S. Pat. No. 4,265,979 to Baehr et. al. Baehr discloses a paper-free gypsum board construction. A subsequent improvement is described in commonly owned U.S. Pat. No. 4,378,452 to Pilgrim. Pilgrim discloses a

GRG board that is faced on one or both sides with a porous, nonwoven glass mat. The glass mat of Pilgrim is slightly embedded into the slurry core.

[0005] A further embodiment was realized by embedding the mat within the core. The creates a thin film of slurry on the outer surface of the board. Building boards with this construction are referred to as embedded glass reinforced gypsum (EGRG) boards. EGRG boards eliminate, or greatly reduce, the presence of exposed fibers and otherwise provide a smooth working surface.

[0006] Thus, there exists a need in the art to provide building boards that can be easily and firmly secured to associated framing members. There also exists a need in the art for building boards that can easily and firmly hold finishing materials. The present disclosure fulfills these and other needs in the art by providing a pressure sensitive adhesive layer on the interior or exterior surface of a building board.

SUMMARY OF THE INVENTION

[0007] One of the advantages of this invention is realized by providing building boards that can be easily and firmly attached to associated framing members.

[0008] Another advantage is attained by including a polymer-based adhesive on the surface of the board that eliminates the need for external fasteners.

[0009] Yet another advantage is attained by applying a performance enhancing layer to the surface of a building board.

[0010] A further advantage is achieved by providing a polymer-based adhesive over top of a building board.

[0011] An additional advantage is realized by applying a polymer-based adhesive to the polymer modified dense slurry layer of a building board, thereby permitting the adhesive to bond to the slurry layer.

[0012] Various embodiments of the invention may have none, some, or all of these advantages. Other technical advantages of the present invention will be readily apparent to one skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] For a more complete understanding of the present disclosure and its advantages, reference is now made to the following descriptions, taken in conjunction with the accompanying drawings, in which:

[0014] FIG. 1 is a perspective view of a building board in accordance with the present disclosure.

[0015] FIG. 2 is a elevational view of a roller coater for use in applying the polymer-based adhesive of the present disclosure.

[0016] FIG. 3 is a cross sectional view taken along Line 2-2 of FIG. 1.

[0017] Similar reference characters refer to similar components throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE DRAWINGS

[0018] The present disclosure relates to coatings for building boards. In particular, the disclosure relates to pressure sensitive adhesives ("PSA"). These PSA coatings can be any of a variety of polymer based adhesives that are bonded to the surface of the board. The disclosed PSAs eliminate the need for fasteners, which are otherwise required to hang objects upon the board or hold boards in place after installation. The various components of the present invention, and the manner in which they interrelate, are described in greater detail hereinafter.

[0019] The PSAs **10** are thermoplastic based surface adhesives within an inner and an outer surface. The inner surface is adapted to adhere to an exterior surface of an underlying building board **20**. PSA **10** is preferably applied to the board via a roller coater **40**. In the preferred embodiment, the interior surface of PSA **10** is adhered to a polymer modified dense gypsum slurry layer (PMDSL) **30** that is formed at the exterior surface of board **20**. The PSA may include reactive and/or nonreactive components that chemically bond with one or more polymers in PMDSL **30**. When the PSA **10** is applied to the exterior surface of a building board **20**, the outer surface of PSA **10** functions as a binding adhesive for applied finishing materials. This eliminates the need for secondarily applied adhesive mechanisms to hold or affix the finishing materials. In particular, PSA **10** can be used to adhere decorative tiles to a gypsum wallboard (i.e.

tile backing board). The inner surface of PSA **10** is secured to the exterior surface of the tile backing board. The outer surface of the PSA **10** would then be used to firmly secure associated tiles. A release liner may optionally be used to cover the outer surface of PSA **10** until the tiles are adhered.

[0020] Alternatively, PSA **10** can be secured to the back, or interior surface, of a building board **20**. When applied in this manner, PSA **10** can be used to secure the building board to studs or framing members. This eliminates the use of traditional fasteners like screws or nails. It is also within the scope of the present disclosure to apply a PSA **10** to both the interior and exterior faces of board **20**.

Roller Coater Applied PSAs.

