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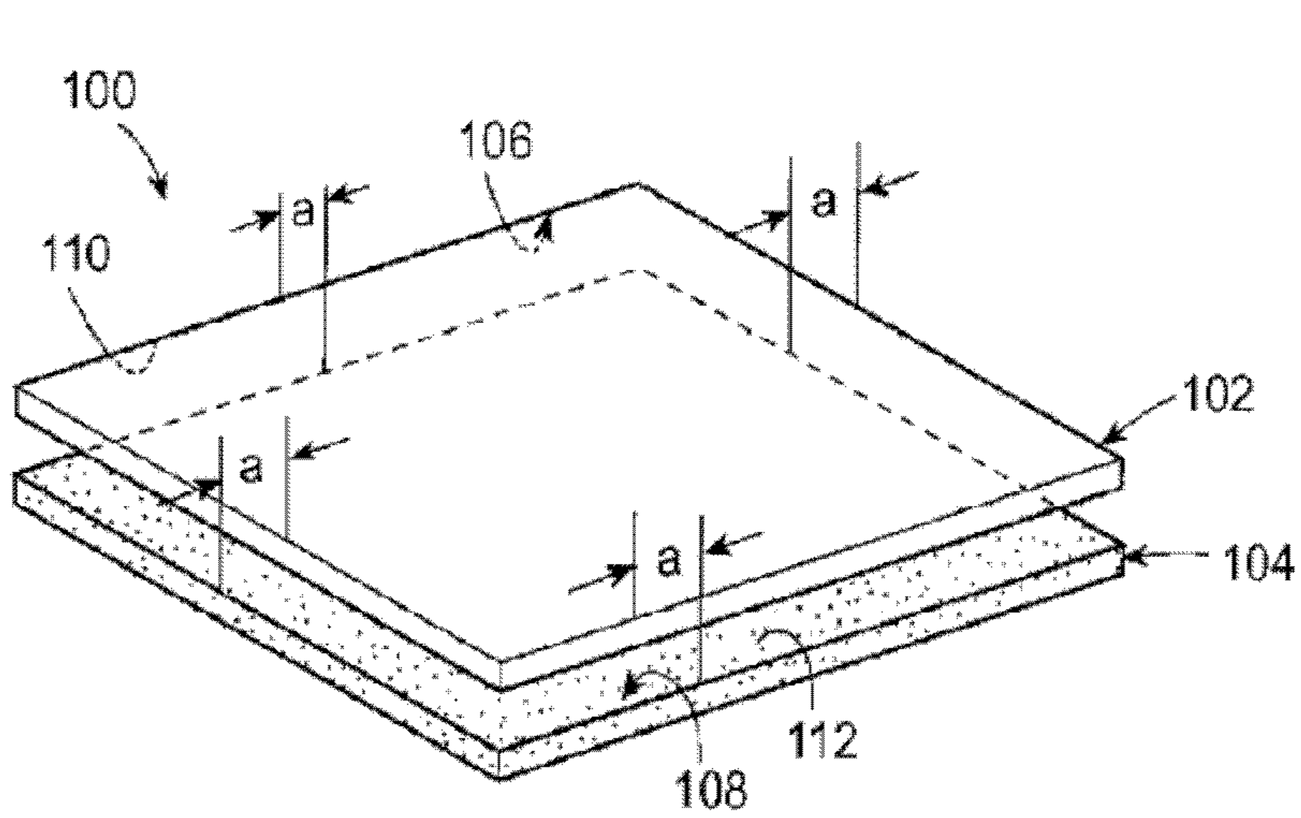
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CORRECTION – ARTICLE 8
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(54) Titre : CARREAU A OBJECTIFS MULTIPLES
(54) Title: MULTI-PURPOSE TILE

FIG. 9



(57) Abrégé/Abstract:
A multi-purpose tile is installable on ceilings walls and floors. The tile includes a base layer of foam plastic material bonded to an upper substrate layer of non-foam plastic or metal material. The bonding process includes pressurization of the foam layer to the non-foam constituents of the tile. The pressure is at a selected level that basically does not change the density of the foam base layer before and after pressurization. The thickness ratio of the foam based layer relati ve to other constituent layers of the tile can be approximately 15 to 20 times thicker than the other constituent layers thus ensuring that the tile is a lightweight, low density structure that is easy to handle and install.

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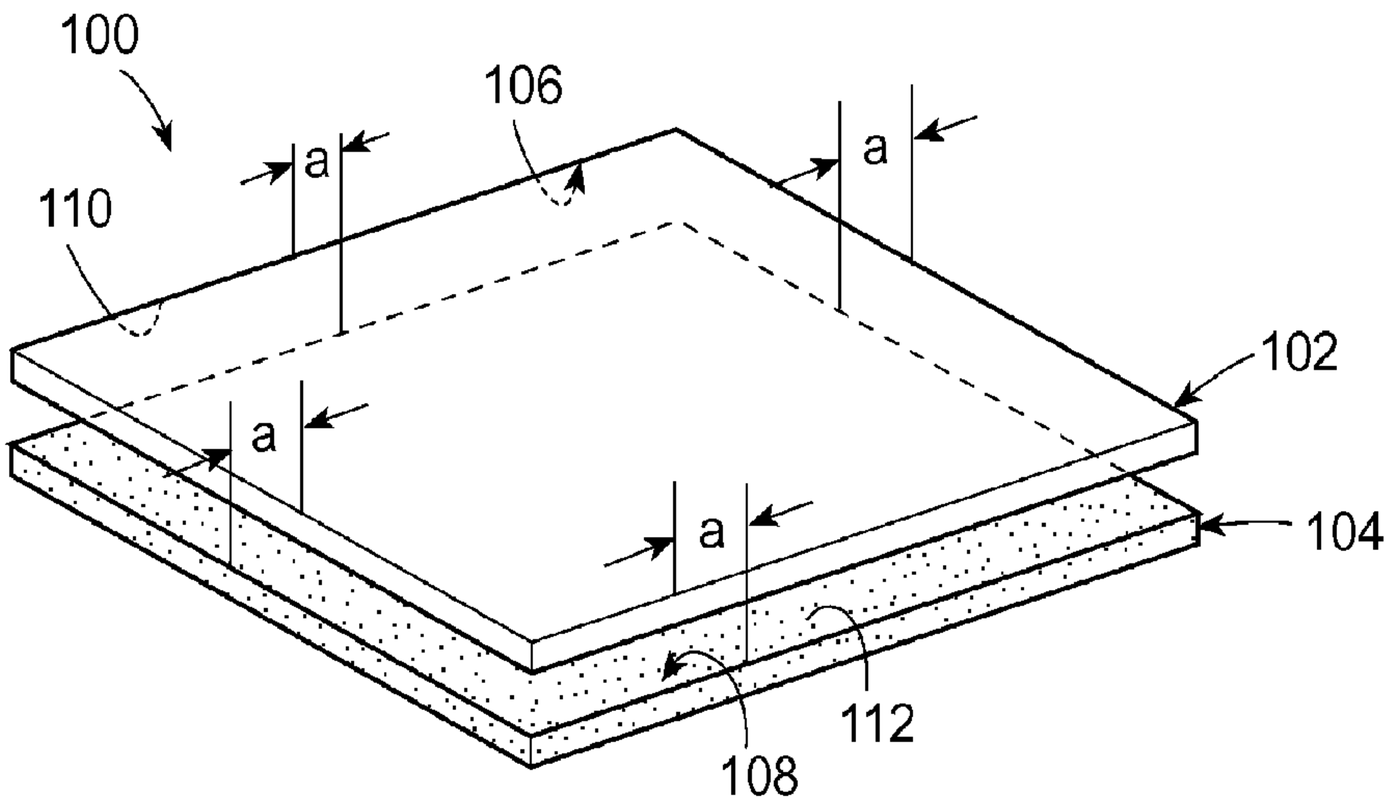
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(54) Title: MULTI-PURPOSE TILE

FIG. 9



(57) Abstract: A multi-purpose tile is installable on ceilings walls and floors. The tile includes a base layer of foam plastic material bonded to an upper substrate layer of non-foam plastic or metal material. The bonding process includes pressurization of the foam layer to the non-foam constituents of the tile. The pressure is at a selected level that basically does not change the density of the foam base layer before and after pressurization. The thickness ratio of the foam based layer relati ve to other constituent layers of the tile can be approximately 15 to 20 times thicker than the other constituent layers thus ensuring that the tile is a lightweight, low density structure that is easy to handle and install.

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MULTI-PURPOSE TILE

BACKGROUND OF THE INVENTION

[0001] This invention is directed to a novel, laminated, light-weight, multi-purpose, composite flexible plastic tile that can be used as a ceiling tile, a wall tile and a floor tile. The tile can be directly bonded to a ceiling, wall or floor surface.

[0002] The tile can also be used as a ceiling tile in a suspended or hung ceiling assembly having grid sections that support the tile.

[0003] When used as a wall covering, the tile can be folded to continuously fit within an inside corner of intersecting walls or wrap around an outside corner.

[0004] When used as a floor covering, the tile can be installed with other similar tiles in a floating floor assembly, wherein the tiles are not bonded directly to a floor base. Examples of a floating floor assembly are shown in U.S. patents 7,155,871 and 7,458, 191 which are incorporated by reference herein.

[0005] The multi-purpose tile is relatively inexpensive to manufacture and does not require special skills or training to handle and install, making it attractive for do-it-yourself individuals who have had no previous experience installing tiles.

[0006] The invention is also directed to methods for preparing the tile, and a method of covering a floor surface, wall surface or ceiling surface.

DESCRIPTION OF THE DRAWINGS

[0007] In the accompanying drawings,

[0008] Fig. 1 is a simplified perspective view of a tile incorporating one embodiment of the present invention;

[0009] Fig. 2 is an enlarged fragmentary sectional view thereof showing the laminate details of the tile;

[0010] Fig. 2a is a view similar to Fig. 2 showing a laminate subassembly of the tile and a foam base layer thereof before they are joined together;

[0011] Fig. 3 is an enlarged sectional view thereof taken on the line 3-3 of Fig. 1 showing the approximate thickness ratios of the laminated components of the tile;

[0012] Figs. 4-6 are simplified schematic sectional views showing V-shaped and curved grooving of the foam base of the tile to facilitate bending or folding of the tile at inside and outside corners of intersecting support surfaces;

[0013] Figs. 7A and 7B are simplified perspective views showing grooved tiles positioned at inside and outside corners of intersecting support surfaces;

[0014] Fig. 8 is a simplified schematic diagram of the manufacturing steps for making one embodiment of the tile incorporating a PVC foam base layer;

[0015] Fig. 9 is a perspective view of a floor tile incorporating another embodiment of the invention; and,

[0016] Fig. 10 is a perspective view of an assembly pattern thereof.

