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(54) **Glass fiber facing sheet**

Glasfaserdeckschicht

Feuille de garniture en fibres de verre

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EP 0 962 605 B1

Description

Field of the Invention

[0001] The invention relates to glass fiber facing sheets for cement boards and more particularly, relates to nonwoven, open mesh facing sheets formed of continuous glass yarns, to a method of making same and to engineered surfaces, specifically, cement boards including such facing sheet material.

Background of the Invention

[0002] Interior and exterior construction boards with cores of plaster, cement, or hybrid materials, such as cement boards or gypsum boards, are used in a wide variety of indoor and outdoor structural applications. For example, cement boards are used as a support surface for overlying materials such as wood siding, stucco, synthetic stucco, aluminum, brick, tile, stone aggregate and marble. In addition, cement boards are used in exterior insulating systems, commercial roof deck systems, and exterior curtain walls.

[0003] Generally, cement boards contain a core formed of a cementitious material which is interposed between two layers of facing material. The facing material advantageously contributes flexural and impact strength to the high compressive strength but brittle material forming the hardened cementitious core. In addition, the facing material can provide a durable surface and/or other desirable surface properties to the cement board.

[0004] One material which has been used to form facing sheet material is glass fibers. In addition to increased dimensional stability in the presence of moisture, glass fiber facings provide greater physical and mechanical properties to the cement board. As described, for example, in U.S. Pat. No. 5,371,989 to Lehnert et al., the method of making cement boards containing glass fiber facing sheets typically consists of providing a continuous feed of the facing material and depositing a cementitious slurry onto the top surface of the facing material. A second continuous feed of facing material is then applied to the top surface of the slurry. The slurry is then dried to harden the cementitious composition and to integrate the facing material in the cement board. The cement board is cut to a predetermined length for shipping and for its eventual use.

[0005] U.S. Pat. No. 4,647,496 to Lehnert et al. describes the use of randomly oriented fibrous glass mats as the facing material for gypsum boards. Additionally, U.S. Pat. No. 5,397,631 to Green et al. describes coating a gypsum board including a randomly oriented glass mat with a water-resistant resinous binder to prevent the deterioration of the bond between the gypsum and the glass mat.

[0006] An alternative to the randomly oriented fibrous glass mats to reinforce cement boards is the use of open mesh glass scrims formed from continuous glass yarns. Because these scrims contain continuous yarns, they possess greater tensile strength than the randomly oriented fibrous glass mats. For example, U.S. Pat. No. 3,993,882 to Knauf et al. describes using a facing sheet formed of a glass fabric. In addition, published European patent application 637,658 to Bay Mills Limited describes the use of glass rovings to form nonwoven scrims for stucco boards.

[0007] GB-A-2102731 relates to flexible and rollable sheet material which is reinforced. GB-A-2102731 also relates to glass scrims which are said to have use in roofing applications as reinforcements for underslating felts.

[0008] In order to reduce glass usage, the mesh size of the glass scrims may be increased thus reducing the number of yarns or "picks per inch" in the transverse and/or the longitudinal direction without reducing the strength of the cement board. Nevertheless, the resulting increase in the size of the mesh openings in the glass fiber facing sheet causes other problems. Particularly, when the open mesh facing is applied to a cementitious slurry, pitting or the formation of indentations may occur in the center of the mesh openings which negatively affects the aesthetic appearance and surface properties of the cement board.

Summary of the Invention

[0009] The present invention provides a glass fiber facing sheet for engineered surfaces such as for masonry applications, roofing applications, and the like, preferably for cement board. The glass fiber facing sheet provides a smooth surface which is essentially free of pitting. The glass fiber facing sheet is created from a minimal amount of material compared to glass fiber facing sheets that use a heavier weight scrim, thus reducing the cost and weight of the resulting cement board or other product but without significant negative impact on the physical and mechanical properties of the final product.

[0010] In accordance with the present invention, the glass fiber facing sheet comprises an open mesh glass scrim having a plurality of intersecting glass yarns which are bonded at their crossover points to provide dimensional stability to the scrim. The glass scrim of the present invention is preferably a nonwoven scrim comprising generally transverse and generally longitudinal yarns having less than 100 mesh openings per square inch, i.e., less than 10 by 10 picks per inch. Preferably, the glass yarns are bonded through the use of a polymeric binder. A polymer web is joined to one or both faces of the glass scrim and covers at least a portion of the mesh openings in the scrim. The polymer web is formed of melt blown polymer fibers which are preferably formed directly on the surface of the scrim. The melt blown polymer web is generally a low strength web that does not contribute significantly to the strength of the

cement board. Nevertheless, the polymer web causes a cementitious slurry or other liquid used to form cement board, roofing materials and the like, to window pane evenly over the mesh openings on the exterior of the scrim thus improving the appearance and, at least in some cases the strength of the final product, e.g., cement board, by improving the interaction of the liquid or slurry and the glass scrim. Because the melt blown web is typically thin and is normally applied to only one face of the glass scrim, the opposed face of the scrim provides an exposed three-dimensional grid profile surface which remains available to interact mechanically with hardenable liquids such as the cementitious slurry used in the cement board. Accordingly, when used in forming cement board, the glass fiber facing sheet of the present invention is mechanically integrated into a surface portion of the cementitious core by virtue of the exposed grid profile surface of the scrim. A second open mesh glass scrim may be mechanically integrated into the other surface of the cement core to further enhance the properties of the cement board and may also include a melt blown polymer web on the surface of the scrim.

[0011] In one preferred embodiment of the invention, the melt blown polymer web applied to the surface of the glass scrim has a basis weight of between about 2 and 30 g/m^2 (grams per square meters of scrim) Cement board formed using this facing sheet has a smooth exterior surface with little or no pitting. In another preferred embodiment of the invention, the melt blown polymer web applied to the surface of the open mesh glass scrim has a higher basis weight of between about 10 and 50 g/m^2. The basis weight of the melt blown polymer web in this embodiment provides various desirable surface properties including a smooth finished exterior surface which can be painted directly.

[0012] In yet another preferred embodiment of the invention, the melt blown polymer web applied to the surface of the glass scrim has an even higher basis weight of between about 45 and 75 g/m^2. The melt blown polymer web may then be subjected to heat and pressure to melt and coalesce the fibers in the polymer web to form a microporous layer. The microporous layer provides a water resistant surface which nonetheless allows gases such as water vapor to pass through the web. Alternatively, a microporous film such as a high density polyethylene film may be applied to the facing sheet prior to or following deposition of the melt blown polymer web to provide essentially the same result.

[0013] The present disclosure also includes a method of creating a glass fiber facing sheet for engineered surfaces on products such as cement boards. According to this preferred embodiment, the melt blown polymer web is generally formed directly on the surface of the scrim and is preferably formed from an adhesive polymer composition which adheres to the surface of the scrim. In another preferred method embodiment, the present invention includes a method of making an engineered surface comprising providing a method of making an engineered surface comprising providing a facing sheet comprising an open mesh glass scrim defined by a plurality of intersecting, continuous filament glass yarns bonded at crossover points thereof and a melt blown polymer web joined to one face of the glass scrim and covering at least a portion of the mesh openings thereon, the opposed face of the glass scrim defining an exposed grid profile surface, integrating the exposed grid profile surface of the facing sheet into a surface portion of a cementitious slurry layer, and allowing the cementitious slurry layer to harden to form the engineered surface.

[0014] The present disclosure further includes a method of making a cement board using the glass fiber facing sheet of the invention. The glass fiber facing sheets can be used to prepare cement boards of various types using conventional cement board manufacturing apparatus and manufacturing layouts. The method comprises providing a first facing sheet, preferably formed of glass fibers, and depositing a first cementitious slurry onto and through the facing sheet. A second cementitious slurry typically varying in material composition and/or viscosity from the first cementitious slurry may optionally be deposited on the first cementitious slurry. A glass fiber facing sheet formed according to the method described above is then applied to the cementitious slurry with the exposed grid profile directly contacting the cementitious slurry. An additional cementitious slurry preferably having a low viscosity may optionally be applied to the surface of the glass fiber facing sheet. The cementitious slurry(s) and the glass fiber facing sheet(s) are then preferably pressed to control thickness and consolidate the materials and the cementitious material hardened, for example by heating, to mechanically integrate the exposed three-dimensional grid profile surface of the glass fiber facing sheet into the cementitious core thereby forming the cement board.

