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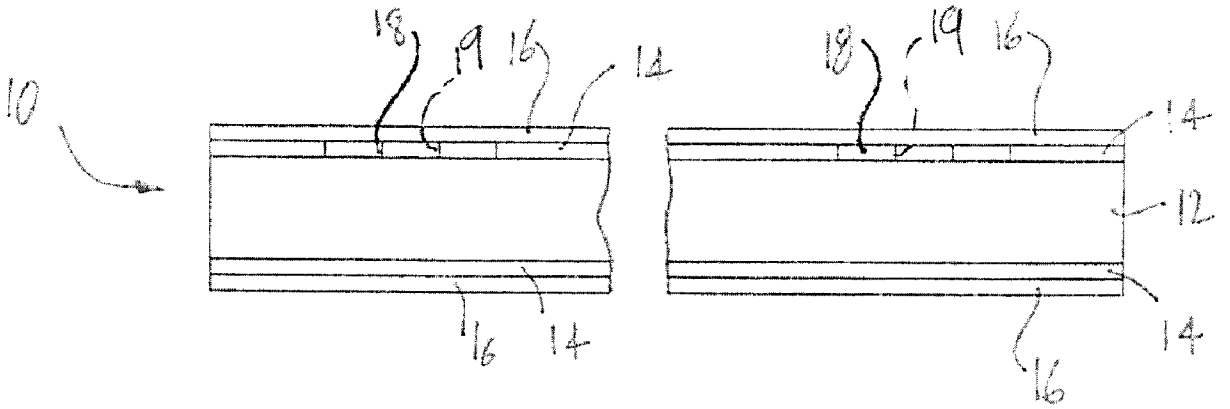
(72) Inventeur/Inventor:
MCGUIRE, LUC, CA

(73) Propriétaire/Owner:
MCGUIRE, LUC, CA

(74) Agent: NORTON ROSE FULBRIGHT CANADA LLP/S.E.N.C.R.L., S.R.L.

(54) Titre : PANNEAU COMPOSITE INTERMEDIAIRE POUR TOITURE ET MURS
(54) Title: INTERMEDIATE COMPOSITE PANEL FOR ROOFING AND WALLS



(57) Abrégé/Abstract:
A composite intermediate panel comprises a structural layer providing the structural integrity of the composite intermediate panel. Pressure-sensitive adhesive layers are on opposite main surfaces of the structural panel, the pressure-sensitive adhesive layers applied in plant. A backing sheet layer is provided for each adhesive layer, the backing sheet layer adhered to the pressure-sensitive adhesive layer, and being peelable off the pressure-sensitive adhesive layer to expose the pressure-sensitive layer. Attachment units of rigid material are on one of the main surfaces of the building panel, the attachment units being positioned at a location where mechanical fasteners secure the building panel to a structure.

ABSTRACT

A composite intermediate panel comprises a structural layer providing the structural integrity of the composite intermediate panel. Pressure-sensitive adhesive layers are on opposite main surfaces of the structural panel, the pressure-sensitive adhesive layers applied in plant. A backing sheet layer is provided for each adhesive layer, the backing sheet layer adhered to the pressure-sensitive adhesive layer, and being peelable off the pressure-sensitive adhesive layer to expose the pressure-sensitive layer. Attachment units of rigid material are on one of the main surfaces of the building panel, the attachment units being positioned at a location where mechanical fasteners secure the building panel to a structure.

INTERMEDIATE COMPOSITE PANEL FOR ROOFING AND WALLS

FIELD OF THE APPLICATION

[0001] The present application relates to multi-layer construction or building panels and, more particularly, to a intermediate composite panel such as roofing or wall panel and methods of manufacturing and assembling same.

BACKGROUND ART

[0002] In the construction industry, multilayer panels are frequently used, as such panels offer multiple functions related to the layers that compose them. Such multilayer panels can benefit from their various layers (e.g., elastomeric, asphalt, fiberboard, EPS or XPS, fiberglass, mineral wool etc.) to offer features such as structural support, waterproofness, insulation and fire-resistance.

[0003] In fabricating multilayer panels in factory, in plant, there results faster installation at the construction site, and therefore a reduction on the labor required. Moreover, the quality of assembly of the multilayer panel is controlled in plant, while the assembly of multiple layers on the construction site may result in some errors and incorrect assembly.

SUMMARY OF INVENTION

[0004] It is an aim of the present invention to provide a novel construction panel for walls and/or roofing providing additional features.