[0017] Corresponding reference numbers indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Referring to the drawings, a tile incorporating one embodiment of the invention is generally indicated by the reference number 10 in Fig. 1.

[0019] The tile 10 has a polygonal shape, such as a rectangle and is preferably in the form of a square having a peripheral edge 12. However the features and principles of the invention are adaptable to tiles of other shapes such as elongated rectangles and other geometrical shapes.

[0020] The tile 10 includes a base layer 14 (Figs. 1 and 2) formed of a poly-foam or foamed plastic material having a lower surface or bottom foam surface 16 and an upper surface 18 (Fig. 2). If the tile 10 is to be directly bonded to ceiling, wall or floor surface the lower surface 16 can be provided with a suitable known bonding layer (not shown) covered with a suitable known release paper (not shown). Alternatively, the lower surface 16 can be left dry, that is, without a bonding material, to permit optional use of a bonding material by an installer during installation of the tile 10. The lower surface 16 is preferably left dry when the tile 10 is used in a hung ceiling assembly or in a floating floor assembly.

[0021] An upper substrate layer 24 (Fig. 2), formed of a non-foam plastic or metallic material has a lower surface 26 and an upper surface 28. The upper substrate layer 24 is provided over the upper foam surface 18 (Fig. 2).

[0022] An adhesive 32, which can be a layer or coating, is provided between the upper surface 18 of the foam base layer 14 and the lower surface 26 of the substrate layer 24 to join the substrate layer 24 and the foam base layer 14 together (Fig. 2).

[0023] The tile 10 also includes a design pattern or a decorative appearance of any selected type on or at the upper surface 28 of the substrate layer 24. The design pattern can be a wood grain design, a mineral grain design that resembles marble, granite or any other natural stone grain, or a color pattern, color blend or single color to name just a few design possibilities. The decoration or design pattern can be printed onto or otherwise applied to the upper surface 28 of the substrate layer 24, but is preferably provided on a separate printing film or design layer 34 of any suitable known plastic material (Fig. 2).

[0024] The design layer 34 is covered by a transparent or semi-transparent abrasion resistant wear layer 36 (Fig. 2) of known material and fabrication through which the design layer 34 can be viewed. The top of the wear layer 36 is the top surface of the tile 10. The wear layer 36 protects the design pattern, especially when the tile 10 is used as a floor tile. However, if no design or decoration is provided on or at the substrate layer 24, then the wear layer 36 may be opaque.

[0025] The wear layer 36 has a slightly curved surface declination 50 (Fig. 3) at each side of the peripheral edge 12 (Fig. 1) of the tile 10. The surface declinations 50 extend the full length of each side of the tile 10 at the peripheral edge 12.

[0026] The peripheral edge 12 of the tile 10 can also include beveled edge portions 60 (Fig. 3) that diverge upwardly from the lower base surface 16 of the foam base layer 14. The beveled edge portions 60 intersect the curved surface declinations 50 at an intersection line 62 (Fig. 3) that is slightly below the top surface 36 of the tile 10. The beveled edge portions 60 have an angle of divergence 64 (Fig. 3) of approximately 5 to 35 degrees as measured, for example, from a vertical axis 66 (Fig. 3).

[0027] If the tile 10 is used as a floor tile, the wear layer 36 can be provided with suitable known relief or surface embossments (not shown) or any other known texturing to provide traction. Relief or surface embossments may also be desirable if the tile 10 is used as a wall or ceiling tile.

[0028] The distance between the bottom surface 16 and the upper surface 18 of the base layer 14 defines a first partial thickness of the tile member unit 10.

[0029] The distance between the top surface 36 of the tile member 10 and the upper foam surface 18 defines a second partial thickness of the tile member 10.

[0030] Thus as most clearly shown in Fig. 2 the overall thickness of the tile 10 is substantially the sum of the first partial thickness and second partial thickness of the tile 10.

[0031] Although the dimensions of the tile 10 are a matter of choice, a suitable size can be, for example, 12 inches by 12 inches. Smaller or larger size tiles are a matter of choice.

[0032] The overall thickness of the tile 10 can vary from about 2 to 17 mm and the thickness of the foam base layer 14 can be approximately 15 to 20 times thicker than the total thickness of the other constituent layers of the tile 10.

[0033] The tile 10 has relatively low density and light weight as compared to solid layer tiles, especially because the foam base layer 14 constitutes a substantial volume of the tile as shown in Figs. 2 and 3. The tile 10 also has relatively good impact resistance, good thermal insulation, and good acoustical insulation. The low density and lightweight characteristics of the tile 10 facilitate handling and installation.

[0034] The tile 10 can be assembled with other similar tiles 10 in any selected assembly pattern on a ceiling, wall or floor.

[0035] When used as a wall covering the tile 10 can be provided with any suitable known self-adhesive material or provided with a dry bottom surface 16 and installed with a mastic or bonding material to bond the tile 10 directly to the wall surface.

[0036] The lightweight features of the tile 10 are advantageous for obtaining a secure bond when installing the tile 10 on vertical wall surfaces. It is also especially easy to install the tile 10 at vertical corners (Figs. 7A and 7B), such as at inside corners of intersecting walls, and at outside corners, such as at entry ways. An inside or outside corner installation is accomplished by forming a groove in the foam base layer 14 of the tile 10 to facilitate bending or folding of the tile.

[0037] For example, referring to Figs. 4-6 the lower base surface 16 of the foam base layer 14 can be scored or grooved at any selected locations such as 70 and 72 (Fig. 4). The depth of the scoring or grooving should not extend past the upper surface 18 (Fig. 2) of the foam base layer 14.

[0038] The grooving or scoring can be in the form of a V-shaped groove 74 (Fig. 6) or a semi-circular groove 76 (Fig. 5). Grooves of any other known shape that facilitate bending or folding of the tile 10 can also be used to enable the tile to conform in one continuous piece to any vertical intersecting surfaces that intersect at any intersection angle.

[0039] Since most interior vertical surfaces intersect at 90° angles the V-shaped groove 74 can be approximately 120° as shown in Fig 6. The grooves 74 and 76 can be cut or formed with a router (not shown) or any other suitable known grooving tool wherein the grooves 74 and 76 are directed into the lower base surface 16 of the foam base layer 14.

[0040] Once the base surface 16 is grooved the tile 10 can be folded or bent at the groove to conform to an inside corner 80 or an outside corner 82 as shown in Figs. 7A and 7B.

[0041] The tile 10 can also be bonded directly to a ceiling surface (not shown) in a manner similar to that described for installing the tile on a wall surface. If the tile 10 is to be continuously installed on a ceiling and wall surface the tile can be grooved and folded, as previously described, to enable the tile to conform to the intersection of the wall and ceiling surfaces.

[0042] When used in a hung ceiling installation (not shown) the tile 10 can be easily positioned in and removed from a suspended ceiling grid support frame (not shown). If desired, a suitable known low tack adhesive can be applied in one or more small spots on the wear layer 36 of the tile 10 near the peripheral edge 12 to lightly adhere the tile 10 to the ceiling grid (not shown) of the hung ceiling, yet still permit clean and easy removal of the tile 10 from the grid support.

[0043] Foam plastic materials suitable for forming the foam base layer 14 include polyurethane, polyamide copolymers, polystyrene, polyvinyl chloride (PVC), polypropylene and polyethylene foamed plastics, all of which have good molding processability.

[0044] Polyvinyl chloride (PVC) foam materials are especially suitable for forming the foam base layer 14 because they are chemically stable, corrosion resistant, and have excellent flame-retardant properties.

[0045] It is well known that foam plastic material contains hollow globules or air cells, which can be closed cells, that provide the foam plastic material with reduced density and lighter weight in comparison with dimensionally similar non-foam plastic material.

[0046] It is also well known in the art that the preparation of a composite laminated plastic tile that includes plural layers usually requires relatively high compression forces and relatively high temperatures to provide a secure surface to surface bond between the layers of the laminate tile.

[0047] Applicant has found that the elevated pressures and temperatures that are usually associated with preparing a composite laminated plastic tile with solid layers are generally not feasible for laminating the presently disclosed composite plastic tile having a foam layer. The elevated pressures and temperatures generally used for laminating solid plastic layer tile can burst or unduly compress the air cells in a foam layer and thereby substantially increase the density of the foam layer 14, compared to the density of the foam layer 14 in its non-compressed condition.

[0048] It is thus of significant importance in making the light weight, laminated, multi-purpose tile 10, to avoid a substantial increase in density of the foam base layer 14 when the component layers of the tile 10 as shown in Fig. 2 are placed under pressure to produce the laminated composite tile 10. It is also of significant importance to establish a pressure or pressure range for laminating the component layers of the tile 10 that provides a good surface to surface bond between the layers without unduly increasing the density of the foam base layer 14, compared to the density of the foam layer 14 in its non-compressed condition.

[0049] Another problem dealt with by applicant in making the tile 10 as a light weight, foam based structure is preserving the dimensional integrity of the tile 10, maintaining the stability and shape of the tile 10, and preventing warpage of the tile 10.

[0050] In making the tile 10 the foam base layer 14 is preferably formed of PVC. The thickness of the foam base layer 14 can vary from about 1 to 15 mm, preferably from about 1.5 to 12 mm, more preferably from about 2 to 10 mm, even more preferably from about 2 to 8 mm, and most preferably from about 2 to 6 mm.

[0051] The components of the foam base layer 14 are well known in the art and typically comprise, in weight %:

Plastic material	40 to 90%
Foaming agent	0.7 to 3%
Foam control agent	4 to 8%
Stabilizing agent	1.5 to 5%
Plasticizing agent	0 to 15%
Lubrication agent	1 to 2%
Heavy calcium	0 to 50%
Toughening agent	3 to 9%
Flame-retardant agent	3 to 15%
Antiseptic and anti-mildew agent	0.5 to 2%

[0052] The density of the foam base layer 14 can vary from about 0.1 to 1.5 grams/cc, preferably from about 0.2 to 1.4 grams/cc, more preferably from about 0.3 to 1.3 grams/cc, even more preferably from about 0.4 to 1.2 grams/cc, even more preferably from about 0.5 to 1.2 grams/cc, and most preferably from about 0.6 to 1.2 grams/cc.

[0053] The upper substrate layer 24 can comprise metal, alloy or macromolecular materials, and preferably comprises macromolecular materials, for example, addition polymers such as vinyl monomer copolymers or homo-polymers; condensation polymers such as polyesters,

polyamides, polyimides, epoxy resins, phenol-formaldehyde resins, urea-formaldehyde resins; natural macromolecular materials or modified derivatives thereof, such as plant fibers, animal fibers, and the like, or mineral fibers such as asbestos, ceramic fibers, carbon fibers, and the like.