[0015] Cement boards including the glass fiber facing sheet of the present invention have a smooth finish with little or no pitting. In addition, these boards can be lighter and/or less expensive than conventional cement boards while possessing mechanical and physical properties comparable to or exceeding conventional boards.

Brief Description of the Drawings

[0016] In the drawings which form a portion of the original disclosure of the invention:

Figure 1 illustrates a perspective view of one glass fiber facing sheet of the invention including a melt blown polymer web having a density of between about 2 and 30 g/m^2 according to a preferred embodiment of the invention.

Figure 2 illustrates a perspective view of one glass fiber facing sheet of the invention including a melt blown polymer web having a density of between about 10 and 50 g/m^2 according to an alternative

preferred embodiment of the invention.

Figure 3 illustrates a perspective view of one glass fiber facing sheet of the invention including a melt blown polymer web having a density of between about 45 and 75 g/m^2 and which has been melted to form a microporous film according to an alternative preferred embodiment of the invention.

Figure 4 illustrates a plan view of the glass fiber facing sheet in **Figure 1** taken from the bottom thereof and illustrates the exposed grid profile of the facing sheet.

Figure 5 schematically illustrates one preferred method of forming the melt blown polymer web on one face of the glass scrim to form a glass fiber facing sheet according to the invention.

Figure 6 schematically illustrates one preferred method of making a cement board including the glass fiber facing sheet of the invention.

Figure 7 illustrates a perspective view of a cement board including a glass fiber facing sheet of the invention.

Figure 8 is a sectional view of the cement board in Figure 7 along line 8-8.

Detailed Description of the Preferred Embodiments

[0017] In the following detailed description, preferred embodiments of the invention are described and discussed in detail to enable practice of the invention. It will be apparent that although specific terms are used to describe the preferred embodiments, these are used in the descriptive sense and not for the purpose of limiting the invention thereto. It will also be apparent that the invention is susceptible to a wide variety of changes as will become apparent from a consideration of the preferred embodiments of the invention as shown in the attached drawings and described in detail below.

[0018] Figure 1 illustrates a glass fiber facing sheet **10** for an engineered surface such as cement board **12** according to one preferred embodiment of the invention. The glass fiber facing sheet **10** of the invention comprises an open mesh glass scrim **15** and a melt blown polymer web **20**. The open mesh glass scrim **15** is formed by a plurality of intersecting, continuous multifilament, glass yarns **25** and **30** which are bonded at their crossover points **35** to provide dimensional stability to the glass scrim. Preferably, as shown in Figure 1, the open mesh glass scrim is formed by a plurality of generally transverse glass yarns **25** and a plurality of generally longitudinal glass yarns **30** which are bonded at their crossover points **35** to provide dimensional stability to the glass scrim. As will be apparent, the glass scrim **15** can be formed from or include yarns of various orientations in place of or in addition to the generally transverse and generally longitudinal yarns illustrated in Figure 1 including diagonally oriented yarns, randomly oriented yarns, and yarns in a 0°/60°/120° orientation, which intersect and are bonded at their crossover points and define a generally open mesh scrim. The scrim **15** can be woven, knitted or nonwoven. Preferably, scrims such as scrim **15** comprising transverse yarns **25** and the longitudinal yarns **30** are nonwoven. The glass scrim **15** can be formed by the apparatus and process of U.S. Patent No. 4,242,779 issued January 6, 1991 to Curinier et al. which is hereby incorporated by reference. This process involves using an apparatus for forming a web of transverse (weft) yarns **25** for use in the scrim **15** and subsequently superimposing one or more webs of longitudinal (warp) yarns **30** on the web of weft yarns to form the open mesh glass scrim.

[0019] Preferably, the quantity of glass yarns used to form the glass scrim **15** is minimal, thereby reducing the cost and the weight of the resulting cement board using the glass fiber facing sheet **10**. Nevertheless, the amount of continuous glass yarns used in the glass scrim **15** are sufficient to impart the desired physical and mechanical properties to the scrim **15** and the glass fiber facing sheet **10**. Therefore, scrims having generally transverse **25** and generally longitudinal yarns **30** are preferred. The amount of generally transverse yarns **25** and generally longitudinal yarns **30** may be defined by the "picks per inch" or pick count of the scrim **15**. Alternatively, the number of transverse yarns **25** and longitudinal yarns **30** may be defined by the number of mesh openings **40** in the glass scrim **15**. Preferably, the glass scrim **15** has less than about 100 mesh openings per square inch (i.e, a pick count of less than 10 by 10). More preferably, the glass scrim **15** has less than about 70 mesh openings per square inch or even less than about 50 mesh openings per square inch. Generally, the individual yarns used to form the scrim can have a size ranging from about 900 yds/lb to about 9,000 yds/lb.

[0020] The transverse yarns **25** and the longitudinal yarns **30** are bonded at their crossover points **35** to provide dimensional stability to the scrim **15** and therefore to the glass fiber facing sheet **10**. Preferably, the transverse yarns **25** and the longitudinal yarns **30** are bonded at their crossover points **35** by a polymeric binder. The polymeric binder is preferably applied as a low viscosity coating so that it can uniformly penetrate into the transverse yarns **25** and longitudinal yarns **30** and coat the filaments forming the yarns. Numerous different polymeric binders capable of penetrating the transverse yarns **25** and the longitudinal yarns **30** and interlocking the transverse yarns and longitudinal yarns together at their crossover points **35** can be used in the invention. Preferably, the polymeric binder is an alkali and moisture resistant thermoplastic or thermosetting polymer coating which can, in addition to providing dimensional stability to the scrim, also prevent chemical interaction between the cementitious materials forming the core of the cement board and the glass filamentary material, particularly when an alkaline and/or silicious cementitious material, e.g. Portland cement, is contained in the core of the cement board. Exemplary moisture resistant materials for the polymeric binder include polyvinyl chlo-

ride, polyvinyl acetate, polyvinylidene chloride, polyvinyl alcohol, styrene butadiene rubber, urethane, silicone, metallic resinates, wax, asphalt, acrylic resins, styrene acrylate copolymers, aromatic isocyanates and diisocyanates, organchydrogenpolysiloxenes, thermoset resins such as epoxies and phenolics, mixtures thereof, and the like. The preferred polymeric binder for binding the transverse yarns **25** and the longitudinal yarns **30** is polyvinyl chloride (PVC) which is applied as a plastisol. Preferably, the polymer coating is applied to the scrim in between about 5 and 150 parts dry weight of resin to 100 parts by weight of fabric. In other words, the coating is applied at 5% to 150% dry weight pick-up.

[0021] A melt blown polymer web **20** is preferably joined to the glass scrim **15** on one face **45** of the scrim, but may be applied on both faces of the scrim. The melt blown polymer web **20** covers at least a portion of the mesh openings **40** in the glass scrim **15,** preferably, a significant portion (e.g. most, if not all) of the mesh openings. The term "covers" as used in this context includes both partial and complete coverage of the mesh openings. The polymer web **20** is preferably composed of a plurality of randomly oriented melt blown polymer fibers. Preferably, the melt blown web partially and uniformly covers the mesh openings, i.e., each opening includes a porous web that only. partially covers the scrim opening because of the openings in the porous web. The melt blown polymer fibers preferably are formed from an adhesive polymer so that the web adheres to the face **45** of the glass scrim **15** without requiring application of a separate adhesive layer. Therefore, the polymer used for the melt blown polymer web **20** is typically a polymer which possesses a certain tackiness to the glass surface or the polymeric binder, at least when the fibers are at a temperature above their softening point (e.g. 350° to 400°F). Such materials include polyolefins such as polypropylene, polyethylene and amorphous poly(α-olefins); ethylene copolymers such as ethylene vinyl acetate or ethylene methacrylate copolymers, polyesters such as polyethylene terephthalate; polyamides; polyacrylates; polystyrene; styrene block copolymers; thermoplastic elastomers; mixtures thereof; and other known fiber forming thermoplastic materials. Preferably, the polymer used to form the melt blown polymer web **20** is not tacky at temperatures considerably below its softening point (e.g. at room temperature) to allow the facing sheet to be rolled and unrolled without sticking to itself, i.e., without adherence between the opposed face of the scrim and the melt blown polymer web. Preferred melt blown polymers include amorphous poly(α-olefin) polymers (e.g. 8494-36G from National Starch and Chemical Co.) and polyamides (e.g. HL-6520-X from HB Fuller Co.)