[0005] The panel is a composite product that is made in factory so as to have controlled quality.

[0006] Therefore, in accordance with the present application, there is provided a composite intermediate panel comprising: a structural layer providing the structural

integrity of the composite intermediate panel; pressure-sensitive adhesive layers on opposite main surfaces of the structural panel, the pressure-sensitive adhesive layers applied in plant; a backing sheet layer for each adhesive layer, the backing sheet layer adhered to the pressure-sensitive adhesive layer, and being peelable off the pressure-sensitive adhesive layer to expose the pressure-sensitive layer; and at least one attachment unit of rigid material on at least one of the main surfaces of the building panel, the at least one attachment unit being positioned at a location where mechanical fasteners secure the building panel to a structure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Fig. 1 is a side view, fragmented, of an intermediate composite panel constructed in accordance with an embodiment of the present disclosure;

[0008] Fig. 2 is a side view, fragmented, of an intermediate composite panel similar to that of Fig. 1, with an additional functional layer;

[0009] Fig. 3 is a side view, fragmented, of an intermediate composite panel similar to that of Fig. 1, with rabbet edges;

[0010] Fig. 4 is a side view of a bottom layer of the intermediate composite panel of Fig. 1, as mounted to a structure, with a top layer of composite panel thereon; and

[0011] Fig. 5 is a top plan view of the intermediate composite panel of Figs. 1 and 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] Referring now to the drawings, and more particularly to Figs. 1 and 5, an intermediate composite insulated building panel constructed in accordance with an embodiment is

generally shown at 10, and is also referred to as multilayer building panel.

[0013] In the embodiment of Fig. 1, the insulated building panel 10 has five layers, namely a structural layer 12, adhesive layers 14, and backing sheet layers 16. Additionally, attachment units 18 are provided on one of the surfaces of the building panel 10.

[0014] The structural layer 12 provides structural integrity to the building panel 10. More specifically, the structural layer 12 may be a relatively rigid panel made of a polymeric material, such as urethane-based polymers (e.g., polyisocyanurate) or polystyrene, among possibilities. Such material have some structural properties in addition to insulation properties. Moreover, an additive is optionally used to add a flame and/or smoke retardant property to the structural layer 12. In another embodiment, all six faces of the structural layer 12 are coated with asphalt. As an alternative to the materials suggested above, it is considered to have layer 12 made of a perlite panel, rock wool, wood fibers, expanded or extruded polystyrene, polyurethane, polyisocyanurate, cement, gypsum or other materials. Coatings may be used to treat the structural layer 12 before the application of the adhesive layer 14, to ensure optimal adherence of the adhesive. The material(s) used for the structural layer 12 are dependent on the contemplated use. For instance, the structural layer 12 may be used for sound insulation, thermal insulation, or the like.

[0015] The thickness of the structural layer 12 is selected as a function of the contemplated use of the building panel 10 (e.g., flat roof, pitch roof, wall, ceiling, etc.). For instance, a suitable thickness for the structural layer 12 ranges between 0.25" to 8.0" (with the thicker range including a functional layer, as described hereinafter).

[0016] The adhesive layers 14 respectively cover at least a portion of the two main surfaces of the structural layer 12, if not a substantial portion, or a complete coverage of the main surfaces. It is pointed out that all six surfaces of the structural layer 12 may be covered with adhesive layers 14. The adhesive for the layer 14 is a pressure-sensitive, auto adhesive applied in plant, whereby the adhesive must maintain adhering properties at ambient temperatures. As an example, the adhesive used for the layer 14 may be at least one of a bitumen adhesive, polyurethane resin, urethane and polyurethane-based adhesive, asphaltic urethane, solvent-based or solvent-free adhesives, acrylic adhesive, chlorinated asphaltic composite, synthetic-polymer adhesives, polyvinyl acetate, polyvinyl alcohol, polyester adhesives, neoprene, butyl rubber, thermoplastic elastomers.

[0017] The adhesive layers 14 may cover only a portion of the two main surfaces of the structural layer 12, and be applied in a linear pattern, or as points, among other possibilities.