[0054] The upper substrate layer 24 preferably comprises addition polymers and more preferably comprises vinyl monomer copolymers and/or homo-polymers such as polyethylene, polyvinyl chloride (PVC), polystyrene, polymethacrylates, polyacrylates, polyacrylamides, ABS (acrylonitrile-butadiene-styrene) copolymers, polypropylene, ethylene-propylene copolymers, polyvinylidene chloride, polytetrafluoroethylene, polyvinylidene fluoride, hexafluoropropene, styrene-maleic anhydride copolymers, and the like.

[0055] The upper substrate layer 24 most preferably comprises polyethylene or polyvinyl chloride (PVC). The polyethylene can be low density polyethylene, medium density polyethylene, high density polyethylene or ultra high density polyethylene.

[0056] The upper substrate layer 24 can also include filler materials and other additives that improve the physical properties and/or chemical properties and/or the processability of the product. These additives include known toughening agents, plasticizing agents, reinforcing agents, anti-mildew (antiseptic) agents, flame-retardant agents, and the like.

[0057] The thickness of the upper substrate layer 24 can vary from about 0.1 to 2 mm, preferably from about 0.15 to 1.8 mm, more preferably from about 0.2 to 1.5 mm, and most preferably from about 0.3 to 1.5 mm.

[0058] The thickness ratio of the foam base layer 14 to the upper substrate layer 24 can vary from about 1 to 15 : 0.1 to 2, preferably from

about 1.5 to 10 : 0.1 to 1.5, more preferably from about 1.5 to 8 : 0.2 to 1.5, and most preferably from about 2 to 8 : 0.3 to 1.5, respectively.

[0059] The adhesive layer 32 can be any well-known bonding agent or binder capable of bonding together the upper substrate layer 24 and the foam base layer 14, for example polyurethanes, epoxy resins, polyacrylates, ethylene-vinyl acetate copolymers, ethylene-acrylic acid copolymers, and the like. Preferably, the adhesive layer 32 is a hot-melt bonding agent.

[0060] The design layer 34 can comprise any suitable known plastic material such as a known formulation of PVC resin, stabilizer, plasticizer and other additives that are well known in the art. The design layer can be formed with or printed with printed patterns, such as wood grains, metal or stone design and fibrous patterns or three-dimensional figures. Thus the design layer 34 can provide the tile 10 with a three dimensional appearance that resembles heavier products such as granite, stone or metal.

[0061] The thickness of the design layer can vary from about 0.01 to 0.1 mm, preferably from about 0.015 to 0.08 mm, more preferably from about 0.2 to 0.7 mm, and most preferably from about 0.02 to 0.5 mm.

[0062] The wear layer 36 that forms the upper surface of the tile 10 can comprise any suitable known abrasion-resistant material, such as an abrasion-resistant macromolecular material coated onto the layer beneath it, or a known ceramic bead coating. If the wear layer 36 is furnished in layer form, it can be bonded to the layer beneath it.

[0063] The wear layer 36 can also comprise an organic polymer layer and/or inorganic material layer, such as an ultraviolet coating or a combination of another organic polymer layer and an ultraviolet coating. For example, an ultraviolet paint capable of improving the surface scratch resistance, glossiness, antimicrobial resistance and other properties of the

product. Other organic polymers including polyvinyl chloride resins or other polymers such as vinyl resins, and a suitable amount of plasticizing agent and other processing additives can be included, as needed.

[0064] The method for producing the light weight foamed plastic composite tile 10 includes:

(a) preparing a foam base layer;

(b) preparing a substrate layer;

(c) applying adhesive on a surface of the substrate layer and/or the foam base layer;

(d) contacting the substrate layer and the foam base layer so that the substrate layer and foam base layer are bonded together by the adhesive; and

(e) applying pressure to the substrate layer and the foam base layer at a pressure and temperature sufficient to produce a laminated light weight foam plastic composite tile including the foam layer, wherein each of the layers of the light weight foam plastic composite tile have substantially the same thickness and density after being pressed together as they did before being pressed together.

[0065] The substrate layer 24 can be bonded to the foam base layer 14 by coating the upper surface 18 of the foam base layer 14 and/or the lower surface 26 of the substrate layer 24 with the adhesive bonding agent 32 and contacting the mating surfaces 18 and 26.

[0066] A known balance layer (not shown) can be disposed between the foam base layer 14 and the substrate layer 24. The balance layer helps provide dimensional stability to the tile 10 by minimizing the effect of coefficients of expansion of different materials that are laminated above and

below the balance layer. The balance layer thus helps inhibit curving, cupping or arching of the tile 10, and also helps to ensure the dimensional stability of the tile 10.

[0067] A known balance layer (not shown) can also be included between the wear layer 36 and the upper substrate layer 24 for purposes previously described.

[0068] The bonding of the upper substrate layer 24 to the foam base layer 14 is accomplished under pressure. Other methods to bond the foam base layer 14 to the substrate layer 24 can be employed, such as a known one-step formation using an adhesive thermal bonding machine known in the art that employs pressure after adhesive application.

[0069] The substrate layer 24, the design layer 34, and the wear layer 36 can be initially laminated together to form an upper substrate laminate subassembly 40 as shown schematically in Fig. 2a. The laminate subassembly 40 and the foam base layer 14 can then be laminated together to form the tile 10 (Fig. 2).

[0070] Alternatively, the wear layer 36, the design layer 34 the substrate layer 24 and the foam base layer 14 can be laminated together simultaneously to form the tile 10.

[0071] The pressing process can be either cold or ambient temperature pressing or thermal pressing at an elevated temperature. Thermal pressing is preferred for joining together the constituent components of the tile 10, and most preferably includes a heating stage and a cooling stage as schematically indicated in Fig. 8.

[0072] The pressure applied during the heating stage can vary from about 10 to 150 kg/cm^2, preferably from about 10 to 80 kg/cm^2, more preferably from about 15 to 80 kg/cm^2, and most preferably from about 15 to 60 kg/cm^2.

[0073] The pressure applied during the cooling stage can vary from about 10 to150 kg/cm^2, preferably from about 10 to 80 kg/cm^2, more preferably from about 15 to 80 kg/cm^2, and most preferably from about 15 to 60 kg/cm^2.

[0074] The duration of the pressing process is about 15 to 100 minutes, preferably about 20 to 90 minutes, more preferably about 25 to 80 minutes, and most preferably about 30 to 70 minutes.

[0075] The pressures applied during the heating stage and the cooling stage can be the same or different, and are preferably the same.

[0076] The temperature during the heating stage can vary from about 40 to 150°C, preferably from about 50 to 130°C, more preferably from about 60 to 100°C and most preferably from about 75 to 100°C.

[0077] The temperature during the cooling stage can vary from about 15 to 30°C, preferably from about 18 to 26°C and most preferably from about 20 to 25°C.

[0078] The duration of pressing during the heating stage can vary from about 5 to 50 minutes, preferably from about 10 to 45 minutes and more preferably from about 15 to 40 minutes. The duration of pressing during the cooling stage can vary from about 5 to 50 minutes, preferably from about 10 to 45 minutes, and more preferably from about 15 to 40 minutes. The duration of pressing during the heating stage and the cooling stage can be the same or different, and are preferably the same.

[0079] After formation of the tile 10 one or more post-treatment finishing steps can also be included, such as cutting, polishing, burnishing, inspecting and packaging of the tile 10.

[0080] In one illustrative embodiment of the invention the tile 10 includes the foam base layer 14 being formed of PVC of the type previously

described, having a thickness of 4mm. The substrate layer 24 is a PVC layer having a thickness of 1 mm, the design layer 34 has a thickness of 0.3 mm, and the abrasion resistant layer 36 has a thickness of 0.2 mm. The total thickness of the upper substrate laminate 40 is thus 1.5 mm.

[0081] The tile 10 with the PVC foam base layer 14 is formed under pressure during a heating and cooling stage as follows.

[0082] A pressure of 35 kg/cm^2 is applied to the PVC foam base layer 14 in contact with the upper substrate layer 24 at a temperature of about 80°C for 25 minutes. The pressure is maintained for an additional 25 minutes during the cooling stage to ambient temperate.

[0083] After pressurization, the thickness of the upper substrate laminate 40 is about 1.5 mm. The thickness of the PVC foam base layer 14 is 3.95 mm. The density of the PVC foam base layer 14 before and after pressurization basically remains unchanged at 1.0 g/cc.

[0084] Thus the base layer of foam 14 is bonded to the upper substrate layer 24, and the base layer of foam 14 is placed under pressure while being bonded to the upper substrate layer 24, and the density and thickness of the base layer of foam 14 after being bonded to the upper substrate layer 24 is substantially the same density and thickness as before being placed under pressure.

[0085] After the formation of the tile 10 is completed, and if desired, a suitable known adhesive can be applied to the lower base surface 16 of the PVC foam base layer 14, to facilitate affixation of the tile 10 to a wall or ceiling.

[0086] In a second illustrative embodiment of the invention the tile 10 includes the substrate layer 24 being formed of polyethylene (PE) having a thickness of 1 mm. The upper substrate laminate 40 has a total thickness of 1.5 mm.

[0087] The PVC foam base layer 14 has a thickness of 4mm.

[0088] The adhesive 32 is of a suitable known formulation and is contacted to the upper surface 18 of the foam base layer 14, and to the lower surface 26 of the upper substrate layer 24. The adhesive coated surface 18 of the foam base layer 14 and the adhesive coated surface 26 of the upper substrate layer 24 are then superimposed and pressed together at a pressure of 80 kg/cm^2 while heating to a temperature of 80°C for 25 minutes. Pressurization is then continued after the heating stage for an additional 40 minutes during the cooling stage to ambient temperature.

[0089] After pressurization, the thickness of the upper substrate laminate 40 remains at 1.5 mm and the thickness of the PVC foam base layer 14 is 3.93 mm. The density of the PVC foam base layer 14 before and after pressurization basically remains unchanged at 1.2 grams/cc.

[0090] In a third illustrative embodiment of the invention the tile 10 includes the substrate layer 24 being formed of polyethylene (PE) and the upper substrate laminate 40 having a total thickness of 0.7 mm. The foam base layer 14 is formed of PVC foam having a thickness of 4 mm.

[0091] The adhesive 32 is of a suitable known formulation and is contacted or coated onto the upper surface 18 of the PVC foam base layer 14, and to the lower surface 26 of the substrate layer 24. The adhesive surfaces are superimposed and pressed together at a pressure of 20 kg/cm^2 and a temperature of 60°C for 40 minutes. The application of pressure is continued after the heating stage for 20 minutes during the cooling stage to ambient temperature.