[0022] The amount of melt blown fibers forming the polymer web **20** and applied to the face **45** of the glass scrim **15** is normally described in terms of basis weight, or grams of melt blown fibers per square meters of glass scrim surface. Preferably, the basis weight of the melt blown polymer web **20** is between about 1 and 100 g/m^2. In one preferred embodiment, illustrated in Figure 1, the basis weight of the melt blown polymer web **20** is about 2 and 30 g/m^2.

[0023] The melt blown polymer webs **20** illustrated in Figure 1 have very little inherent strength and are essentially nonstructural. Nevertheless, as described herein, the melt blown polymer web prevents pitting (i. e. indentations caused when the slurry used to form the cementitious core sinks into the mesh openings of the glass scrim). This is particularly a problem in the large open mesh glass scrims that are used in preferred embodiments of the present invention, The melt blown polymer web **20** maintains a portion of the cementitious slurry on the surface of the glass fiber facing sheet **10** and causes the slurry to "window pane" the mesh openings **40** of the glass scrim **15** thereby forming a substantially planar bridge surface between the transverse and longitudinal yarns **25** and **30.** Accordingly, at least in some cases, the melt blown polymer web **20** increases the composite strength of the cement board **12** by improving the mechanical integration of the facing sheet **10** into the cement board **12**.

[0024] Figure 2 illustrates a glass fiber facing sheet **110** according to an alternative preferred embodiment of the invention. In Figure 2, the basis weight of the melt blown polymer web **120** is between about 10 and 50 g/m^2. The increased basis weight of the melt blown polymer web **120** over the embodiment illustrated in Figure 1 provides a corresponding increase in the inherent strength of the web. Nevertheless, the majority of the strength provided by the facing sheet **110** in the cement board **12** is provided by the glass scrim **15.** In the.embodiment shown in Figure 2, the higher basis weight melt blown polymer web **120,** which by itself is relatively weak, combines with the cementitious slurry to provide various desirable surface properties including a smooth finished exterior surface which can be painted directly without requiring any additional material on the surface of the cement board.

[0025] Figure 3 illustrates a glass fiber facing sheet **210** according to yet another embodiment of the invention. In Figure 3, the melt blown polymer web **220** applied to the surface of the glass scrim **15** has an even higher basis weight of between about 45 and 75 g/m^2. As in Figure 2, the increased basis weight over the embodiment illustrated in Figure 1 does increase the inherent strength of the web **220** but the majority of the strength provided by the facing sheet **210** is still provided by glass scrim **15**. The melt blown polymer web **220** may be subjected to heat and pressure to melt and coalesce the melt blown fibers in the polymer web to form a microporous layer **220**. The microporous layer **220** provides a water resistant surface which nonetheless allows gases such as water vapor to pass through the facing sheet **210**. The microporosity of the layer **220** can be particularly desirable in the formation of cement boards because the cement used in the core of the ce-

ment board is a hydrated compound and therefore water vapor may be evaporated from the hydrated cement. The microporous layer **220** allows the water vapor to pass through the glass scrim **15** thus preventing the buildup of moisture on the interior of the facing sheet **210** and the eventual corrosion of the cement board.

[0026] In the embodiments illustrated in Figures 1-3, the glass fiber facing sheet may additionally include a microporous film (not shown) either between the glass scrim **15** and the melt blown polymer web **20, 120, 220** or on top of the melt blown polymer web. The microporous layer provides all the benefits described with respect to the embodiment of Figure 3. Suitable microporous films include the polymers described for use as melt blown polymer fibers. Preferably, the microporous layer is a microporous high density polyethylene film.

[0027] As described above, the melt blown polymer web **20** is preferably applied to one face **45** of the glass scrim **15** to form the glass fiber facing sheet **10**. The opposed face **50** of the glass scrim **15** is preferably not covered by the melt blown polymer web **20** and defines an exposed three-dimensional grid profile surface **55** as illustrated in Figure 4. The grid profile surface **55** is available to interact mechanically with a cementitious slurry used in the cement board **12**. As described below, this allows the glass fiber facing sheet **10** to be mechanically integrated into a surface portion of the cementitious core by virtue of the exposed grid profile surface **55** of the scrim **15**.

[0028] The present disclosure also includes a method of making a glass fiber facing sheet **10** for an engineered surface such as the surface of cement board **12** according to the invention. First, the glass scrim **15** is created from a plurality of intersecting yarns such as generally transverse yarns **25** and generally longitudinal yarns **30**. As stated above, the glass scrim **15** may include other yarn orientations. Typically, the scrim **15** is created by forming a web of weft yarns and then superimposing one or more webs of warp yarns as described in U.S. Patent No. 4,242,779. Alternatively, the generally transverse yarns **25** and generally longitudinal yarns **30** can be woven or knitted to form the glass scrim **15.** Once the glass scrim **15** is formed, the transverse yarns **25** and longitudinal yarns **30** are interlocked at their crossover points **35** to provide dimensional stability to the glass scrim **15**. As described above, preferably this is accomplished by applying a polymer coating to the scrim **15**. Generally, the glass scrim **15** is coated by the polymer coating by passing the glass scrim through a resinous bath containing the coating and then allowing the coating to harden on the surface and throughout the transverse yarns **25** and longitudinal yarns **30** of the glass scrim. Typically, the coating is hardened on the scrim **15** by heating the coated glass scrim to set the polymeric binder.

[0029] Once the glass scrim **15** is formed and coated with the polymeric binder, the melt blown polymer web **20** is preferably formed onto one face **45** of the glass scrim **15** to cover the mesh openings **40** thereon. This provides an exposed grid profile surface **55** on the opposed face of the glass scrim **15** for mechanical interaction with the cementitious composition of the cement board. The melt blown polymer web **20** can be formed onto the face **45** of the glass scrim **15** in an "on-line" process prior to taking the coated glass scrim up on rolls (e.g. roll **60** in Figure 5) or alternatively, the melt blown polymer web can be formed on the face of the coated glass scrim **15** after it is taken up on rolls in an "off-line" process.

[0030] Figure 5 schematically illustrates the application of the melt blown polymer web **20** to the face **45** of the glass scrim **15** to form the glass fiber facing sheet **10** of the invention by forming a melt blown web directly on the glass scrim using a conventional melt blowing apparatus. Melt blowing apparatus are known to the skilled artisan and are disclosed, for example, in U.S. Patent No. 3,849,241 to Buntin et al. and U.S. Patent No. 4,048,364 to Harding et al. The melt blowing process involves supplying polymeric pellets or other polymer materials to a melting apparatus **64** such as an extruder, melting the molten polymeric material in the melting apparatus, and pumping it to melt blowing heads **66**. The filamentary streams exit the heads **66** where high velocity converging streams of a heated gas, typically air, are supplied from nozzles. The converging streams of high velocity heated gas attenuate the polymer streams and deposit same on the surface of glass scrim **15**. The fibers are randomly oriented and together form the melt blown polymer web **20.** Once the melt blown polymer web **20** has been formed on the surface of the glass scrim **15**, the web/scrim laminate constituting the facing sheet **10** of the invention, may be taken up on a collecting roll **70**. Alternatively, the facing sheet **10** can be formed "on-line" in a process of forming an engineered surface such as cement board without being collected on rolls prior to use in forming the final product, e.g. cement board.

[0031] In the event that the melt blown polymer web **20** is to be melted to form a microporous layer **220** as described with respect to the embodiment in Figure 3, the process of making the glass fiber facing sheet **10** can include a heater (not shown) or alternative means for melting and coalescing the melt blown fibers to form the microporous layer. Alternatively, if a separate microporous film is to be applied to the surface of the glass scrim **15** prior to applying the melt blown polymer web **20**, then an additional melt blown apparatus and head (not shown) can be provided before the melt blowing apparatus **62** to form a light weight tacky web on the surface of the glass scrim **15** thereby allowing the microporous film to bond thereto. Additionally, it may be advantageous to apply a separate microporous layer on the melt blown polymer web, in which case, the additional melt blown apparatus and head would be provided after the melt blowing apparatus **62**.