[0018] As an example, the adhesive may be applied by a continuous manufacturing process, such that the layers 14 may cover the full surface of the structural layer 12, or parts of the surface. In an embodiment, between 0.04-0.20 lb/ft^2 of adhesive is applied, although more or less adhesive may be used depending on the conditions in which the building panel 10 will be used. A suitable thickness of adhesive for given conditions ranges between 1/64" and 1/8". Again, there may be required more or less adhesive depending on the conditions in which the building panel 10 will be used. By adding the adhesive layer 14 in plant, automated equipment may be used, ensuring that the suitable amount of adhesive is applied, as a lack or an excess of adhesive may affect the performance. For instance, it is considered to use a roll applicator, with induction. The application of adhesive may be followed up by

another heating step (e.g., on a conveyor with radiant heating capabilities). Also, the conditions of adhesive application may be controlled in plant, such as temperature, and humidity. The heating steps may be performed to reduce the water content in the adhesive layer 14 in embodiments in which a water-based adhesive is used.

[0019] It is considered to provide regions (e.g., strips) without adhesive, to ease the manipulation of the panel 10. For instance, when there is an adhesive layer 14 on both faces of the panel 10, such regions can be identified to guide the installer in manipulating the panel 10 by these regions. Also, gloves that do not adhere to the adhesive may also be used. The regions can also be used for marking the panel 10. These regions may be longitudinal strips extending along the full length of the panel 10, as generally illustrated as A in Fig. 5

[0020] The backing sheet layers 16 are installed on the respective adhesive layers 14 also in plant. By installing it quickly after the adhesive layers 14 have been applied (e.g., taking into account a curing time), the backing sheet layer 16 protects the adhesive layer 14 from dust contamination and loss of tackiness. The backing sheet layers 16 are made of material suited for a manual peeling-off action. Therefore, adherence between the adhesive layers 14 and the backing sheet layers 16 is relatively low, while the backing sheet layer 16 has tear-resistance properties. The backing sheet layer 16 may be made of plastic, thermo-fusible plastic, paper, plasticized paper, Kraft paper, organic felt, fiberglass, to fully cover the adhesive layer 14.

[0021] In an embodiment, the backing sheet layer 16 is applied above given temperatures to ensure a suitable bond with the adhesive layer 14 (e.g., above 5°C). An in-plant stabilization period to allow the layers 14 and 16 to bond may also be required. Moreover, a combination of the adhesive

layer 14 and backing sheet layer 16 may be applied to a first side of the panel 10, to then apply layers 14 and 16 to the other side of the panel 10.

[0022] The attachment units 18 are preferably positioned onto the adhesive layer 14, prior to the addition of the backing sheet layer 16, on one side of the panel 10. The attachment units 18 therefore remain in position by adhering to the adhesive layer 14. The backing sheet layer 16 may have marks on its surface to indicate where the attachment units 18 are located, such that the panel 10 may be fixed to the structure by mechanical fasteners without the prior removal of the top backing sheet layer 16.

[0023] The attachment units 18 are typically strips of a rigid material (e.g., metals such as galvanized steel, aluminum, stainless steel, or polymeric material). The attachment units 18 may be pre-perforated with holes 19 to receive mechanical fasteners. The attachment units 18 will act as interfaces between mechanical fasteners and the panel 10, to solidify the interaction between mechanical fasteners and panel 10. The holes 19 (e.g., pre-perforated) in the attachment strips 18 may be distributed over the full length of the strips 18, to provide numerous possible fastening locations all along the strip 18. Therefore, when the panel 10 is connected to uneven surfaces, such as that of a steel deck, the plurality of fastening locations (i.e., holes 19) ensure that the fasteners can be aligned parts of the uneven surface (e.g., ridges of the steel deck). In the case of a steel deck, the strips 18 are preferably placed in a transverse or diagonal relation with the ridges of the steel deck.

[0024] The pre-perforated holes 19 may have any appropriate shape, such as round, obround, rectangular, etc. In a embodiment, the strips 18 do not have any pre-perforated holes. Self-tapping fasteners may be used to secure the panel

10 to a surface or structure, and adequately tap through the strip 18 if there are no pre-perforated holes. An example of measurement of the strip 18 is a width of 1" for a thickness of 0.07". The length is as a function of the dimensions of the panel 10. For instance, the strip 18 may have a length of 18" ± 2" for on the 48" width of the panel.

[0025] According to an embodiment, the number of attachment units 18 provided on the panel 10 corresponds to the required retention force of mechanical fasteners, taking into account the presence of the adhesive layer 14 contributing to the mechanical bond of the panel 10 to a structure.