[0092] After pressurization, the thickness of the upper substrate laminate 40 is 0.7 mm and the thickness of the PVC foam base layer 14 is 3.93 mm. The density of the PVC foam material of the layer 14 before and after pressurization basically remains unchanged at 0.6g/cc.

[0093] In a fourth illustrative embodiment of the invention a floor tile for a floating floor assembly is generally indicated by the reference number 100 in Fig. 9. The features and principles of the floor tile 100 are also adaptable to floor planks.

[0094] The floor tile 100 includes a first floor member portion 102 and a second floor member portion or underlayer portion 104 that are of identical size and shape. The first floor member portion 102 is laminated to the second floor member portion 104 such that the first floor member portion 102 has a predetermined offset from the second floor member portion 104 in the manner described in U.S. patents 7,155,871, 7,322,159, and 7,458,191, the disclosures of which are hereby incorporated by reference in this application.

[0095] The layer structure of the first floor member portion 102 includes a base layer, a substrate layer, and adhesive layer, a design layer and an abrasion resistant layer, all of which are structurally similar to the corresponding layers 14, 24, 32, 34 and 36 of the tile 10 as shown in Fig. 2.

[0096] The second floor member portion 104 is a foam layer that is structurally similar to the base layer 14 of the tile 10 as shown in Fig. 2.

The first floor member portion 102 is preferably formed as a complete and separate laminate unit before being laminated to the second floor member portion 104.

[0097] Preferably, but not necessarily, the second floor member portion 104 has no surface declinations or beveled edges.

[0098] The first floor member portion 102 extends an offset amount "a" beyond the second floor member portion 104 to define an offset L-shaped marginal section 106 (Fig. 9) of the first floor member portion 102.

[0099] Also, in the offset arrangement of the first and second floor member portions 102 and 104, the second floor member portion 104 extends the offset amount "a" beyond the first floor member portion 102 to define an offset L-shaped marginal section 108 (Fig. 9) of the second floor member portion 104.

[0100] The L-shaped marginal section 106 of the first floor member portion 102 and the L-shaped marginal section 108 of the second floor member portion 104 are of identical size and shape.

[0101] A suitable known bonding material for laminating the first and second floor member portions 102 and 104 together can be provided on either a lower surface 110 of the first floor member portion 102 or an upper surface 112 of the second floor member portion 104. Under this arrangement only one of the L-shaped marginal sections 106 or 108 is provided with adhesive.

[0102] However, the bonding material for the laminated first and second floor member portions 102 and 104 is preferably provided on the lower surface 110 of the first floor member portion 102 and on the upper surface 112 of the second floor member portion 104.

[0103] The L-shaped marginal section 106 thus has an exposed downwardly directed adhesive surface that is part of the lower surface 110 of the first floor member portion 102, and the L-shaped marginal section 108 has an exposed upwardly directed adhesive surface that is part of the upper surface 112 of the second floor member portion 104. The adhesive on the exposed adhesive surfaces on the L-shaped marginal sections 106 and 108 is

the bonding material used for laminating the first floor member portion 102 and the second floor member portion 104 together.

[0104] Although the dimensions of the floor tile 100 are a matter of choice, a suitable size for the first floor member portion 102 and the second floor member portion 104 can be, for example, 12 inches by 12 inches. Smaller or larger size floor tiles are a matter of choice. The thickness of the first floor member portion 102 can vary from about 2 to 5 mm and the thickness of the second floor member portion 120 can vary from about 2 to 5 mm. The marginal offset "a" can be, for example, approximately 1 inch. The amount of offset "a" is a matter of choice, and larger or smaller offsets are also usable.

[0105] The foam structure of second floor member portion 104 of the floor tile 100 is yieldable to small bumps and other imperfections generally referred to as surface irregularities in a floor base. The second floor member portion 104 thus enables the floor tile 100 to conform to such surface irregularities and lie flat on a floor base.

[0106] During installation of the floor tiles 100 in side-by-side and end-to-end relationship the downwardly directed L-shaped marginal section 106 of the first floor member portion 102 is positioned to engage the upwardly directed L-shaped marginal section 108 of the second floor member portion 104 in the manner shown in the tile assembly 120 of Fig. 10. The tile assembly 120 is but one example of known tile assembly patterns that are a matter of choice.

[0107] The tile 10 can be installed on a floor base without any mastic or adhesive coating on the floor base, and without mastic or adhesive on an undersurface 114 (Fig. 9) of the second floor member portion 104. Thus, during installation, the floor tiles 100 can be placed on a dry floor base

surface for easy shifting to any selected position thereby facilitating installation of the floor tiles 100 in any selected pattern or arrangement.

[0108] As various changes can be made in the above constructions and methods without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a liming sense.

AMENDED CLAIMS
received by the International Bureau on 04 November 2014 (04.11.2014)

AMENDED CLAIMS

What is claimed is:

1. A multi-purpose tile comprising,

a) a tile member unit having a polygonal shape, a top surface and a bottom surface, and a predetermined overall thickness,

b) said tile member unit including a base layer of foam plastic material having an upper foam surface, and a bottom foam surface that is the bottom surface of the tile member unit,

c) an upper substrate layer formed of a non-foam plastic or metal material provided over the upper foam surface, said upper substrate layer having an uppermost surface,

d) said tile member unit further including a display or design provided over the uppermost surface of the upper substrate layer such that said display or design shows at the top surface of said tile member unit, and

e) the base layer of foam is bonded to the upper substrate layer, and the base layer of foam is placed under pressure while being bonded to the upper substrate layer, and the density and thickness of the base layer of foam after being bonded to the upper substrate layer is substantially the same density and thickness as before being placed under pressure, and wherein the base layer of foam plastic material is a closed cell foam pvc plastic material with a toughening agent such that said base layer is impact resistant and is of lower density and lighter weight than a solid pvc material of similar dimension, and

f) the distance between the upper foam surface and the bottom foam surface defines a first partial thickness of said tile member unit,

g) the distance between said top surface of said tile member unit and said upper foam surface of said base layer of foam plastic material defines a second partial thickness of said tile member unit,

h) the predetermined overall thickness of said tile member unit is substantially the sum of said first partial thickness and said second partial thickness, and

i) said first partial thickness is about 15 to 20 times thicker than the second partial thickness.

2. The multi-purpose tile as claimed in claim 1 wherein the tile member unit has a rectangular periphery and a beveled edge extending the full length of each side of the rectangular periphery, said beveled edge diverging upwardly from the bottom foam surface toward the top surface of the tile member unit.

3. The multi-purpose tile as claimed in claim 1 wherein the base layer of foam plastic material has a density in the range of about 0.1 grams/cubic centimeter to 1.5 grams/cubic centimeter.

4. The multi-purpose tile of claim 1, wherein the upper substrate layer is at least one material selected from the group consisting of metals, alloys, macromolecular materials such as vinyl monomer copolymers and/or homo-polymers; condensation polymers such as polyesters, polyamides, polyimides, epoxy resins, phenol-formaldehyde resins, urea formaldehyde resins; natural macromolecular materials or modified derivatives thereof such as plant fibers, animal fibers, mineral fibers, ceramic fibers and carbon fibers.

5. The multi-purpose tile of claim 4, wherein the vinyl monomer copolymers and/or homo-polymers are selected from the group consisting of polyethylene, polyvinyl chloride, polystyrene, polymethacrylates, polyacrylates, polyacrylamides, ABS, (acrylonitrile-butadiene-styrene) copolymers, polypropylene, ethylene-propylene copolymers, polyvinylidene chloride, polyteterafluoroethelyne, polyvinylidene fluoride, hexafluoropropene, and styrene-maleic anhydride copolymers.

6. The multi-purpose tile as claimed in claim 1, wherein said tile member unit has an abrasion resistant wear layer provided over the uppermost surface of said upper substrate layer, and the top surface of said wear layer is the top surface of said tile member unit, and the wear layer is a transparent plastic material and a design is provided between the wear layer and the upper substrate layer and the design is visible through the transparent wear layer.

7. The multi-purpose tile as claimed in claim 1 wherein the base layer of closed cell foam pvc plastic material contains approximately 3% to 9% by weight of the toughening agent.

8. The multi-purpose tile as claimed in claim 1, further including,

j) an underlayer portion having a polygonal shape of substantially the same size and shape as the tile member unit, with at least two side edges and a lower surface constituting a bottom surface of the multi-purpose tile,

k) said tile member unit has at least two side edges, and said underlayer portion and said tile member unit are laminated together in offset relationship from each other,

l) the offset of said tile member unit and said underlayer portion defining a first offset marginal portion of said tile member unit, and a second offset marginal portion of said underlayer portion, said first offset marginal portion of said tile member unit extending beyond at least one of the side edges of said underlayer portion, and said second marginal portion of said underlayer portion extending beyond at least one of the side edges of said tile member unit,

m) said first offset marginal portion having a first marginal lower surface and said second offset marginal portion having a second marginal upper surface, and at least one of the first marginal lower surface and the second marginal upper surface having an exposed adhesive coating, and

n) the underlayer portion having a predetermined yieldability to surface irregularities of a base surface upon which the multi-purpose tile is laid such that the underlayer portion, when lying in flat contact on a base surface can conform to surface irregularities of a base surface.

9. The multi-purpose tile as claimed in claim 8, wherein the underlayer portion is a flexible, non-foam plastic material.

10. A method of preparing a multi-purpose tile for installation on ceilings, walls and floors comprising,

a) forming a tile member unit with a top surface and a bottom surface, a polygonal shape and a predetermined overall thickness,

b) providing the tile member unit with a base layer of foam plastic material having an upper foam surface, and a bottom foam surface that serves as the bottom surface of the tile member unit,

c) providing an upper substrate layer of a non-foam plastic or metal material over the upper foam surface,

d) providing the tile member unit with a design or display over the upper substrate layer such that the design or display shows at the top surface of the tile member unit,

e) forming the base layer of foam plastic material of a closed cell pvc plastic material with a toughening agent such that the base layer is impact resistant and is of lower density and lighter weight than a solid pvc material of similar dimension,

f) bonding the base layer of foam plastic material to the upper substrate layer with an adhesive bonding material by placing the base layer of foam under a predetermined pressure while being bonded to the upper substrate layer such that the density and thickness of the base layer of foam after being bonded to the upper substrate layer is substantially the same density and thickness as before being placed under pressure,

g) defining a first partial thickness of the tile member unit as the distance between the upper foam surface and the bottom foam surface,

h) defining a second partial thickness of the tile member unit as the distance between the top surface of the tile member unit and the upper foam surface of the base layer of foam plastic material,

i) defining the predetermined overall thickness of the tile member unit as substantially the sum of the first partial thickness and the second partial thickness, and,

j) making the first partial thickness about 15 to 20 times thicker than the second partial thickness.