[0021] The PSAs disclosed herein can be directly applied to the surface of the underlying building board via one or more heated roller coaters. This allows the PSAs to be directly applied to the polymer modified dense gypsum slurry layer (PMSDL) in the underlying board. The roller coaters can be forward or rearward driven and may be heated. The rollers are used in applying a strong or weak chemical bond to the polymeric compound within the PMDSL. The application and metering roller are heated, and the application roll hardness is engineered to create the proper uniformity of the PSA coating applied to the topography of the PMDSL. The heated roller coater can coat either face of the building board singularly or simultaneously. The rollers can also apply the PSA in varied application volumes.

[0022] The pressure of the application roller is capable of applying varying pressures against the PMDSL to control the interrupted or continuous application of the PSA. The temperature of the rollers is selected based upon the rheology of the polymeric compound and is chosen to provide an engineered continuity of the PSA being applied. The gap between the application roller and the metering roller is varied to control the application rate of the PSA. The application rate can be varied depending upon the inherent heat, the particular rheology of the PSA, and/or the effect of desired operating temperature.

Reactive and Nonreactive PSAs.

[0023] The PSAs described herein are preferably applied after being heated to a liquefied stated. They can consist of reactive and/or nonreactive polymeric compounds. The nonreactive polymeric compounds within the PSA are fully polymerized polymeric compounds that are taken through a phase change to the liquid state thus allowing their application to the PMDSL. The basic structure of the original polymer (or polymers) are maintained, however, crosslinking and other aforementioned chemical bonding will occur.

[0024] When the PSAs include reactive components, they form a polymer matrix within the underlying PMDSL. More specifically, the reactive components within the PSA form a polymer matrix extension with polymer chains within the PMDSL. The reactive polymeric compounds within the PSA initiate as monomers and are then heated to improve kinetics. The reactive compounds subsequently polymerize upon application to the PMDSL. This polymerization is a result of their inherent properties.

[0025] The PSAs described herein can consist of one or more of the following thermoplastic materials, used singularly or in combination with one another: Acrylonitrile butadiene styrene (ABS), Celluloid, Cellulose Acetate, Ethylene-Butyl Acrylate, Ethylene-Methyl Acrylate, Ethylene Vinyl Acetate (EVA), Ethylene Vinyl Alcohol (EVAL), Fluoroplastics (PTFEs, including FEP, PFA, CTFE, ECTFE, ETFE), Ionomers, Liquid Crystal Polymer (LCP), Polyacetal (POM or Acetal), Polyacrylates (Melt and Cure Acrylics), Polyacrylonitrile (PAN or Acrylonitrile), Polyamide (PA or Nylon), Polyamide-imide (PAI), Polyaryletherketone (PAEK or Ketone), Polybutyadiene (PBD), Polybutylene (PB), Polybutylene Terephthalate (PBT), Polybutylene Terephthalate (PET), Polycyclohexylene Dimethylene Terephthalate (PCT), Polycarbonate (PC), Polyketone (PK), Polyester, Polyethylene/Polythene/Polyethane, Polyether Block Amide (PEBA), Polyetheretherketone (PEEK), Polyetherimide (PEI), Polyethersulfone (PES), Polyethylenechlorinates (PEC), Polyimide (PI), Polylactic Acid (PLA), Polymethylpentene (PMP), Polyphenylene Oxide (PPO), Polyphenylene Sulfide (PPS), Polyphthalamide (PPA), Polypropylene (PP), Polystyrene (PS), Polysulfone (PSU), Polyvinyl Chloride (PVC), Spectralon, thermoplastic Olefinic Elastomer (TPO).

[0026] The preferred water vapor permeability of the applied PSA coating may range from a minimum of .01 to a maximum of 98, thus the coating may be virtually impervious to the transmission of water vapor movement or completely open to the transmission of water vapor movement. Thermoplastic PSA translucence may range from .001 % to 100 % translucence.

[0027] The underlying thermoplastic coating and or the thermoplastic PSA coating may contain filler compounds which are intended for uses which may include but are not limited to color (opaque or translucent), UV resistance, tachifying property enhancement, thermal insulation, thermal conductivity, electrically conductivity, electrically non-conductivity, water resistance, water vapor transmission enhancement, water vapor transmission inhibition, light absorption, light refraction, sound propagation, sound inhibition, elastomeric enhancement, rigidity enhancement, impact resistance, puncture resistance, abrasion resistance, volumizing, densifying, fire resistance, and sound reverberation.