[0026] According to another embodiment, the attachment units 18 are adhered directly to the backing sheet layer 16 or between the adhesive layer 14 and the backing sheet layer 16, and are therefore exposed from a top surface of the panel 10. In such a case, mechanical fasteners are firstly used to secure the panel 10 to the structure, and the backing layer sheet 16 is then removed, ripping about the attachment units 18 or the mechanical fasteners to expose the adhesive layer 14. In this case, an installer will not contaminate the adhesive layer 14 by contacting same.

[0027] In order to install the panel 10 to a structure, one of the backing sheet layers 16 is manually peeled off from a remainder of the panel 10, thereby exposing the adhesive layer 14. The peeling off is preferably performed just before the installation of the panel 10, to limit the exposure of the adhesive layer 14 to the ambient air at the construction site, and thus limit the loss of tackiness due to solid contaminants present in the air (e.g., dust, dirt). Moreover, the adhesive layer 14 is selected for use at the temperature of the construction site. This way, there is no curing time during which the adhesive of layer 14 is exposed to the contaminants. The panel 10 is pressed against the structure such that the adhesive contacts the structure. Tools such as rollers may be

used to ensure a complete contact of the panel 10 with the structure.

[0028] As shown in Fig. 4, mechanical fasteners 20 are then installed to further secure the panel 10 to the structure A. The mechanical fasteners 20 are for instance self-tapping screws, that will purchase into the material of the attachment units 18, and into the structure A. Moreover, the head of the fastener 20 abuts against the surface of the attachment unit 18, to apply some pressure onto the attachment unit 18 and keep the panel 10 against the structure A.

[0029] The second backing sheet layer 16 is then peeled off the upwardly-facing side of the panel, and components (e.g., shingles, roofing panels, membranes, gypsum panel, etc) may be pressed into adhesion with the upper adhesive layer 14 of the panel 10.

[0030] In the embodiment of Fig. 2, the insulated building panel 10 has six layers, namely the structural layer 12, the adhesive layers 14, the backing sheet layers 16, as well as a functional layer 22 sandwiched between the structural layer 12 and one of the adhesive layers 14. The functional layer 22 provides additional functions to the building panel 10 described above (e.g., vapor barrier, air barrier, etc).

[0031] In one embodiment, the building panel 10 is used as a roofing panel, used either for exterior sides of roofs, or interior sides of ceilings. In outdoor applications, the functional layer 22 may form an air/water barrier that is oriented toward the exterior of the building with respect to the layer 12. The use of the functional layer 22 as air barrier gives the panel 10 the characteristic of resisting to the passage of water (e.g., rain) while being relatively permeable to vapor. The air-barrier functional layer 22 generally prevents outdoor air from infiltrating the building or indoor air from exfiltrating through the envelope made of building panels 10. Contemplated materials amongst others for

the air-barrier functional layer 22 include woven alkenes bound by polypropylene or other polymers, spun polyolefin optionally bound by polymers, sheeted polyethylene. The air barrier is optional if the building panel 10 is used for indoor applications.

[0032] If the building panel 10 is used as a roofing panel, the functional layer 22 may consist of an elastomeric material which forms the waterproof layer of the building panel 10, preventing water infiltration through the building panel 10 used as part of the roof.

[0033] In indoor applications, the functional layer 22 may form a vapor barrier that is oriented toward the interior of the building with respect to the layer 12. The use of the functional layer 22 as vapor barrier gives the panel 10 the characteristic of being impermeable to the passage of vapor. Accordingly, the functional layer 22 prevents vapor from reaching the structural layer 12 from the interior of the building. Contemplated materials amongst others for the vapor-barrier functional layer 22 include woven polyethylene, woven polypropylene or mixtures thereof, kraft paper with polyethylene, some types of paint or polymers, adhesives and sealants, concrete. The vapor barrier is optional if the building panel 10 is used for indoor applications.

[0034] In another embodiment, also illustrated by Fig. 2, the functional layer 22 is an insulation layer providing the highest thermal value of the layers of the panel 10 and is therefore primarily added for its insulation properties. The insulation layer 22 is preferably selected from expanded polymers. In an embodiment, the insulation layer 22 is expanded polystyrene, molded or cut. Other polymeric materials considered for the insulation layer 22 include non-exclusively expanded and extruded polystyrene, polyisocyanurate (modified polyurethane), as well as expanded resins such as expanded polypropylene, expanded polyethylene,

Arcel™, and the like, and mineral fibers and glass fibers. It is considered to use fire-retardant or flame-retardant additives in the insulation layer 22.