11. The method of claim 10, including limiting the density of the base layer of foam plastic material to a range of about 0.1 grams/cubic centimeter to 1.5 grams/cubic centimeter.

12. The method of claim 10, including making the upper substrate layer from at least one material selected from the group consisting of metals, alloys, macromolecular materials such as vinyl monomer copolymers and/or homo-polymers; condensation polymers such as polyesters, polyamides, polyimides, epoxy resins, phenol-formaldehyde resins, urea formaldehyde resins; natural macromolecular materials or modified derivatives thereof such as plant fibers, animal fibers, mineral fibers, ceramic fibers and carbon fibers.

13. The method claim 12, including selecting the vinyl monomer copolymers and/or homo-polymers from the group consisting of polyethylene, polyvinyl chloride, polystyrene, polymethacrylates, polyacrylates, polyacrylamides, ABS, (acrylonitrile-butadiene-styrene) copolymers, polypropylene, ethylene-propylene copolymers, polyvinylidene chloride, polyteterafluoroethelyne, polyvinylidene fluoride, hexafluoropropene, and styrene-maleic anhydride copolymers.

14. The method of claim 10, wherein the pressure applied during bonding of the base layer of foam to the upper substrate layer is approximately 10 to 150 kg/cm^2.

15. The method of claim 14, wherein the pressing process includes a heating stage and a cooling stage.

16. The method of claim 15, wherein the temperature during the heating stage is approximately 40 to 150°C and the temperature during the cooling stage is approximately 15 to 30°C.

17. The method of claim 15, wherein the pressing duration during the heating stage is approximately 5 to 50 minutes and the pressing duration during the cooling stage is approximately 5 to 50 minutes.

18. The method of claim 10, including, forming the tile member unit with a rectangular periphery and a beveled edge extending the full length of each side of the rectangular periphery such that said beveled edge diverges upwardly from the bottom foam surface toward the top surface of the tile member unit.

19. The method of claim 10, including providing said tile member unit with an abrasion resistant wear layer disposed over the uppermost surface of said upper substrate layer, such that the top surface of the wear layer is the top surface of the tile member unit, and forming the wear layer of a transparent plastic material and providing a design between the wear layer and the upper substrate layer such that the design is visible through the transparent wear layer.

20. The method of claim 10, including forming the base layer of closed cell foam pvc plastic material with approximately 3% to 9% by weight of the toughening agent.

21. The method of claim 10, including scoring or grooving the bottom foam surface between the opposite edges of the tile member unit to facilitate folding of the tile at inside and outside corners of intersecting support surfaces.