[0032] Figure 6 illustrates formation of a cement board **12** employing the glass fiber facing sheet **10** of

the invention using conventional cement board manufacturing apparatus and layouts. As shown in Figure 6, a first facing sheet **72** having any of various constructions is provided and the cement board **12** formed thereon. The first facing sheet **72** can, for example, be an open mesh glass scrim comprising a plurality of generally transverse yarns and generally longitudinal yarns optionally containing a melt blown polymer web as described above or any other material which can be used as a facing material for the cement board **12**. The first facing sheet **72** is typically formed of glass fibers and supplied by a roll **74** or other suitable means and a first cementitious slurry **76** is provided from a mixer **78** and deposited onto the surface of the facing sheet **72**. The cementitious slurry **76** can be formed of numerous different compositions of varying moisture content. Exemplary cementitious materials include hydraulic cements such as aluminous cement, Portland cement, gypsum cements, mixtures thereof with aggregates or polymer binders, and the like as will be known to the skilled artisan. Additional mixers such as mixer **92** can be installed between mixer **78** and pressing rolls **80** for the application of an additional cementitious material such as slurry **93** which may differ in viscosity and/or composition from the first cementitious slurry **76**. Preferably, a second cementitious slurry 93 when used has a higher viscosity and generally contains larger aggregate particles than slurry **76**.

[0033] As shown in Figure 6, the glass fiber facing sheet **10** of the invention can be supplied from a roll **70** ("off-line") or formed on-line. An additional mixer **90** can be used to apply a low viscosity cementitious slurry **91** to facing sheet **10**. The low viscosity slurry **91** will generally pass through the glass fiber facing sheet **10** but will also window pane over the mesh openings **40** to create a smooth surface on the cement board. The glass fiber facing sheet **10** is then applied to the cementitious slurry **76** (and optionally cementitious slurry **93**) such that the exposed three dimensional grid profile surface **55** on the lower face **50** of the glass scrim **15** directly contacts the cementitious slurry(s). The glass fiber facing sheet **10**, the cementitious slurry **76** or slurries and the facing sheet **72** are then pressed together such as by one or more pressing rolls **80**, a doctor blade or any other suitable means. When the glass fiber facing sheet **10** is pressed into the cementitious slurry **76** or slurries, the cementitious slurry is forced up through the mesh openings **40** of the glass fiber facing sheet **10**. The force of gravity then causes the cementitious slurry **76** to sink back down away from the glass fiber facing sheet **10** and form meniscuses within the mesh openings. Nevertheless, the melt blown polymer web **20** prevents the cementitious slurry **76** from sinking into the large mesh openings **40** of the glass fiber facing sheet **10.** Instead, the melt blown polymer web **20** maintains a portion of the cementitious slurry **76** on the surface of the glass fiber facing sheet **10** and causes the slurry to window pane the mesh openings **40** of the glass scrim **15** thereby forming a substantially planar bridge surface between the transverse and longitudinal yarns, **25** and **30**. As a result, the glass fiber facing sheet **10** becomes mechanically integrated into the cement board **12** once the cementitious slurry **76** or slurries harden to thereby provide a generally uniform planar exterior surface on the cement board **12**.

[0034] In the hardening of the cementitious slurry **76** or slurries, the cementitious material becomes hydrated. This process can be accelerated by the application of heat such as from heater **82**. During hardening of the slurry **76**, the exposed three dimensional grid profile surface **55** of the glass fiber facing sheet **10** becomes mechanically interlocked into the cement board **12** since the grid profile surface allows the fluid slurry to intimately contact the filament yarns **25** and **30** forming the scrim **15** around a substantial portion of their cross-sections. Preferably the cementitious slurry **76** substantially fully surrounds the cross-section of the longitudinal and transverse yarns **25** and **30** to achieve a high level of mechanical integration of the facing sheet **10** into the core when the slurry hardens. Once the cement board is formed, it may be cut by appropriate means **84** into boards such as 4' x 8' x 7/16" boards. The resulting cement board is illustrated in Figure 7.

[0035] Figure 8 illustrates a cross-section of the cement board **12** illustrated in Figure 7 along line 8-8 As shown in Figure 8, the glass fiber facing sheet **10** comprising the glass scrim **15** and the melt blown polymer web **20** is mechanically integrated into a surface portion **86** of the cementitious core **80** forming the cement board. In addition, the facing sheet **72** is mechanically integrated into an opposed surface portion **90** of the cementitious core **80**.

[0036] As will be apparent from the foregoing, the glass fiber facing sheet **10** of the present invention provides a smooth cement board **12** which is essentially free of pitting. The glass fiber facing sheet **10** can be constructed using fewer continuous glass yarns per unit length of the scrim fabric, thus reducing the cost of the resulting cement board **12** but without negatively affecting the physical and mechanical properties of the cement board.

[0037] The cement boards including the glass fiber facing sheet of the invention can be used in a wide variety of indoor and outdoor structural application. For example, cement boards are used as a support surface for overlying materials such as wood siding, stucco, synthetic stucco, aluminum, brick, tile, stone aggregate and marble. In addition, cement boards are used in exterior insulating systems, commercial roof deck systems, and exterior curtain walls. In addition to cement boards, the facing sheet of the invention can be used with other engineered surfaces in masonry applications, roofing applications and the like.

[0038] The invention has been described in considerable detail with particular reference to preferred embodiments. However, numerous variations and modifica-

tions can be made without departing from the scope of the invention as defined in the following claims.

Claims

1. A facing sheet (10) for an engineered surface comprising:

   an open mesh glass scrim (15) having a plurality of intersecting yarns (25,30) bonded at their crossover points (35) to provide a dimensional stability to said scrim (15); and
   a melt blown polymer web (20) joined to said glass scrim (15) on one face (45) of said scrim (15) and covering at least a portion of the mesh openings (40) therein; and
   the opposed face (50) of said glass scrim (15) defining an exposed grid profile for mechanical interaction with a cementitious composition (74).

2. A cement board (12) comprising:

   a first facing sheet (72) comprising an open mesh glass scrim (15) having a plurality of intersecting yarns (25, 30) bonded at their crossover points (35) and a melt blown polymer web (20) joined to said glass scrim (15) on one face (45) of said scrim (15) and covering at least a portion of the mesh openings (40) therein, the opposed face (50) of said glass scrim (15) defining an exposed grid profile surface (55) for mechanical interaction with a cementitious composition (76) forming a cementititious core (80) of said cement board (12); and
   the cementitious composition (76) having a surface portion (86) mechanically integrated with the grid profile surface (35) of the opposed face (50) of the glass scrim (15) in said first facing sheet (72).

3. The article (10, 12) according to claim 1 or 2 wherein said scrim (15) is nonwoven.

4. The article (10,12) according to claim 1 or 2 wherein the yarns (25,30) in said scrim (15) are bonded at their crossover points (35) by a polymer binder.

5. The article (10,12) according to claim 4 wherein the polymeric binder is polyvinyl chloride.

6. The article (10,12) according to claim 1 or 2 wherein the basis weight of said melt blown polymer web (20) is between abut 2 and 30 g/m^2.

7. The article (10, 12) according to claim 1 or 2 wherein the basis weight of said melt blown polymer web (20) is between about 10 and 50 g/m^2.

8. The article (10,12) according to claim 1 or 2 wherein the basis weight of said melt blown polymer web (20) is between about 45 and 75 g/m^2.

9. The article (10,12) according to claim 8 wherein said melt blown polymer web (20) forms a microporous layer.

10. The article (10,12) according to claim 1 or 2 further comprising a microporous layer.

11. The article (10,12) according to claim 10 wherein said microporous layer comprises a material selected from the group consisting of polyethylene, nylon, polypropylene and ethylene copolymer films.

12. The article (10,12) according to claim 10 wherein said microporous layer is between said glass scrim (15) and said melt blown polymer web (20) and thereby promotes adhesion between said melt blown polymer web (20) and said glass scrim (15).

13. The article (10, 12) according to claim 10 wherein said microporous layer is located on said melt blown polymer web (20) opposite said glass scrim (15).

14. The article (10,12) according to claim 1 or 2 wherein said glass scrim 915) comprises a plurality of generally transverse and generally longitudinal yarns (25,30).

15. The article (10,12) according to claim 14 wherein said scrim (15) has less than about 15 mesh openings per square centimetre (100 mesh openings per square inch).