[0035] The thickness and density of the insulation layer 18 are selected as a function of the desired insulating value required from the building panel 10. For instance, a suitable thickness for the insulation layer 22 ranges between 0.25" to 4.0".

[0036] The multilayer building panel 10 is assembled in plant/factory. The various layers forming the building panel 10 are bound using suitable adhesives in a laminated fashion. As an example, a polyvinyl adhesive (PVA glue), water-based, asphalt-based or pressure-sensitive adhesives, or hot-melt adhesives may all suitably be used to bond the layers 12 and 22.

[0037] Accordingly, the use of the building panel 10 simplifies the construction of walls, ceiling and roofs (e.g., flat roof, pitch roof), in that a composite panel provides simultaneously the features of waterproofness and insulation with stable features since it is assembled in factory in reproducible conditions. Moreover, the presence of the attachment units 18 for use in combination with mechanical fasteners 20 will increase the mechanical strength of the fixation of the panel 10 to the structure A.

[0038] In order to facilitate the on-site assembly of building panels 10 in side-by-side arrangement to form a roof, a wall or a ceiling, various configurations of the panel 10 are considered. In addition to the flat edges of the panel 10 as illustrated in Fig. 1, a few other configurations are illustrated in Fig. 3.

[0039] Referring to Fig. 3, the structural layer 12 defines rabbets 30 on two edges of the panel 10, for complimentary engagement of adjacent composite panels 10. All four side edges of the panel 10 may be provided with rabbets 30.

[0040] In roof applications for the building panel 10, once the panels 10 form a roof surface by being positioned side by side with mechanical fasteners 20 solidifying the attachment, another layer of panels 10 may be secured onto the first layer, as shown in Fig. 4. In such a case, the second layer is simply secured to the first layer by way of the adhesive layers 14, and thus without mechanical fasteners 20. Hence, in the embodiment of Fig. 4, a top layer of panels 10 is provided. As shown in Fig. 4, the top layer of panels 10 is arranged to overlap a joint between the panels 10 of the lower layer. As the top layer of panels 10 positioned atop another layer are not necessarily bound to the roof by mechanical fasteners as mentioned above, the top layer may be without attachment units 18 as shown in Fig. 4.

[0041] When the building panel 10 is used as a wall or ceiling panel, well-suited dimensions are 4' width by 8' height or 4' width by 4' height, according to standards in the construction industry. Other dimensions are also considered.

[0042] It is observed that the building panel 10 as described above has sound attenuating qualities. Accordingly, the panel 10 may be used as a wall panel and/or ceiling panel for sound insulation through walls and floors/ceilings (e.g., the panel 10 may be an acoustic floor panel). The embodiments of Figs. 1 to 4 allow the panels 10 to provide given functions as described above (e.g., structural force, sound attenuation, insulation, etc), while serving as mechanical link between components. For instance, the panels 10 may be connected on one side to a wooden structure, while supporting on the other side roofing panels, gypsum, etc.

[0043] The panel 10 intends to ease the installation and to reduce the labour required on construction sites. The intermediate composite panel allows suitable resistance (e.g. wind uplift resistance for roofing applications) with less mechanical fasteners, due to the presence of an adhesive.

Moreover, the panel 10 of the present disclosure will cause lower thermal and/or sound conductivity into systems (roofs, walls, ceilings and floors) in comparison to panels requiring more fasteners. Indeed, a larger amount of mechanical fasteners will increase undesired thermal, sound and vapour conductivity into dwellings.

CLAIMS:

1. A composite intermediate panel comprising:

a structural layer providing the structural integrity of the composite intermediate panel;

pressure-sensitive adhesive layers on opposite main surfaces of the structural layer, the pressure-sensitive adhesive layers applied in plant;

a backing sheet layer for each adhesive layer, the backing sheet layer adhered to the pressure-sensitive adhesive layer, and being peelable off the pressure-sensitive adhesive layer to expose the pressure-sensitive layer; and

at least one attachment unit of rigid material on at least one of the main surfaces of the building panel spaced apart from edges of the structural layer and covering at most a fraction of the at least one of the main surfaces, the at least one attachment unit being positioned at a location where mechanical fasteners secure the building panel to a structure.

2. The composite intermediate panel according to claim 1, wherein the at least one attachment unit is between the pressure-sensitive adhesive layer and the backing sheet layer.

3. The composite intermediate panel according to claim 2, further comprising a visual indicator on the backing sheet layer to indicate a position of the at least one attachment unit.