FIG. 1

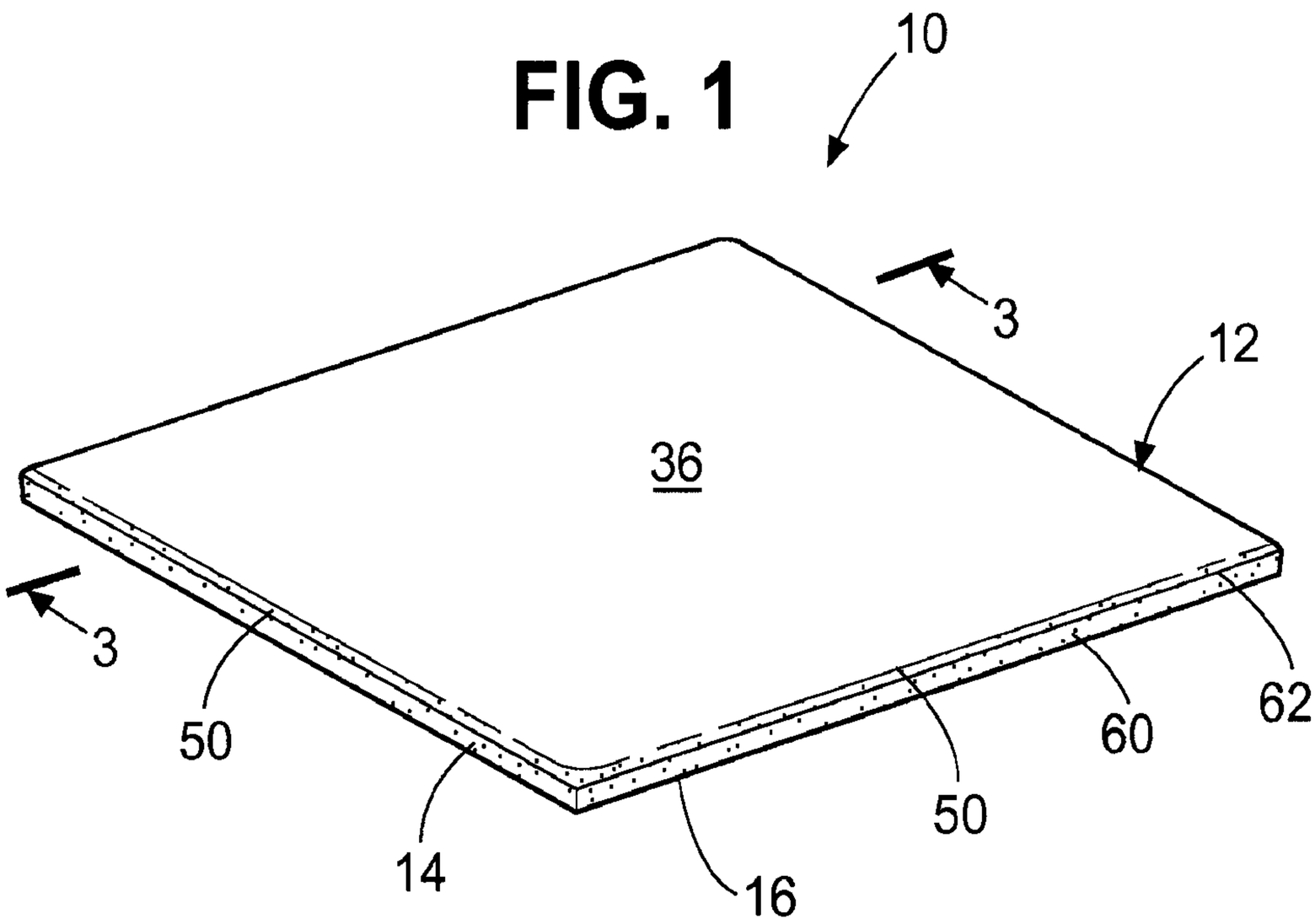


FIG. 2

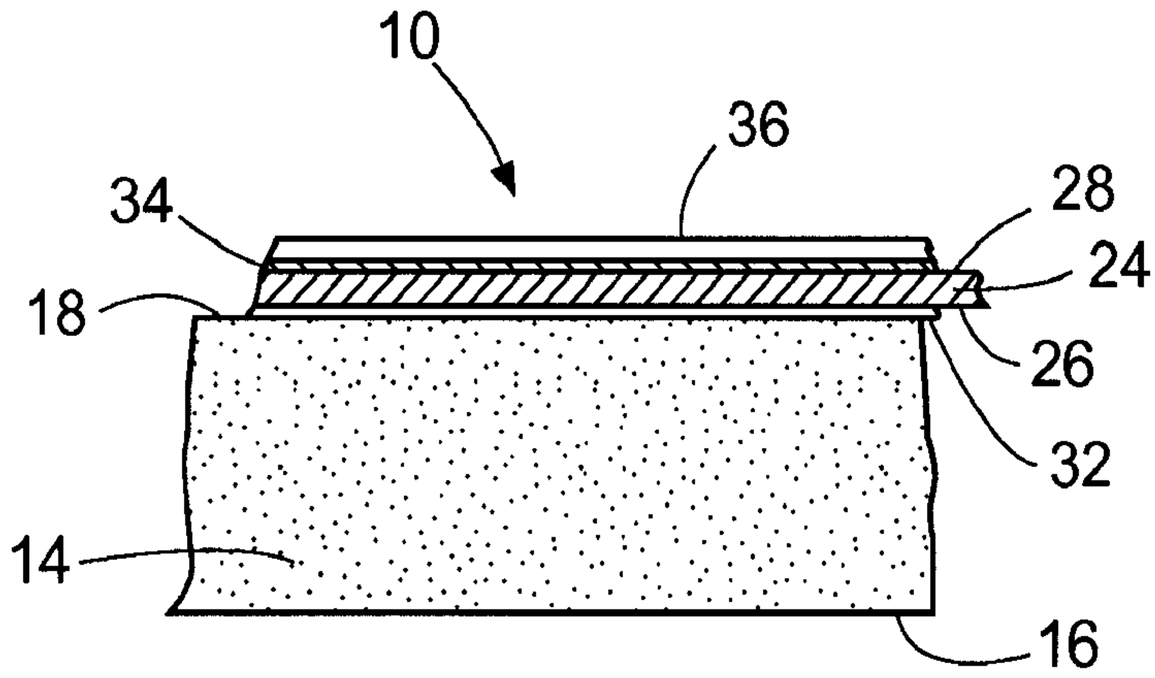


FIG. 2A

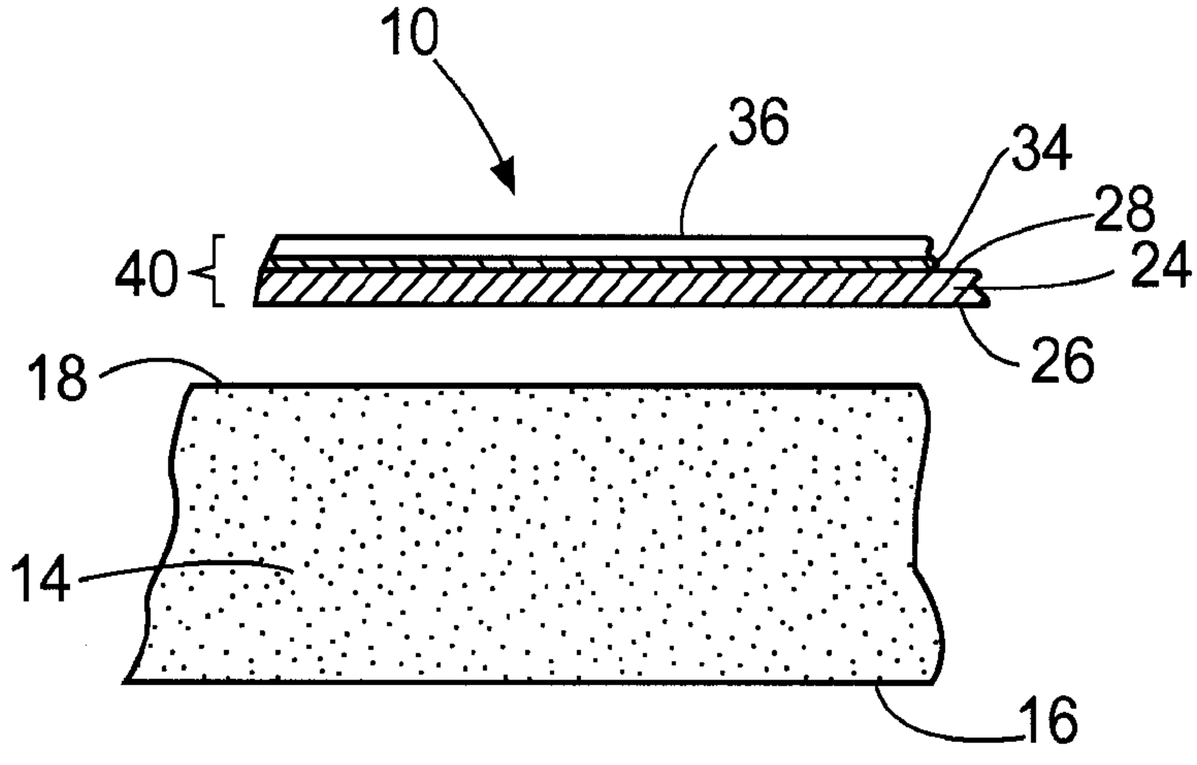


FIG. 3

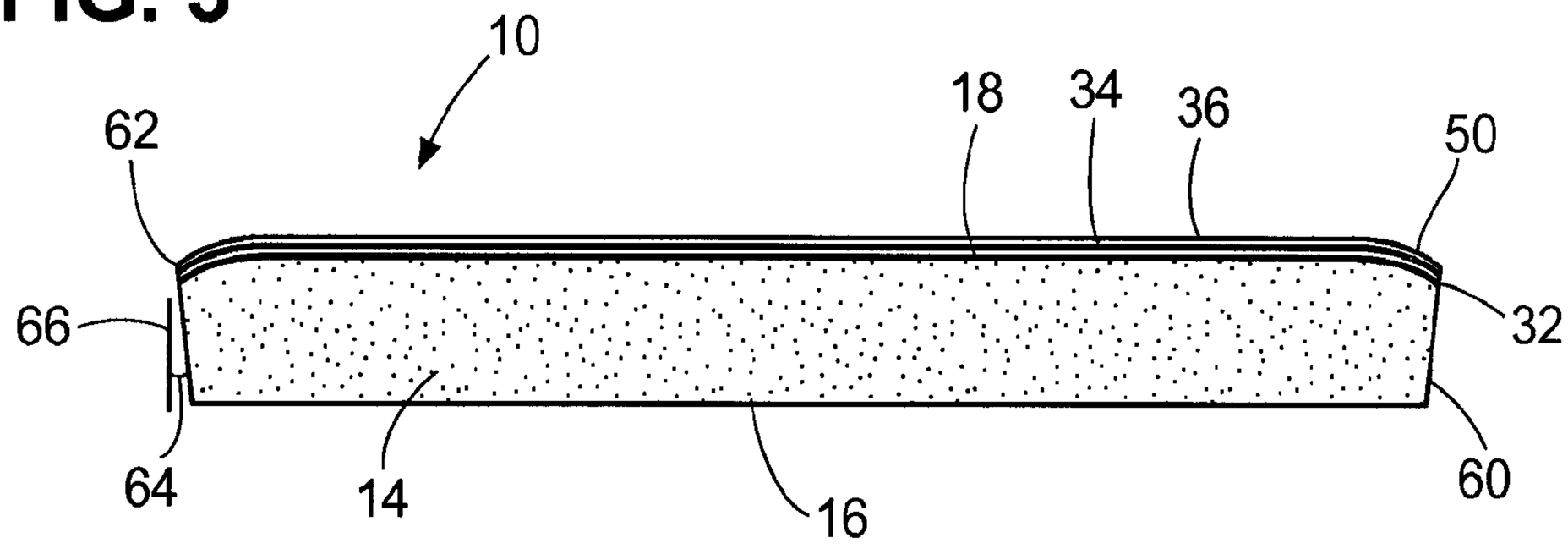


FIG. 4

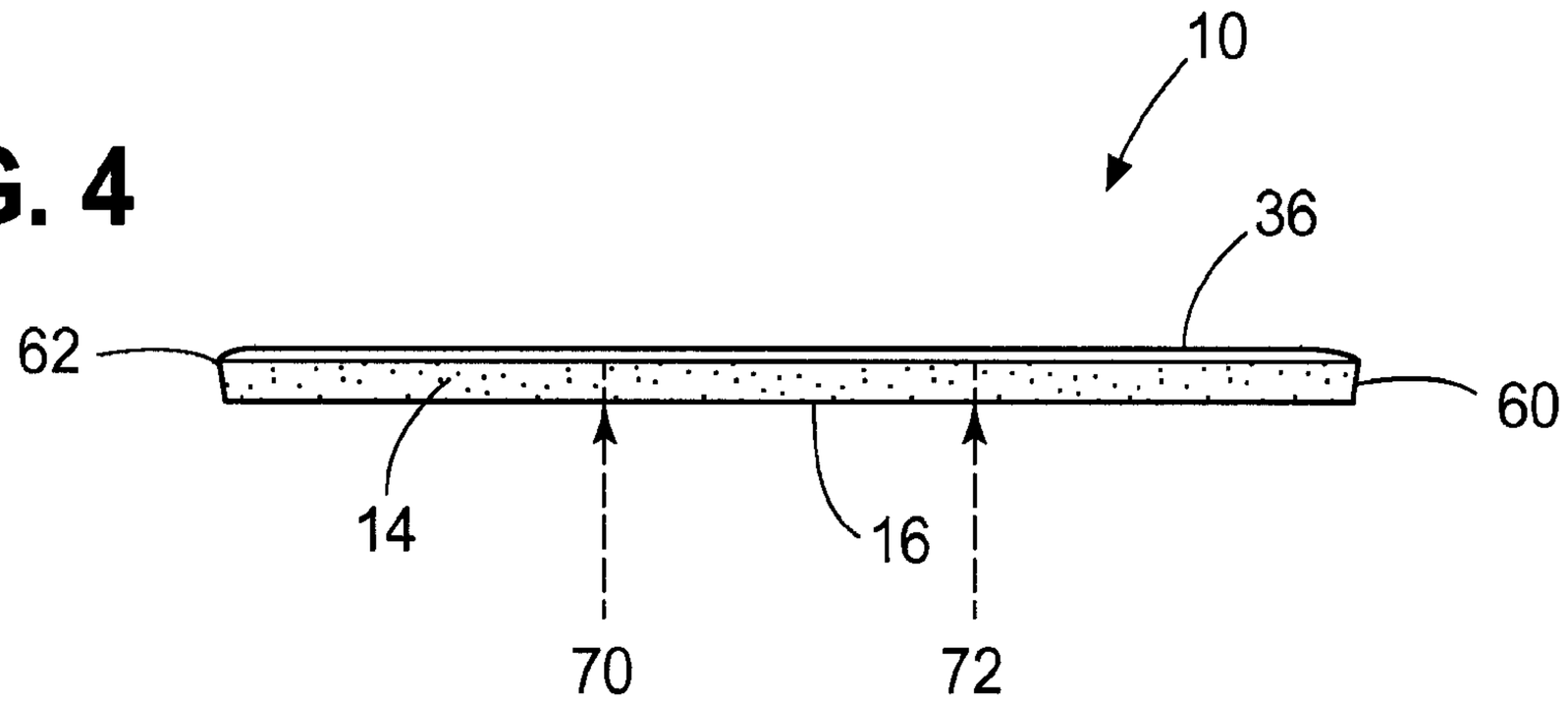


FIG. 5

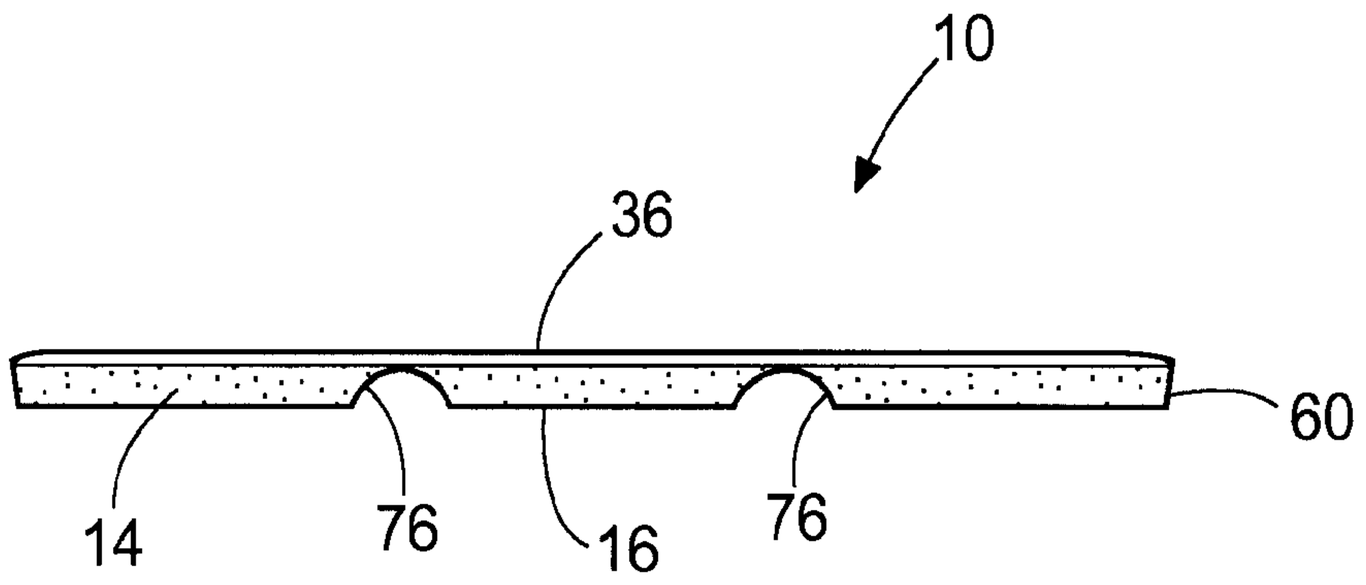


FIG. 6