16. The article (10, 12) according to claim 14 wherein said scrim (15) has less than about 11 mesh openings per square centimetre (70 mesh openings per square inch).

17. The article (10,12) according to claim 1 or 2 wherein said melt blown polymer web (20) consists of a material which is tacky at a temperature above its softening point to facilitate adhesion between said melt blown polymer web (20) and said glass scrim (15) but which is essentially free of tackiness at temperatures considerably below its softening point to thereby allow said facing sheet (10) to be rolled and unrolled without adherence between said opposed face (50) and said melt blown polymer web (20).

18. The article (10,12) according to claim 1 or 2 wherein said melt blown polymer web (20) comprises a polymer selected from the group consisting of polyolefins ethylene copolymers, polyesters, polyamides,

polyacrylates, polystyrene, styrene block copolymers, thermoplastic elastomers, and mixtures thereof.

19. The article (10,12) according to claim 18 wherein said melt blown polymer web (20) comprises an amorphous poly (α-olefin) polymer.

20. The article (10,12) according to claim 1 or 2 wherein said melt blown polymer web (20) comprises a polyamide.

21. The cement board (12) according to claim 2 further comprising a second facing sheet joined to said cementitious core (80) opposite said first facing sheet (72).

22. The cement board (12) according to claim 21 wherein the second facing sheet is an open mesh glass scrim mechanically integrated with an opposed surface portion of said cementitious core (80).

23. The cement board (12) according to claim 22 further comprising the second facing sheet further comprises a melt blown polymer web joined to said glass scrim (15) on one face of said scrim (15) and uniformly covering at least a portion of the mesh openings (40) therein.

24. The cement board (12) according to claim 22 wherein the open mesh glass scrim (15) comprises a plurality of generally transverse and generally longitudinal yarns (25,30) bonded at crossover points (35) thereof.

25. The cement board (12) according to claim 2 wherein the melt blown polymer web (20) provides a substantially smooth exterior surface to said cement board (12).

26. The cement board (12) according to claim 2 wherein said cementitious core (80) comprises a material selected from the group consisting of hydraulic cement and gypsum cement.

Patentansprüche

1. Deckschicht (10) für eine gefertigte Fläche, mit:

einem grobmaschigen Glas-Flächengebilde (15) mit einer Mehrzahl sich schneidender Garne (25, 30), die an ihren Kreuzungspunkten (35) verbunden sind, um dem Flächengebilde (15) eine Formbeständigkeit zu geben; und
einer schmelzgeblasenen Polymerbahn (20), die mit dem Glas-Flächengebilde (15) auf einer Seite (45) des Flächengebildes (15) verbunden ist und wenigstens einen Teil der darin befindlichen Maschenöffnungen (40) überdeckt; und

wobei die gegenüberliegende Seite (50) des Glas-Flächengebildes (15) ein freiliegendes Gitterprofil zur mechanischen Interaktion mit einer zementartigen Zusammensetzung (74) bildet.

2. Zementplatte (12) mit:

einer ersten Deckschicht (72) mit einem grobmaschigen Glas-Flächengebilde (15), das eine Mehrzahl sich schneidender Garne (25, 30) aufweist, die an ihren Kreuzungspunkten (35) verbunden sind, und mit einer schmelzgeblasenen Polymerbahn (20), die mit dem Glas-Flächengebilde (15) auf einer Seite (45) des Flächengebildes (15) verbunden ist und wenigstens einen Teil der darin befindlichen Maschenöffnungen (40) überdeckt, wobei die gegenüberliegende Seite (50) des Glas-Flächengebildes (15) eine freiliegende Gitterprofilfläche (55) bildet zur mechanischen Interaktion mit einer zementartigen Zusammensetzung (76), die einen zementartigen Kern (80) der Zementplatte (12) bildet; und

wobei die zementartige Zusammensetzung (76) einen Oberflächenabschnitt (86) mechanisch einstückig mit der Gitterprofilfläche (55) der gegenüberliegenden Seite (50) des Glas-Flächengebildes (15) in der ersten Deckschicht (72) verbindet.

3. Gegenstand (10, 12) nach Anspruch 1 oder 2, bei dem das Flächengebilde (15) nicht gewebt ist.

4. Gegenstand (10, 12) nach Anspruch 1 oder 2, bei dem die Garne (25, 30) in dem Flächengebilde (15) an ihren Kreuzungspunkten (35) durch ein Polymer-Bindemittel verbunden sind.

5. Gegenstand (10, 12) nach Anspruch 4, bei dem das Polymer-Bindemittel Polyvinylchlorid ist.

6. Gegenstand (10, 12) nach Anspruch 1 oder 2, bei dem die Flächenmasse der schmelzgeblasenen Polymerbahn (20) zwischen ungefähr 2 und 30 g/m^2 beträgt.

7. Gegenstand (10, 12) nach Anspruch 1 oder 2, bei dem die Flächenmasse der schmelzgeblasenen Polymerbahn (20) zwischen ungefähr 10 und 50 g/m^2 beträgt.

8. Gegenstand (10, 12) nach Anspruch 1 oder 2, bei dem die Flächenmasse der schmelzgeblasenen Polymerbahn (20) zwischen ungefähr 45 und 75 g/

m^2 beträgt.

9. Gegenstand (10, 12) nach Anspruch 8, bei dem die schmelzgeblasene Polymerbahn (20) eine mikroporöse Lage bildet.

10. Gegenstand (10, 12) nach Anspruch 1 oder 2, ferner mit einer mikroporösen Lage.

11. Gegenstand (10, 12) nach Anspruch 10, bei dem die mikroporöse Lage ein Material aufweist, das aus der Gruppe ausgewählt ist, die aus Polyethylen-, Nylon-, Polypropylen- und Ethylencopolymer-Filmen besteht.

12. Gegenstand (10, 12) nach Anspruch 10, bei dem die mikroporöse Lage zwischen dem Glas-Flächengebilde (15) und der schmelzgeblasenen Polymerbahn (20) liegt und dadurch die Haftung zwischen der schmelzgeblasenen Polymerbahn (20) und dem Glas-Flächengebilde (15) fördert.

13. Gegenstand (10, 12) nach Anspruch 10, bei dem die mikroporöse Lage auf der schmelzgeblasenen Polymerbahn (20) gegenüber dem Glas-Flächengebilde (15) angeordnet ist.

14. Gegenstand (10, 12) nach Anspruch 1 oder 2, bei dem das Glas-Flächengebilde (15) eine Mehrzahl allgemein quer verlaufender und allgemein längs verlaufender Garne (25, 30) aufweist.

15. Gegenstand (10, 12) nach Anspruch 14, bei dem das Flächengebilde (15) weniger als ungefähr 15 Maschenöffnungen pro Quadratzentimeter (100 Maschenöffnungen pro Quadratinch) aufweist.

16. Gegenstand (10, 12) nach Anspruch 14, bei dem das Flächengebilde (15) weniger als ungefähr 11 Maschenöffnungen pro Quadratzentimeter (70 Maschenöffnungen pro Quadratinch) aufweist.

17. Gegenstand (10, 12) nach Anspruch 1 oder 2, bei dem die schmelzgeblasene Polymerbahn (20) aus einem Material besteht, das bei einer Temperatur oberhalb seines Erweichungspunktes klebrig ist, um die Haftung zwischen der schmelzgeblasenen Polymerbahn (20) und dem Glas-Flächengebilde (15) zu erleichtern, aber im wesentlichen frei von Klebrigkeit ist bei Temperaturen deutlich unter seinem Erweichungspunkt, um dadurch zu ermöglichen, daß die Deckschicht (10) aufgewickelt und abgewickelt wird ohne ein Anhaften zwischen der gegenüberliegenden Seite (50) und der schmelzgeblasenen Polymerbahn (20).

18. Gegenstand (10, 12) nach Anspruch 1 oder 2, bei dem die schmelzgeblasene Polymerbahn (20) ein Polymer aufweist, das aus der Gruppe ausgewählt ist, die aus Polyolefinen, Ethylencopolymeren, Polyestern, Polyamiden, Polyacrylaten, Polystyrol, Styrol-Blockpolymeren, thermoplastischen Elastomeren und Mischungen davon besteht.

19. Gegenstand (10, 12) nach Anspruch 18, bei dem die schmelzgeblasene Polymerbahn (20) ein amorphes Poly(α-Olefin)-Polymer aufweist.