4. The composite intermediate panel according to any one of claims 1 to 3, wherein the at least one attachment unit is a longitudinal attachment strip.

5. The composite intermediate panel according to claim 4, wherein the longitudinal attachment strip has a length ranging between 16" and 20", on a width of the composite intermediate panel.

6. The composite intermediate panel according to claim 5, wherein the width of the composite intermediate panel is about 48".

7. The composite intermediate panel according to any one of claims 1 to 6, wherein the at least one attachment unit is made of metal.

8. The composite intermediate panel according to any one of claims 1 to 7, further comprising rabbets at edges of the structural layer for side by side assembly of two of the composite intermediate panel.

9. The composite intermediate panel according to any one of claims 1 to 8, wherein the pressure-sensitive adhesive comprise at least one of a bitumen adhesive, polyurethane resin, urethane and polyurethane-based adhesive, asphaltic urethane, solvent-based or solvent-free adhesives, acrylic adhesive, chlorinated asphaltic composite, synthetic-polymer adhesives, polyvinyl acetate, polyvinyl alcohol, polyester adhesives, neoprene, butyl rubber, and thermoplastic elastomers.

10. The composite intermediate panel according to any one of claims 1 to 9, wherein the structural layer has a thickness ranging between 0.25" and 8.0" inclusively.

11. The composite intermediate panel according to any one of claims 1 to 10, wherein each said pressure-sensitive

adhesive layer has between 0.04-0.20 lb/ft^2 inclusively of adhesive.

12. The composite intermediate panel according to any one of claims 1 to 11, wherein the backing sheet layer is made with at least one of plastic, thermo-fusible plastic, paper, plasticized paper, Kraft paper, organic felt, and fiberglass.

13. The composite intermediate panel according to any one of claims 1 to 12, wherein the at least one attachment unit has a hole to receive a fastener.

14. The composite intermediate panel according to any one of claims 1 to 13, further comprising a functional layer between the structural layer and one of the pressure-sensitive adhesive layers.

15. The composite intermediate panel according to claim 14, wherein the functional layer is an air barrier made of one of woven alkenes bound by polymers, spun polyolefin bound by polymers, and sheeted polyethylene.

16. The composite intermediate panel according to claim 14, wherein the functional layer is a vapor barrier made of at least one of woven polyethylene, woven polypropylene, mixtures woven polyethylene and woven polypropylene, kraft paper with polyethylene, paint, polymers, adhesives, sealants, and concrete.

17. The composite intermediate panel according to claim 14, wherein the functional layer is an insulating barrier made at least one of expanded polystyrene, extruded polystyrene, polyisocyanurate, expanded resins, mineral fibers and glass fibers.