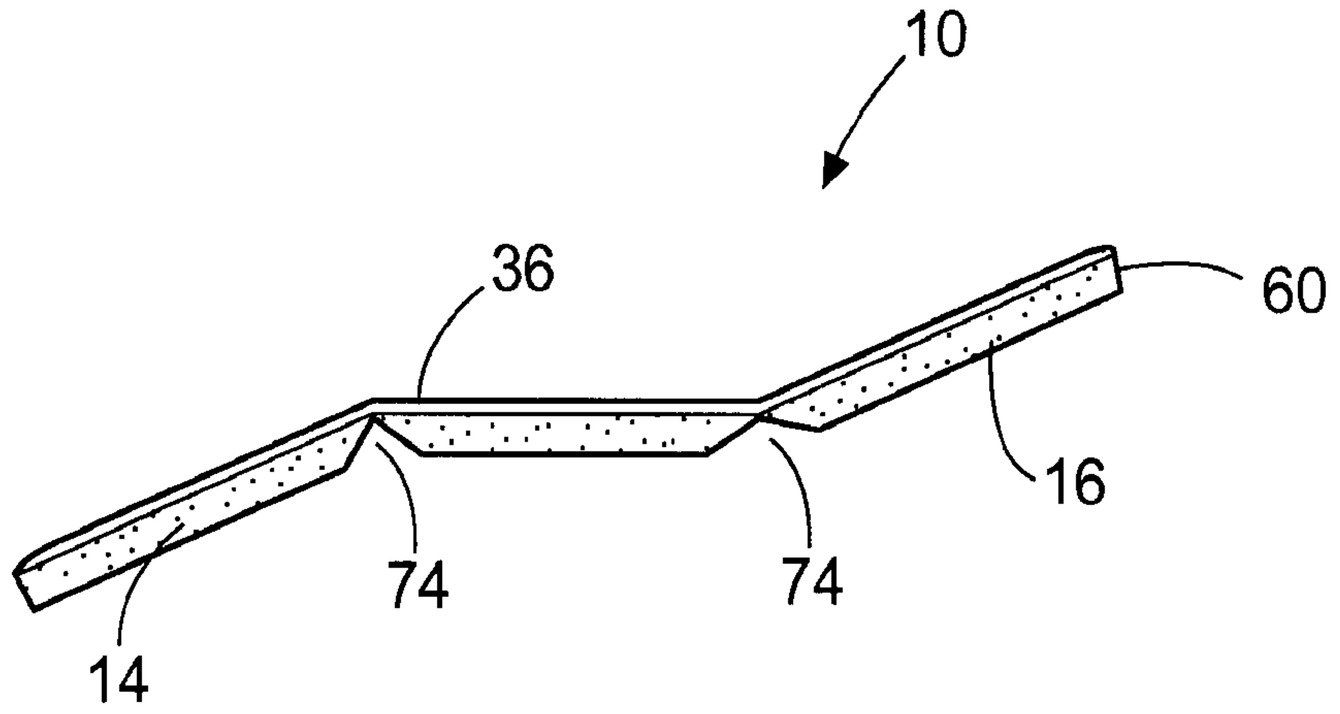


FIG. 7A

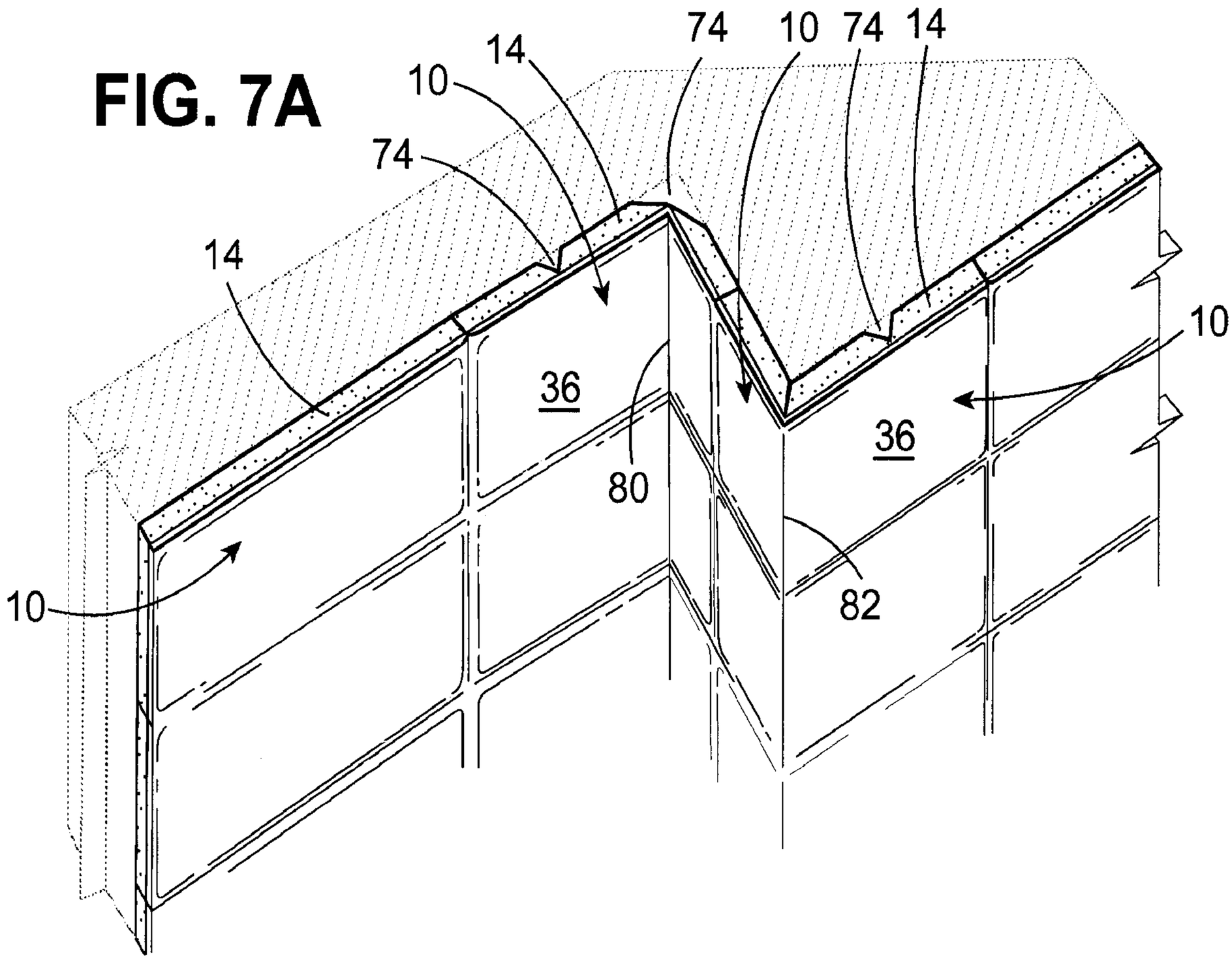


FIG. 7B

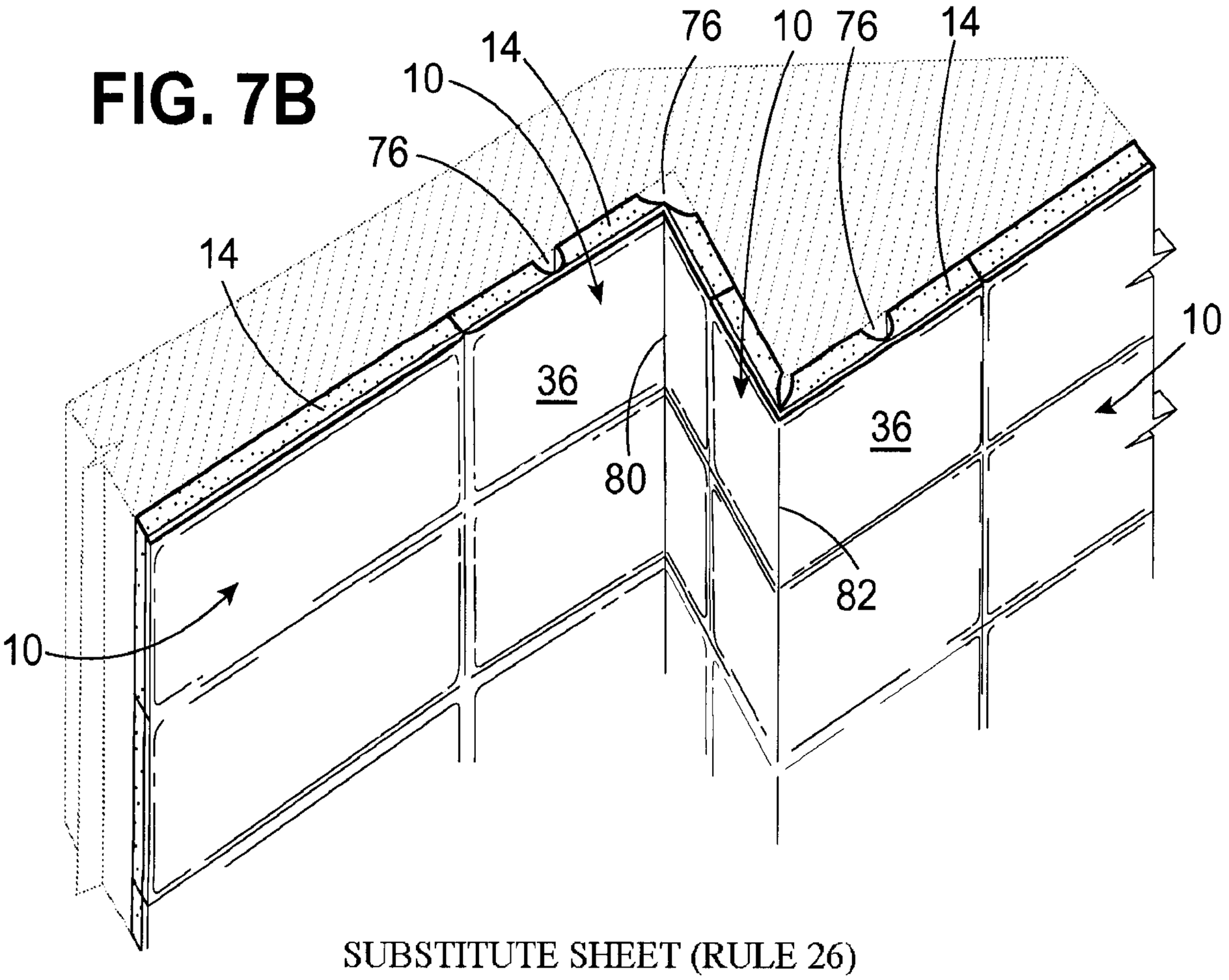


FIG. 8

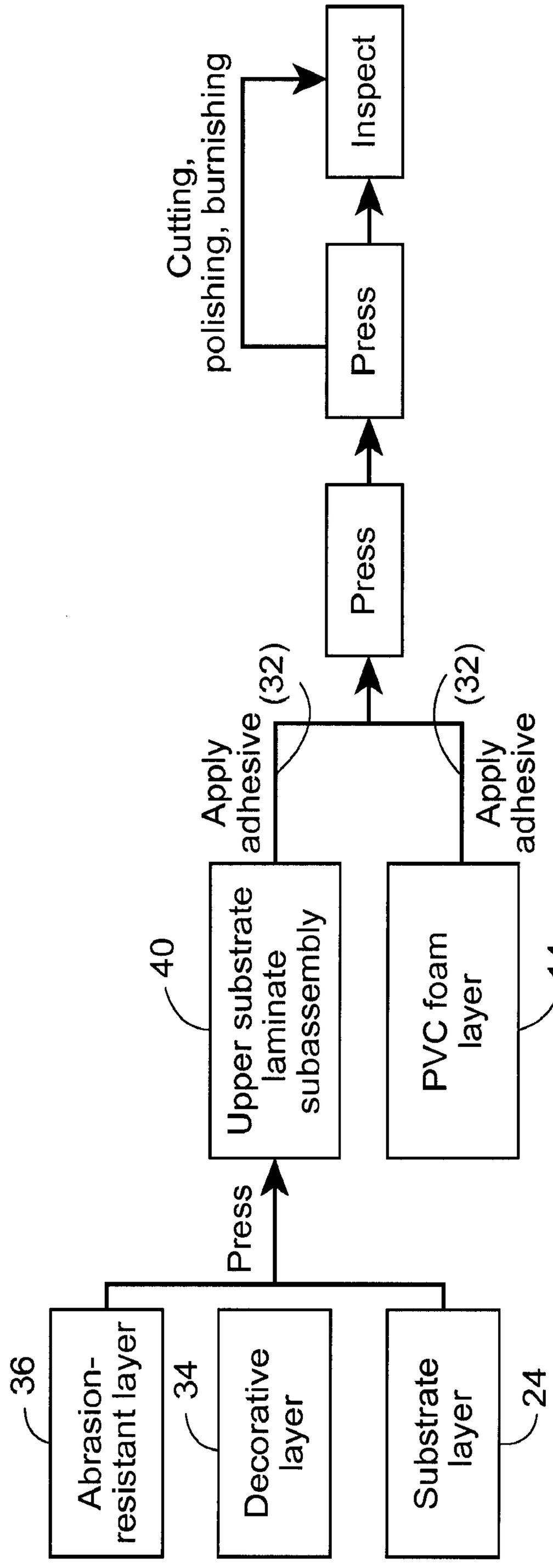

Inspect
Cutting, polishing, burnishing
Press
Press
(32)
(32)
Apply adhesive
Apply adhesive
Upper substrate laminate subassembly