20. Gegenstand (10, 12) nach Anspruch 1 oder 2, bei dem die schmelzgeblasene Polymerbahn (20) ein Polyamid aufweist.

21. Zementplatte (12) nach Anspruch 2, ferner mit einer zweiten Deckschicht, die mit dem zementartigen Kern (80) auf der der ersten Deckschicht (72) gegenüberliegenden Seite verbunden ist.

22. Zementplatte (12) nach Anspruch 21, bei der die zweite Deckschicht ein grobmaschiges Glas-Flächengebilde ist, das mit einem gegenüberliegenden Oberflächenabschnitt des zementartigen Kerns (80) mechanisch einstückig verbunden ist.

23. Zementplatte (12) nach Anspruch 22, ferner mit der zweiten Deckschicht, die ferner eine schmelzgeblasene Polymerbahn aufweist, die mit dem Glas-Flächengebilde (15) auf einer Seite des Flächengebildes (15) verbunden ist und wenigstens einen Teil der darin befindlichen Maschenöffnungen (40) gleichmäßig überdeckt.

24. Zementplatte (12) nach Anspruch 22, bei der das grobmaschige Glas-Flächengebilde (15) eine Mehrzahl allgemein querverlaufender und allgemein längsverlaufender Garne (25, 30) aufweist, die an ihren Kreuzungspunkten (35) verbunden sind.

25. Zementplatte (12) nach Anspruch 2, bei der die schmelzgeblasene Polymerbahn (20) der Zementplatte (12) eine im wesentlichen glatte Außenfläche verleiht.

26. Zementplatte (12) nach Anspruch 2, bei der der zementartige Kern (80) ein Material aufweist, das aus der Gruppe ausgewählt ist, die aus hydraulischem Zement und Gipszement besteht.

Revendications

1. Feuille de garniture (10) pour une surface technique comprenant :

un canevas de verre à mailles ouvertes (15) ayant une pluralité de fils entrecroisés (25, 30)

fixés à leurs points d'entrelacement (35) pour conférer une stabilité dimensionnelle audit canevas (15) ; et

une toile de polymère formée par fusion-soufflage (20) associée audit canevas de verre (15) sur une face (45) dudit canevas (15) et couvrant au moins une partie des ouvertures de maille (40) dans celui-ci ; et

la face opposée (50) dudit canevas de verre (15) définissant un profil de grille exposé pour interaction mécanique avec une composition cimentaire (74).

2. Panneau de ciment (12) comprenant :

une première feuille de garniture (72) comprenant un canevas de verre à mailles ouvertes (15) ayant une pluralité de fils entrecroisés (25, 30) fixés à leurs points d'entrelacement (35) et une toile de polymère formée par fusion-soufflage (20) associé audit canevas de verre (15) sur une face (45) dudit canevas (15) et couvrant au moins une partie des ouvertures de maille (40) dans celui-ci, la face opposée (50) dudit canevas de verre (15) définissant une surface de profil de grille (55) pour interaction mécanique avec une composition cimentaire (76) formant un noyau cimentaire (80) dudit panneau de ciment (12) ; et

la composition cimentaire (76) ayant une partie de surface (86) mécaniquement intégrée à la surface de profil de grille (35) de la face opposée (50) du canevas de verre (15) dans ladite feuille de garniture (72).

3. Article (10, 12) selon la revendication 1 ou 2 dans lequel ledit canevas (15) est non-tissé.

4. Article (10, 12) selon la revendication 1 ou 2 dans lequel les fils (25, 30) dans ledit canevas (15) sont fixés à leurs points d'entrelacement (35) par un liant polymère.

5. Article (10, 12) selon la revendication 4 dans lequel le liant polymère est du chlorure de polyvinyle.

6. Article (10, 12) selon la revendication 1 ou 2 dans lequel le poids de base de ladite toile de polymère formée par fusion-soufflage (20) est compris entre environ 2 et 30 g/m^2.

7. Article (10, 12) selon la revendication 1 ou 2 dans lequel le poids de base de ladite toile de polymère formée par fusion-soufflage (20) est compris entre environ 10 et 50 g/m^2.

8. Article (10, 12) selon la revendication 1 ou 2 dans lequel le poids de base de ladite toile de polymère formée par fusion-soufflage (20) est compris entre environ 45 et 75 g/m^2.

9. Article (10, 12) selon la revendication 8 dans lequel ladite toile de polymère formée par fusion-soufflage (20) forme une couche microporeuse.

10. Article (10, 12) selon la revendication 1 ou 2 comprenant, de plus, une couche microporeuse.

11. Article (10, 12) selon la revendication 10 dans lequel ladite couche microporeuse comprend un matériau choisi dans le groupe consistant en des films de polyéthylène, de nylon, de polypropylène et de copolymère d'éthylène.

12. Article (10, 12) selon la revendication 10 dans lequel ladite couche microporeuse est entre ledit canevas de verre (15) et ladite toile de polymère formée par fusion-soufflage (20) et favorise ainsi l'adhérence entre ladite toile de polymère formée par fusion-soufflage (20) et ledit canevas de verre (15).

13. Article (10, 12) selon la revendication 10 dans lequel ladite couche microporeuse est située sur ladite toile de polymère formée par fusion-soufflage (20) opposée audit canevas de verre (15).

14. Article (10, 12) selon la revendication 1 ou 2 dans lequel ledit canevas de verre (15) comprend une pluralité de fils transversaux et généralement longitudinaux (25, 30).

15. Article (10, 12) selon la revendication 14 dans lequel ledit canevas (15) a moins de 15 ouvertures de maille par centimètre carré (100 ouvertures de maille par pouce carré).

16. Article (10, 12) selon la revendication 14 dans lequel ledit canevas (15) a moins de 11 ouvertures de maille par centimètre carré (70 ouvertures de maille par pouce carré).

17. Article (10, 12) selon la revendication 1 ou 2 dans lequel ladite toile de polymère formée par fusion-soufflage (20) consiste en un matériau qui est adhésif à une température supérieure à son point de ramollissement pour faciliter l'adhérence entre ladite toile de polymère formée par fusion-soufflage (20) et ledit canevas de verre (15) mais qui est essentiellement non adhésive à des températures considérablement inférieures à son point de ramollissement de manière à permettre à ladite feuille de garniture (10) d'être enroulée et déroulée sans adhérence entre ladite face opposée (50) et ladite toile de polymère formée par fusion-soufflage (20).

18. Article (10, 12) selon la revendication 1 ou 2 dans

lequel ladite toile de polymère formée par fusion-soufflage (20) comprend un polymère choisi dans le groupe consistant en des polyoléfines, des copolymères d'éthylène, des polyesters, des polyamides, des polyacrylates, le polystyrène, des copolymères blocs de styrène, des élastomères thermoplastiques et des mélanges de ceux-ci.

19. Article (10, 12) selon la revendication 18 dans lequel ladite toile de polymère formée par fusion-soufflage (20) comprend un polymère amorphe de poly(α-oléfine).

20. Article (10, 12) selon la revendication 1 ou 2 dans lequel ladite toile de polymère formée par fusion-soufflage (20) comprend un polyamide.

21. Panneau de ciment (12) selon la revendication 2 comprenant, de plus, une seconde feuille de garniture fixée audit noyau cimentaire (80) opposée à ladite première feuille de garniture (72).

22. Panneau de ciment (12) selon la revendication 21 dans lequel la seconde feuille de garniture est un canevas de verre à mailles ouvertes mécaniquement intégrée à une partie de surface opposée dudit noyau cimentaire (80).

23. Panneau de ciment (12) selon la revendication 22 comprenant, de plus, la seconde feuille de garniture qui comprend, en outre, une toile de polymère formée par fusion-soufflage associée audit canevas de verre (15) sur une face dudit canevas de verre (15) et recouvrant uniformément au moins une partie des ouvertures de maille (40) dans celle-ci.

24. Panneau de ciment (12) selon la revendication 22 dans lequel le canevas de verre à mailles ouvertes (15) comprend une pluralité de fils transversaux et généralement longitudinaux (25, 30) fixés aux points d'entrelacement (35) de ceux-ci.

25. Panneau de ciment (12) selon la revendication 2 dans lequel ladite toile de polymère formée par fusion-soufflage (20) confère une surface extérieure sensiblement lisse audit panneau de ciment (12).