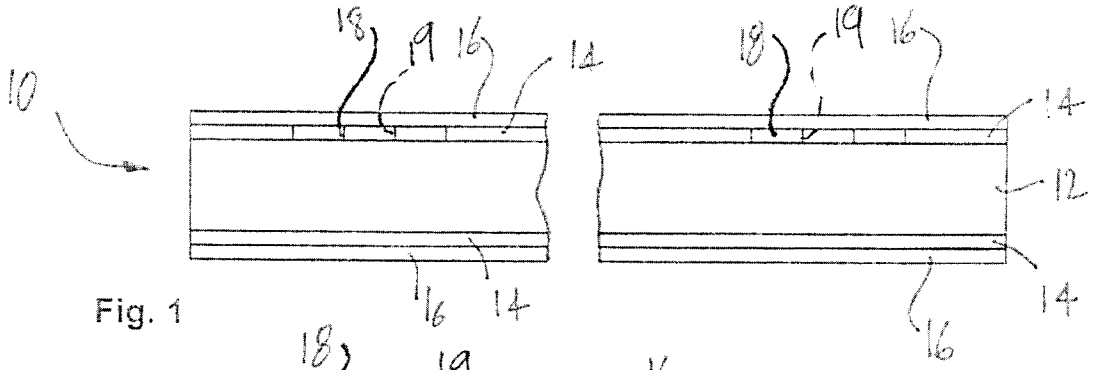


Fig. 1

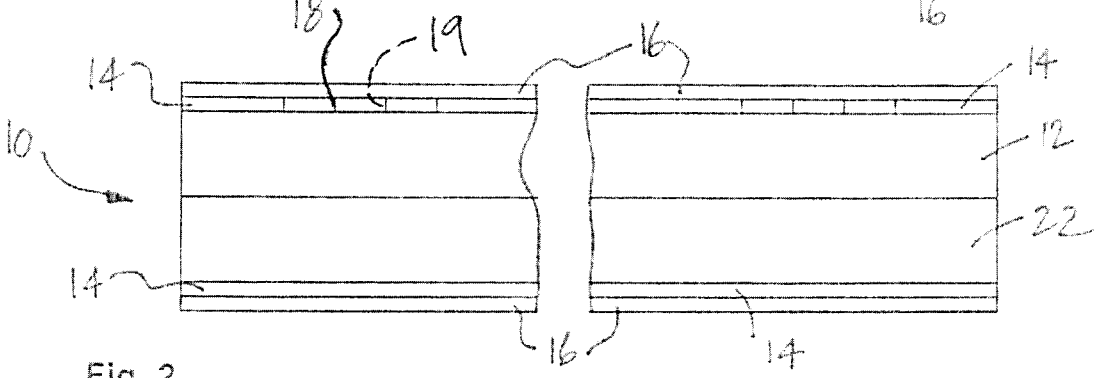


Fig. 2

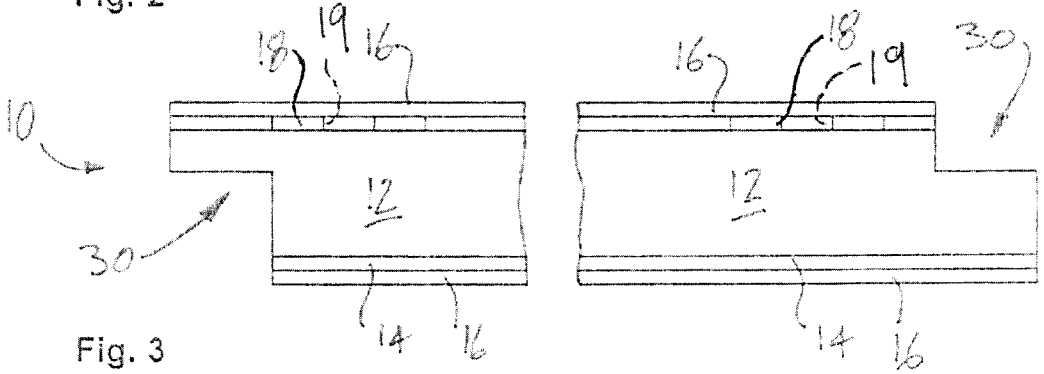


Fig. 3