40
PVC foam layer
14
Press
Abrasion-resistant layer
36
Decorative layer
34
Substrate layer
24

FIG. 9

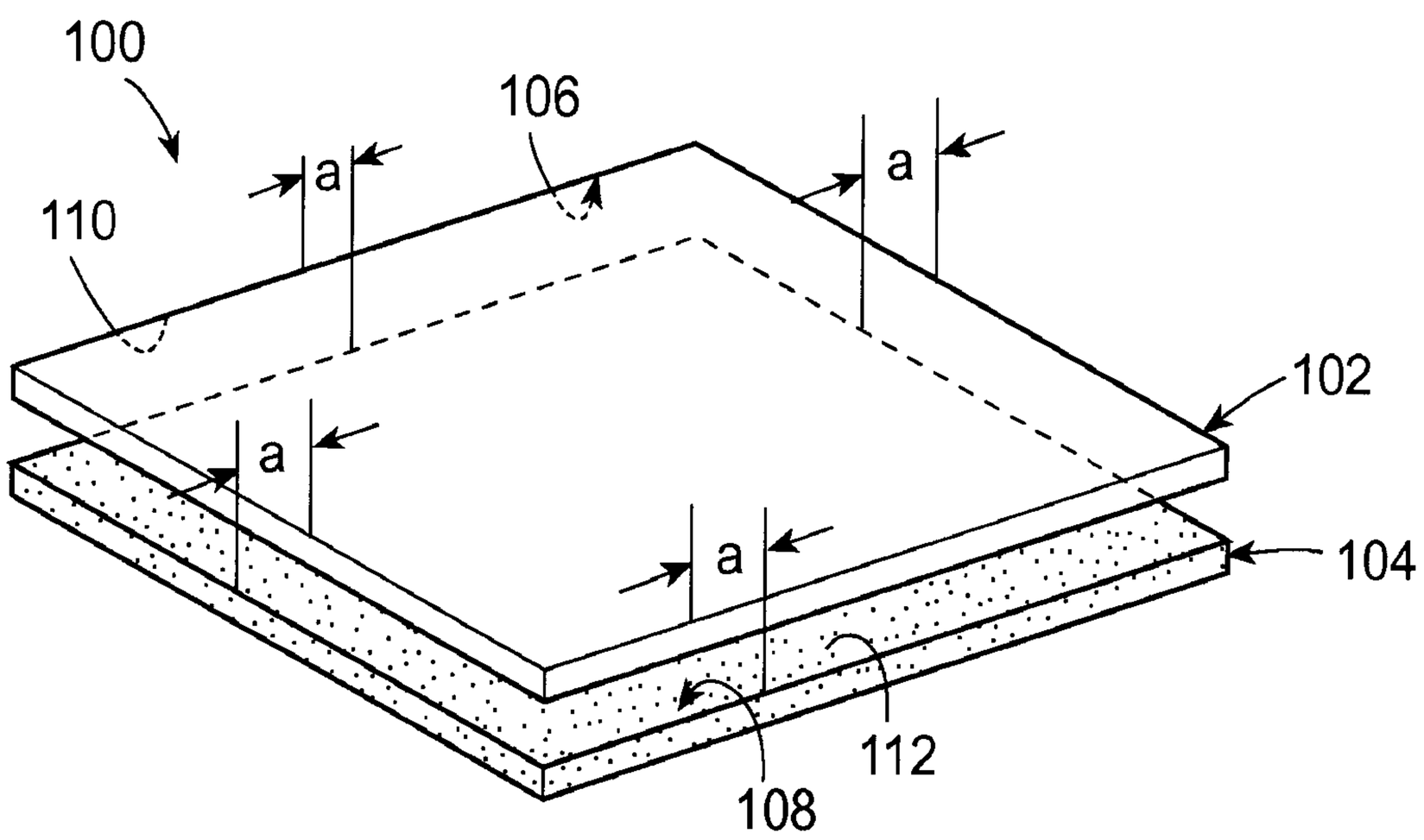

100
106
a
a
110
102
a
a
104
112
108

FIG. 10

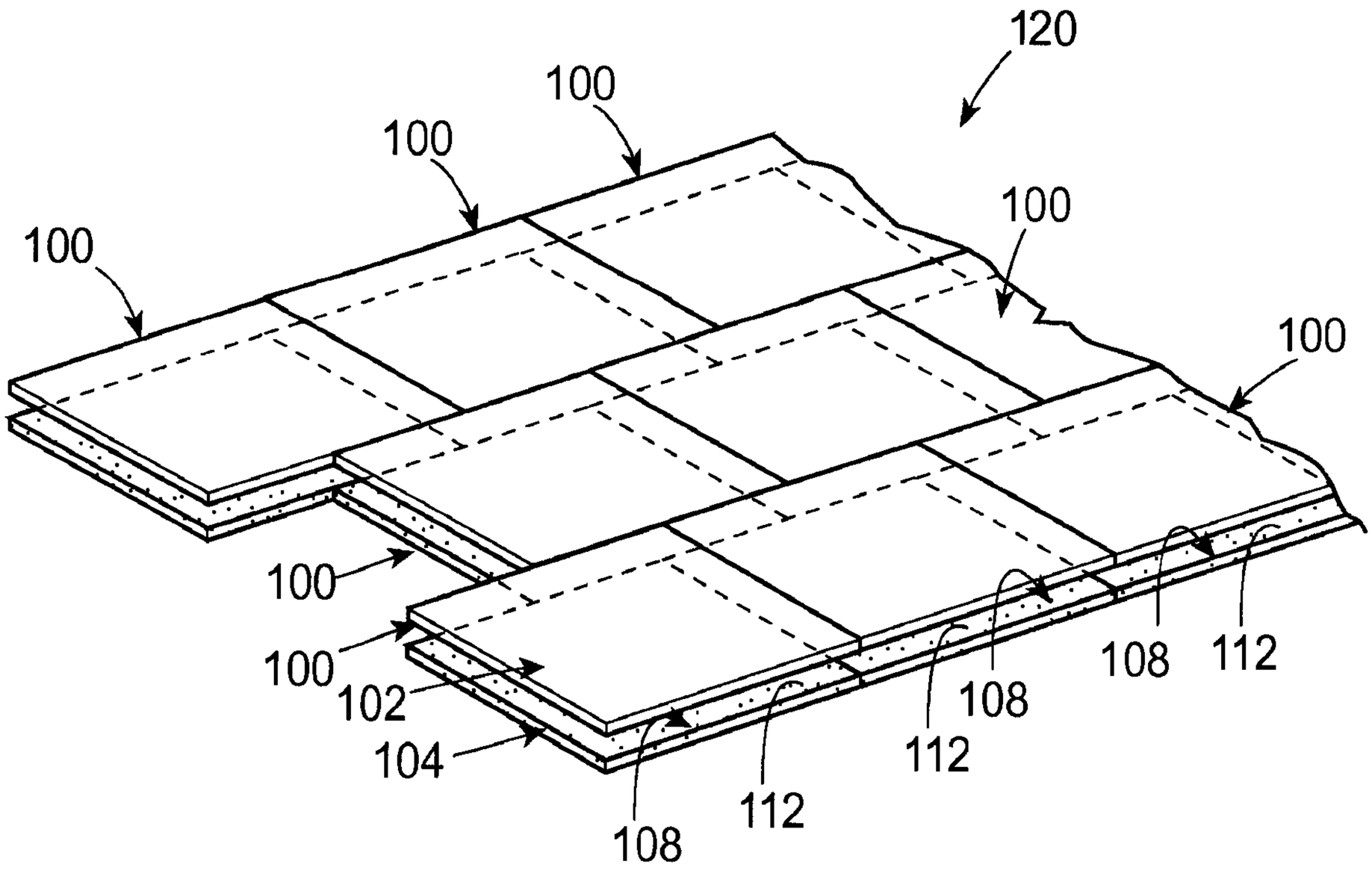

120
100
100
100
100
100
100
102
104
108
112
108
112
108
112
108
112

FIG. 9