26. Panneau de ciment (12) selon la revendication 2 dans lequel ledit noyau cimentaire (80) comprend un matériau choisi dans le groupe consistant en un ciment hydraulique et un ciment gypseux.

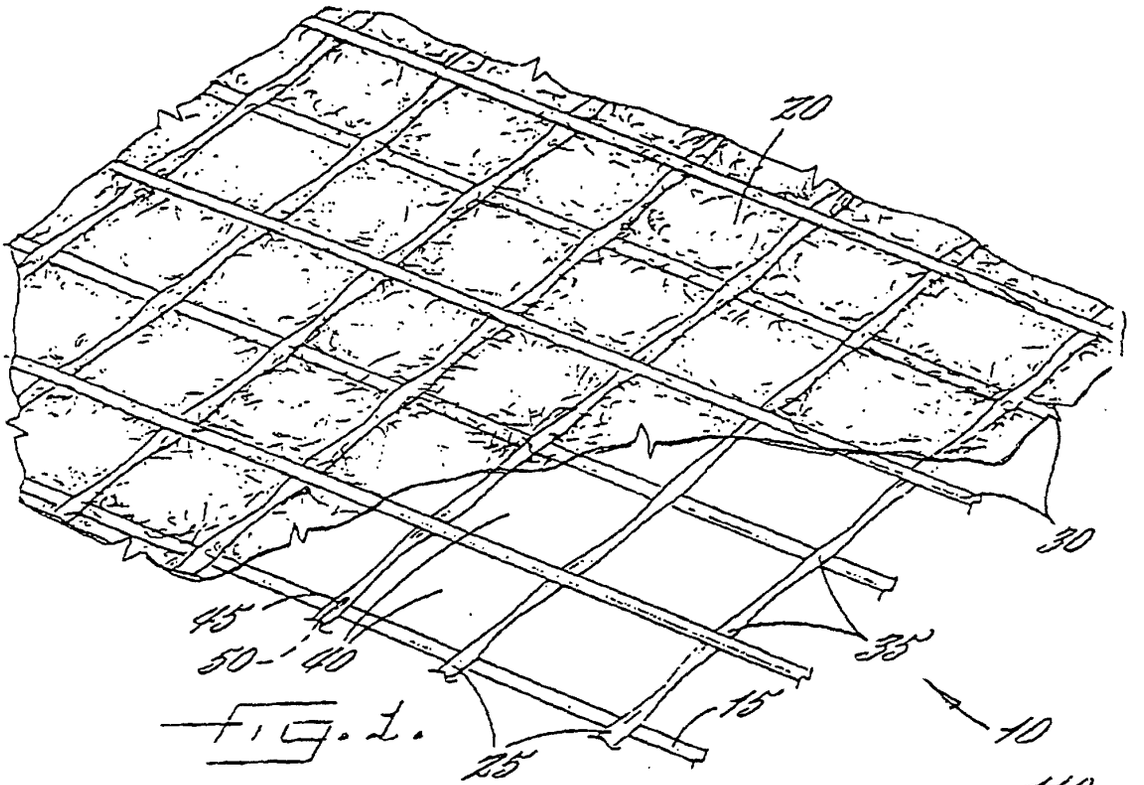

Fig. 1.

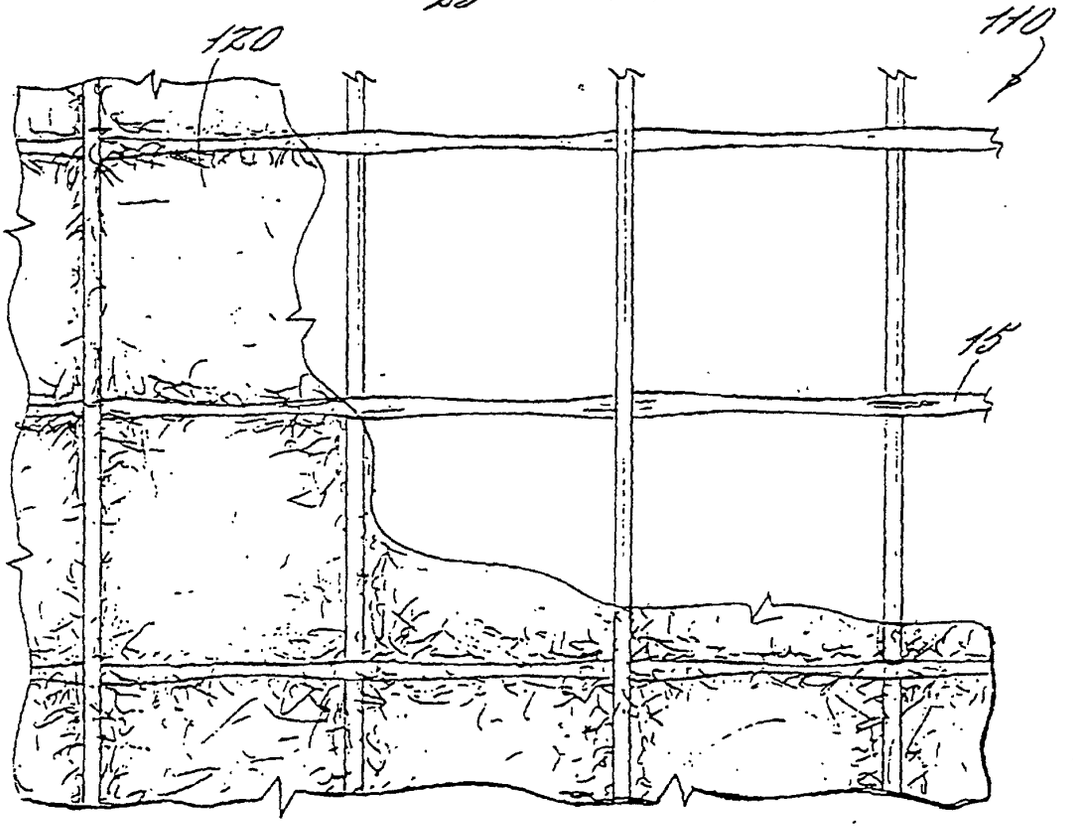

Fig. 2.

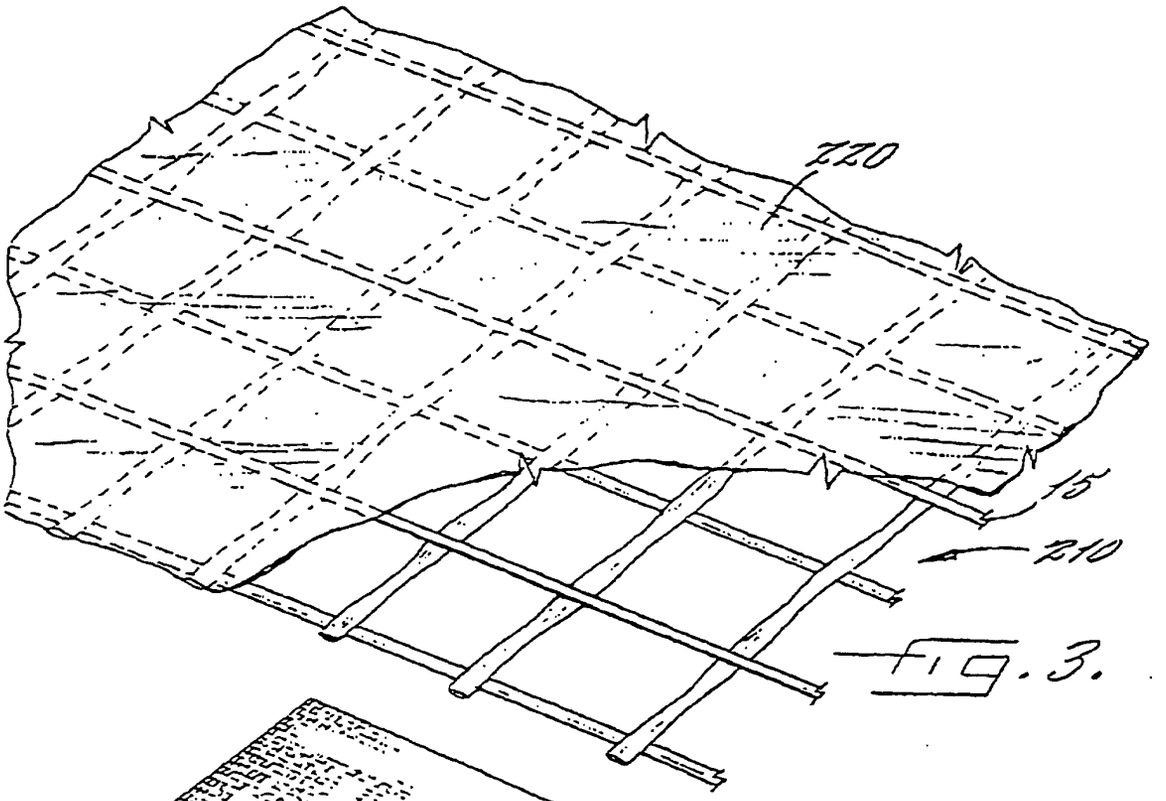

FIG. 3.