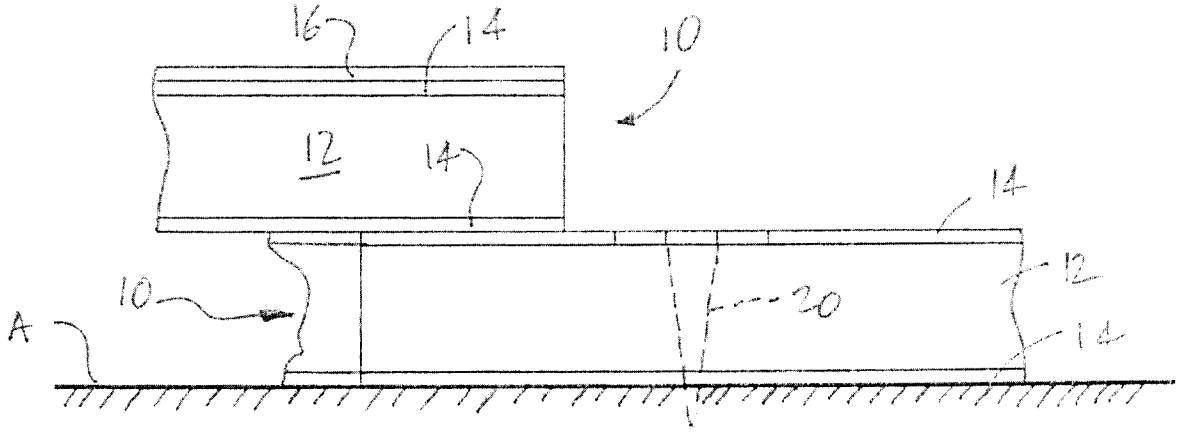


Fig. 4

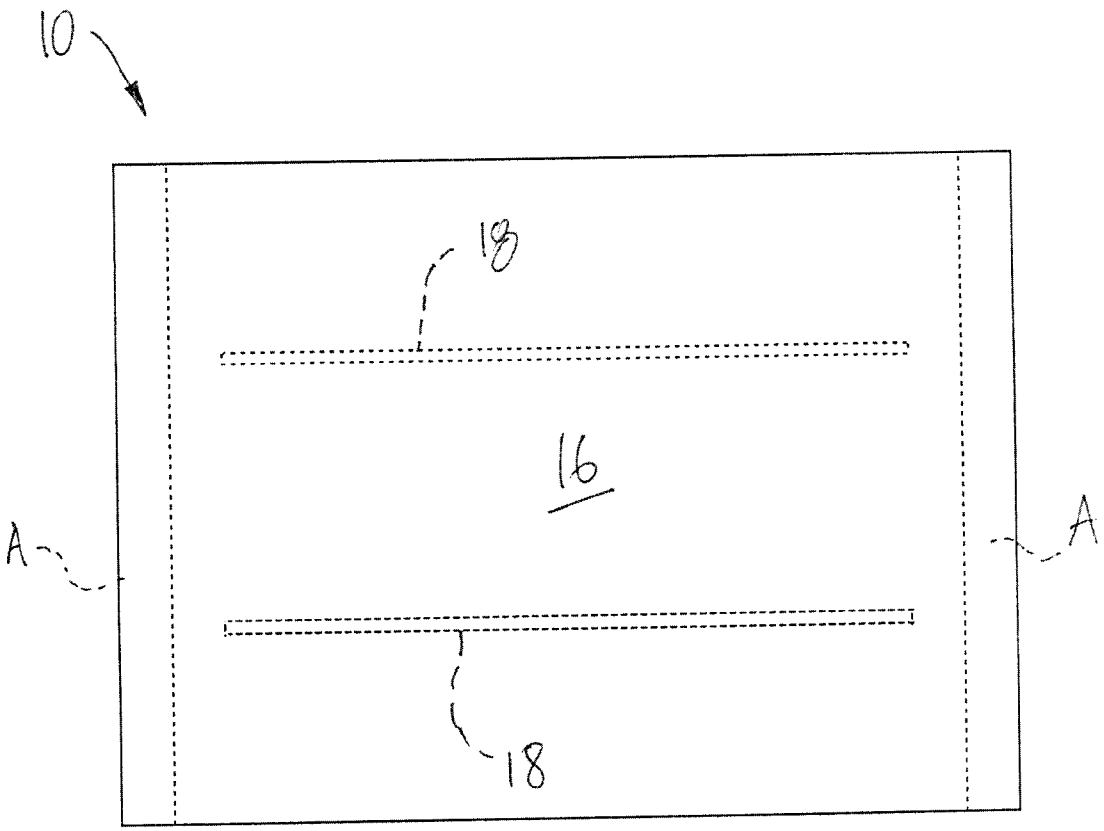
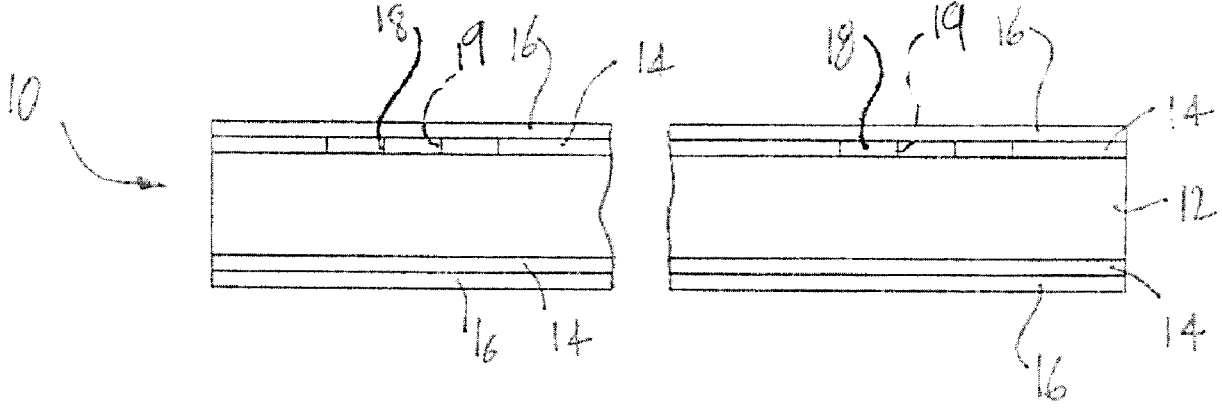


Fig. 5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