[0028] The PSA coating upon application may be engineered to offer desired surface topography that may range from smooth profile (having surface variations of .01 mils or less) to a coarse profile equivalent to a desired specification. The applied film thicknesses of the above mentioned PSA may range from a minimum of .01 mils to and maximum of 500 mils in thickness. The applied film thickness may be applied in one or multiple applications at varying or equivalent application temperatures and varying or equivalent application speeds. The melt point temperature of the PSA may range from a minimum of 100 degrees Fahrenheit to a maximum of 500 degrees Fahrenheit. The PSA coating may be applied immediately following the initial set of the gypsum substrate or anytime thereafter. The application of the PSA coating to the underlying substrate may be accomplished by any of the following: gravity fed, pump fed, forward or reverse roll coaters, or pump fed hot melt curtain coater. It is also within the scope of the invention to apply the PSA via hot melt spray systems, such as high pressure, low volume or low pressure, high volume methods. The PSA coating may be applied to any or all surfaces of the board. The PSA coating may be applied by means of continuous or non-continuous process methods. However, continuous coating methods are preferred.

Mechanics of the Coating Attachment

[0029] Dependent upon rheology, temperature, roller hardness, and coating volume the PSA may be applied to the upper or lower (face or back) topography of the building board. In one possible embodiment, the PSA can be applied so as to mirror the substrate topography. This mirroring of the topography provides mechanical bonding whereby the PSA coating attaches itself to the surface of the PMDSL via simply adhesive properties, by flowing into and throughout the open topographic areas of the PMDSL surface. This provides an adhesion and mechanical interlocking that is in reality a greater contact surface area than visibly evident.

[0030] Due to the polymer contained in the PMDSL, a myriad of chemical bonding opportunities are available. Correct selection of the polymeric compounds allow the application of Vanderwal, ionic, and valent & covalent bonds, and crosslinking bonds between the PMDSL polymer and the heat applied PSA. The PSA can be applied as a single layer or as a multilayer laminate. In the preferred embodiment, the PSA is applied to the PSMDL layer. Alternatively, the PSA can be applied to the glass face or cementitious pre-coated glass mat (also known as GRG board). The PSA can also be applied to paper faced gypsum building panels. It can likewise be applied to any of a variety of cementitious, hydraulic cement, magnesium based, or composite based building panels. Composite based building panels may include, for example, gypsum fiber boards. It can further be applied to any building panel intended for interior or exterior lining surfaces. Although these boards may include a PMDSL, it is within the scope of the present invention to apply the PSA directly to a glass faced or paper faced board.

[0031] Utilizing the aforementioned bonding, mechanical, and chemical adhesion properties single or multi PSA laminations may be incorporated into the resulting composite building panel. These PSA laminates may be engineered for a variety of different physical properties and may provide one or more of the follow characteristics:

- Engineered strength
- Electrically generated radiant heat

- Flexibility/impact/abuse/abrasion/sound/thermal/water/mold and mildew resistance enhancements

[0032] In use, the PSA is applied to the underlying board as noted above. The PSA can be applied to treated or untreated surfaces. It may likewise be adhered to prepared or partially prepared building panels. Thereafter, to aid in storage and transport, the PSA is covered with a specially treated release sheet. The release sheet prevents the PSA from adhering to other panels or objects when placed in stacks for warehousing or sale.

Fillers and Modifiers

[0033] The PSAs described herein may include one or more fillers or modifiers to increase the physical properties of the resulting building boards. Both reactive and nonreactive polymeric compounds provide the ability to suspend and encapsulate performance enhancing filler and or modifier. These fillers and modifiers may provide one or more of the following enhancements:

- Electrical conductivity
- EMF resistance
- Lower polymeric densities
- Sound attenuation
- Water resistance
- Intumescent and or fire resistant enhancers
- Heat transfer resistance
- Elastomeric performance enhancers

[0034] The PSA may be applied to the face and or back of building panels and functions as a binding adhesive for applied finishing materials. This eliminates the need for secondarily applied adhesive mechanisms to hold or affix the finishing materials. When applied to the back of a building panel, the PSA eliminates the use of traditional fasteners like screws, nails and or both.

[0035] When used as a mechanism applied to the back stud installation side of the building panel, the PSA offers an improved affixing, holding, and securing characteristics. This improvement is realized with both organic and or inorganic structural studs and or framing members. The PSA can improve pounds force resistance by between .01 times to 100 times than that achieved with traditional fasteners like nails and or screw.