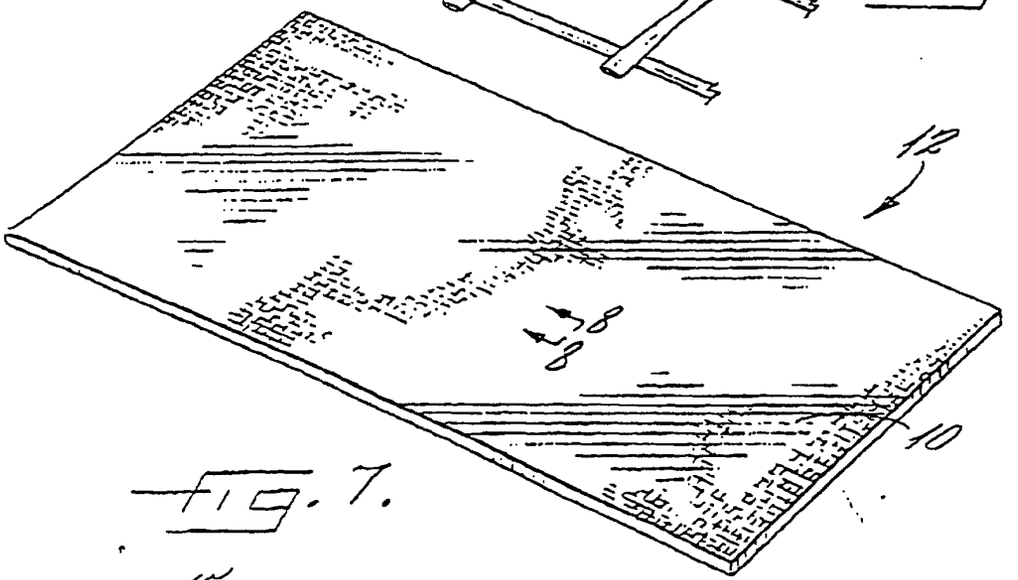

FIG. 7.

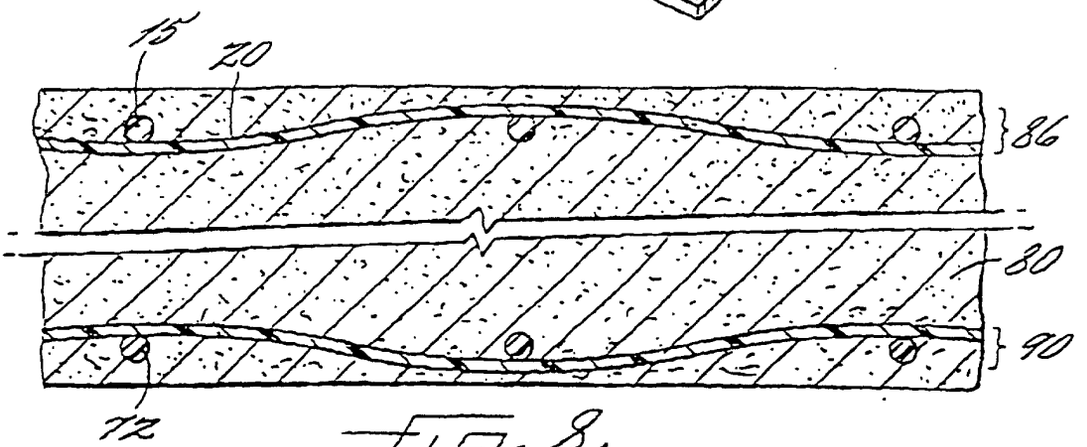

FIG. 8.

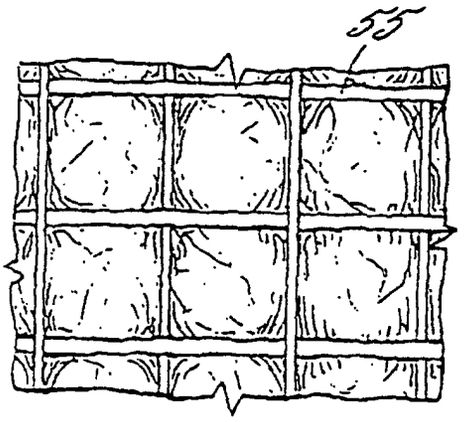

Fig. 4.

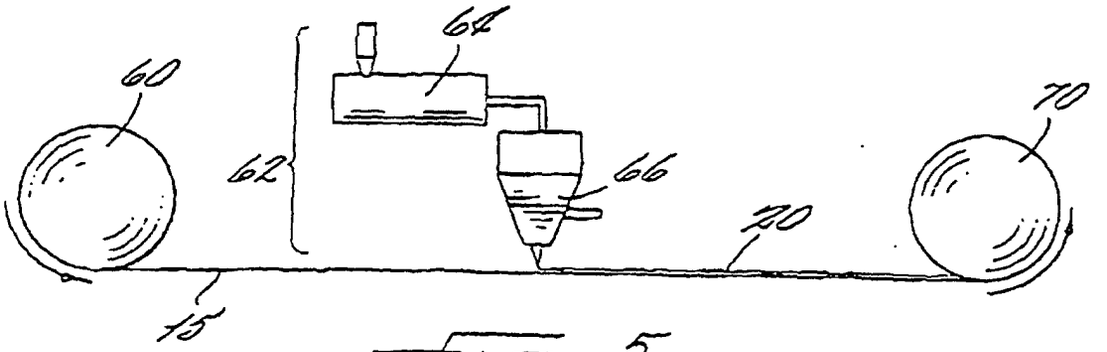

Fig. 5.

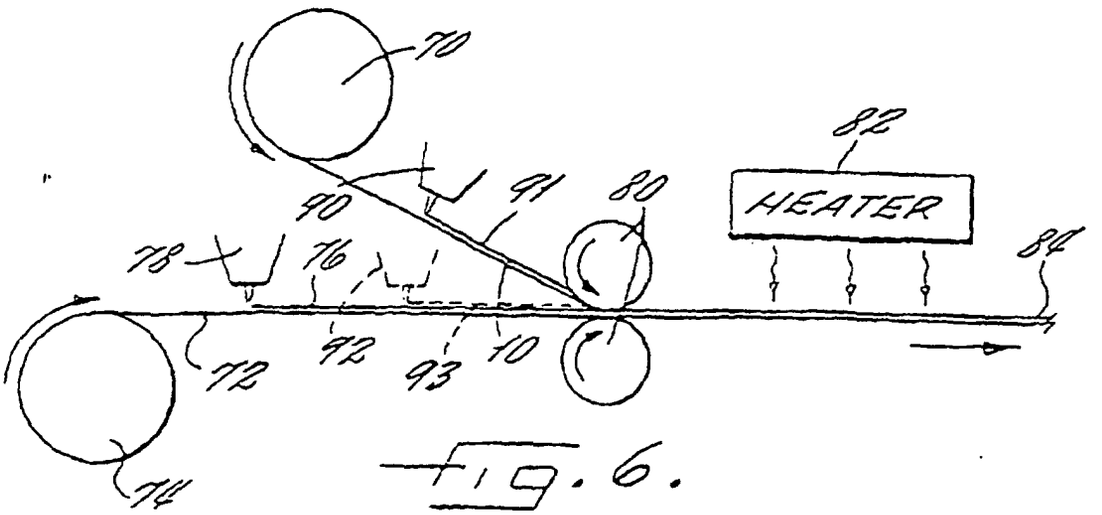

Fig. 6.