[0036] Although this disclosure has been described in terms of certain embodiments and generally associated methods, alterations and permutations of these embodiments and methods will be apparent to those skilled in the art. Accordingly, the above description of example embodiments does not define or constrain this disclosure. Other changes, substitutions, and alterations are also possible without departing from the spirit and scope of this disclosure.

WHAT IS CLAIMED IS:

1. A building board construction comprising:

a gypsum panel including interior and exterior surfaces and a set gypsum core, the exterior surface including a dense gypsum layer that includes a reactive polymer material;

an adhesive layer having interior and exterior surfaces and a thickness within the range of about .01 mils to about 500 mils, the interior surface of the adhesive layer secured to dense gypsum layer, the adhesive layer including a thermoplastic material that reacts with the polymer material within the dense gypsum layer, whereby a polymer matrix is formed once the adhesive layer is secured to the dense gypsum layer;

a series of decorative tiles secured to the exterior surface of the adhesive layer.

2. The building board construction as described in Claim 1 wherein the thermoplastic material comprises Acrylonitrile butadiene styrene (ABS).

3. The building board construction as described in Claim 1 wherein the thermoplastic material comprises Ethylene Vinyl Acetate (EVA).

4. The building board construction as described in Claim 1 wherein the melting point of the adhesive layer is between about 100 degrees Fahrenheit to about 500 degrees Fahrenheit.

5. The building board as described in Claim 1 wherein the adhesive layer is applied via a roller coater immediately following the initial set of the gypsum panel.

6. A building construction comprising:

a building panel including interior and exterior surfaces, the interior surface including a polymer material;

an adhesive layer secured to the interior surface of the building panel, the adhesive layer including a thermoplastic material that is reactive with the polymer

material within the interior surface of the building panel, whereby a polymer matrix is formed between the adhesive layer and the interior surface;

a building framing member, the adhesive layer functioning the secure the building panel to the framing member.

7. The building construction as described in Claim 6 wherein the adhesive layer includes a release liner.

8. The building construction as described in Claim 6 wherein the building panel is formed from hydraulic cement.

9. The building construction as described in Claim 6 wherein the building panel is formed from a magnesium based cement.

10. The building board construction as described in Claim 6 wherein the thermoplastic material comprises Acrylonitrile butadiene styrene (ABS).

11. The building board construction as described in Claim 6 wherein the thermoplastic material comprises Ethylene Vinyl Acetate (EVA).

12. The building board construction as described in Claim 6 wherein the melting point of the adhesive layer is between about 100 degrees Fahrenheit to about 500 degrees Fahrenheit.

13. A building board construction comprising:

a composite building panel including interior and exterior surfaces;

a pressure sensitive adhesive layer applied to one of the surfaces of the composite building panel, the adhesive layer including a thermoplastic material.

14. The building board construction as described in Claim 13 wherein the composite building panel includes a fibrous mat on one of the surfaces and wherein the pressure sensitive adhesive is applied to the fibrous mat.

15. The building board construction as described in Claim 13 wherein the composite building panel includes a paper face on one of the surfaces and wherein the pressure sensitive adhesive is applied to paper face.

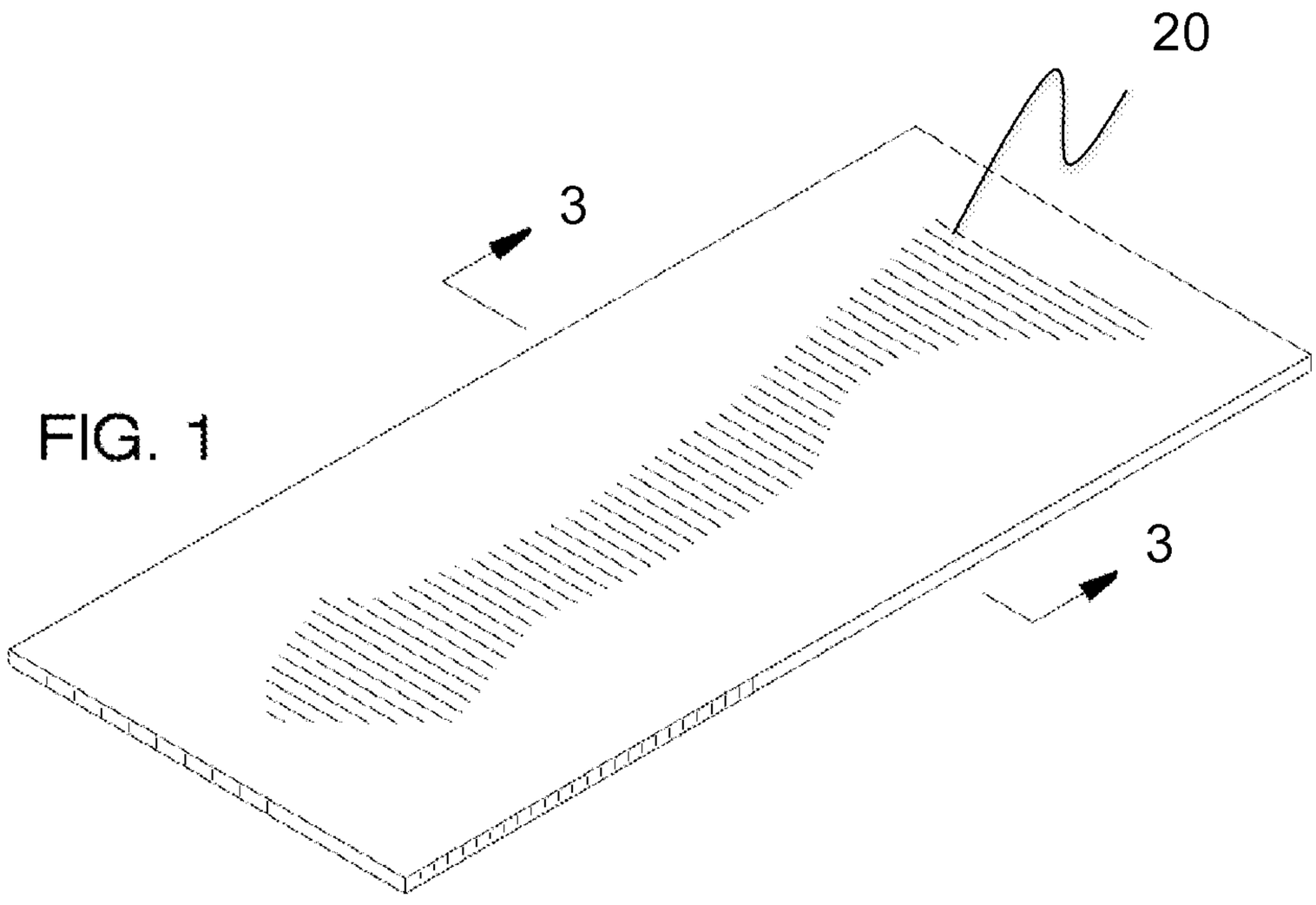


FIG. 1

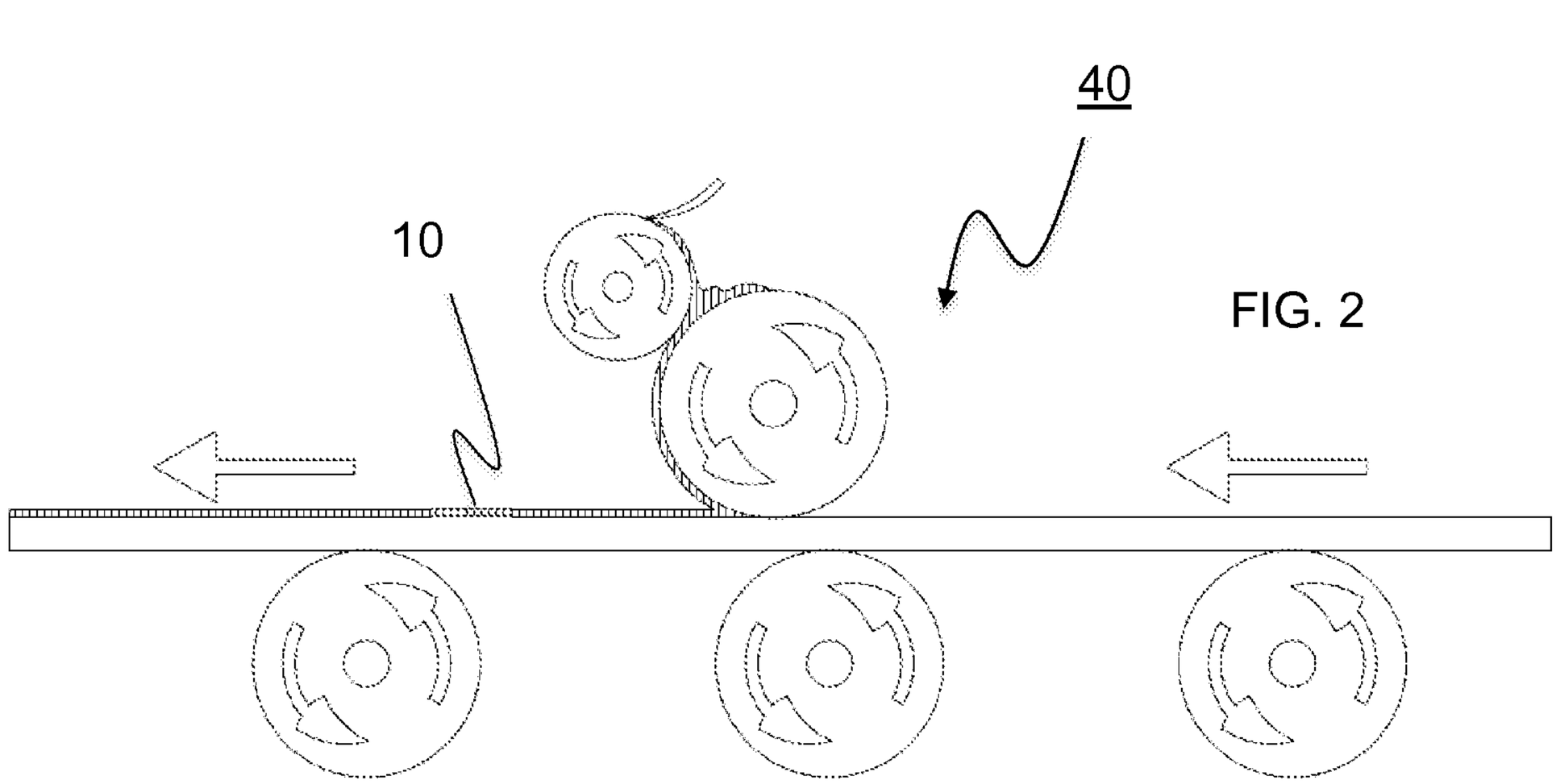


FIG. 2

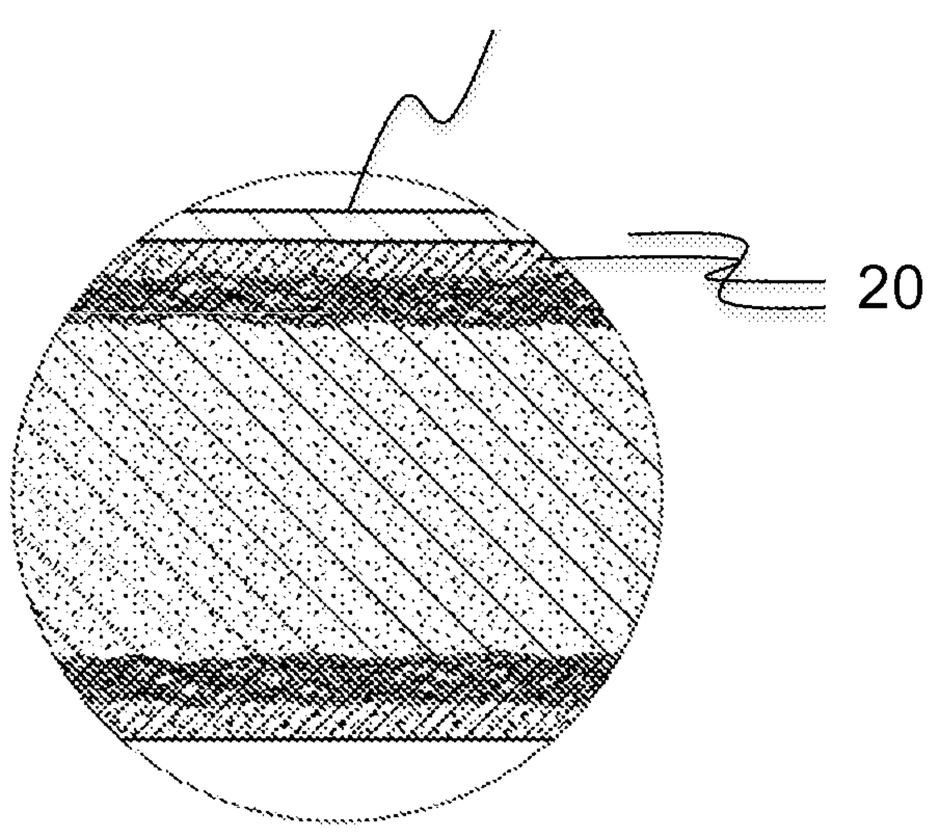
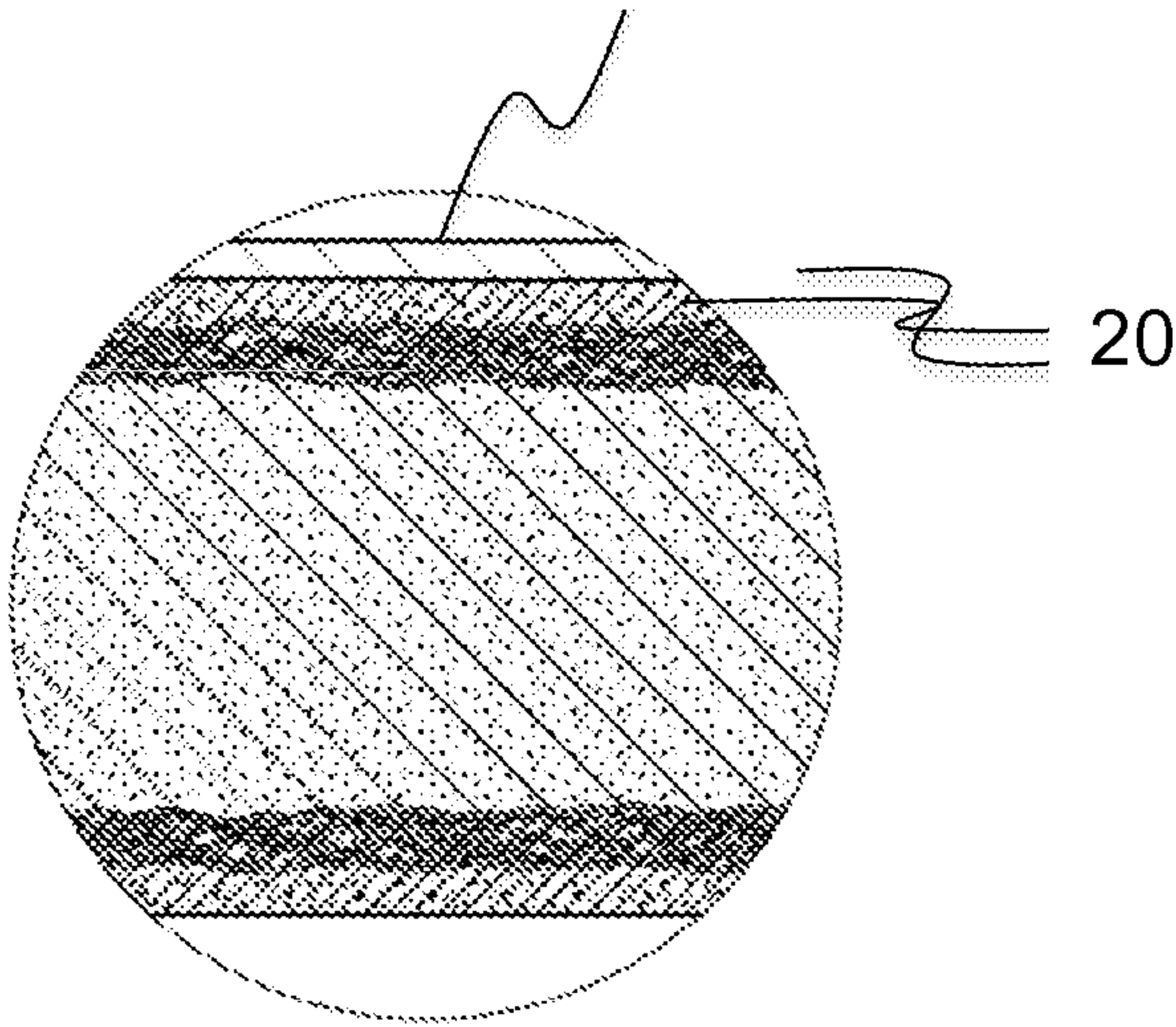


FIG. 3



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