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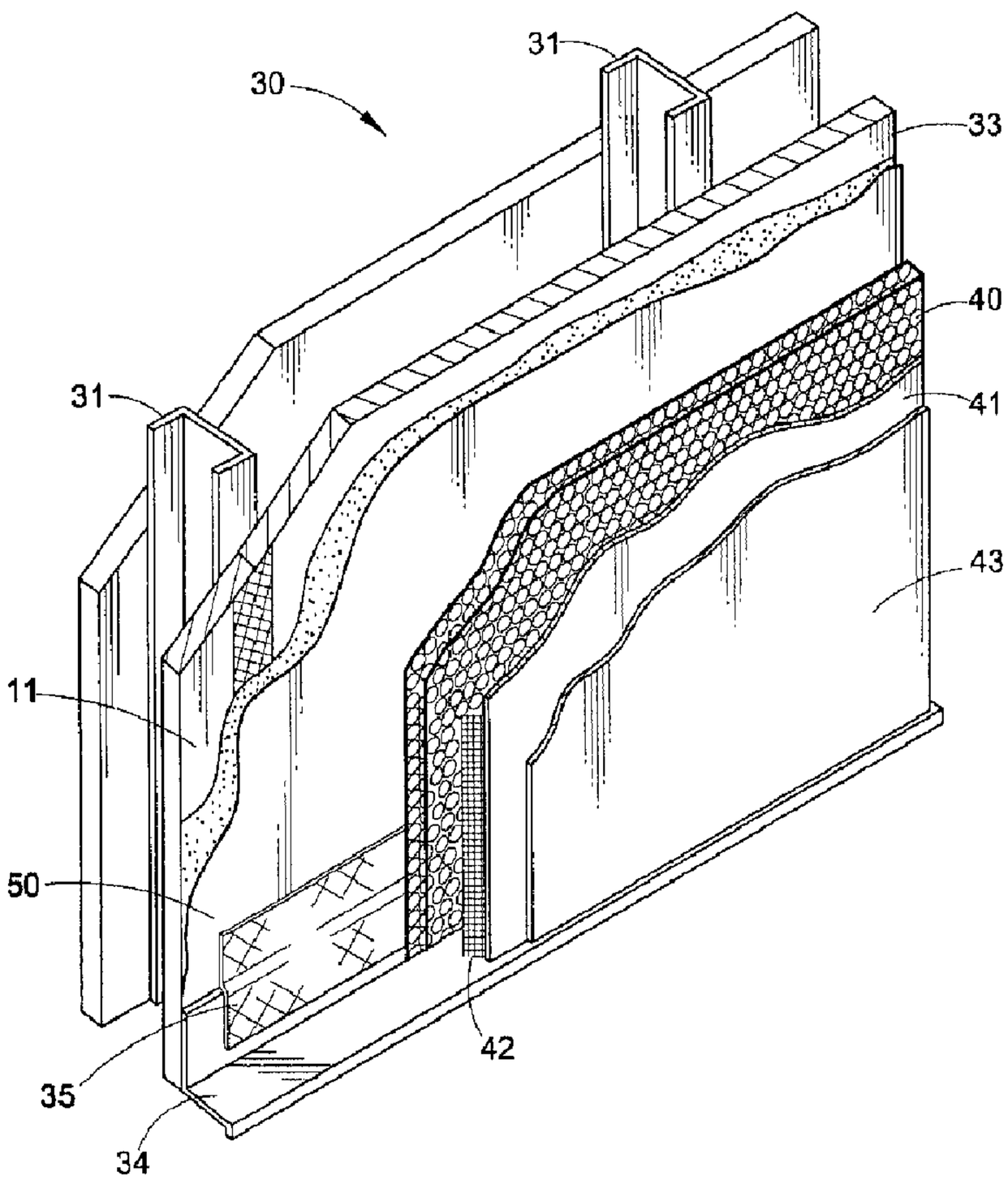

(57) Abrégé/Abstract:
An exterior finish system for building walls is provided. The system includes a moisture permeable insulation layer having interconnected voids and exterior finishing materials applied over said insulation layer. A building wall incorporating the exterior finish system is also provided. A process for finishing an exterior building wall is further provided.

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ABSTRACT

An exterior finish system for building walls is provided. The system includes a moisture permeable insulation layer having interconnected voids and exterior finishing materials applied over said insulation layer. A building wall incorporating the exterior finish system is also provided. A process for finishing an exterior building wall is further provided.

EXTERIOR FINISH SYSTEM

BACKGROUND

An improved exterior finishing system for use in the building and construction industry is provided. The improved exterior finishing system includes an insulation layer that provides thermal insulation and a means for drainage of incidental moisture that may penetrate the exterior surface of the system or other components of the building envelope.

Modern techniques for constructing the walls of buildings may take numerous forms. Among these is the two-by-four (2x4) framed construction. Conventional 2x4 wall construction begins with framing of the walls with wood or steel members. These wood or steel members typically have nominal dimensions of 2"x 4" and are, therefore, called "two-by-fours" or 2x4s. These 2x4s are oriented vertically and spaced at intervals generally either 16" or 24" and are each connected at the top and bottom to similar, horizontally oriented members. This structure is referred to in the relevant art as a "framed" wall.

Traditionally, a sheet of sheathing such as plywood or other material is applied to the exterior of the framed wall, but such application is not required in all circumstances. Such requirements are typically established by governmental building codes. A weather barrier may then be applied to the exterior of the sheathing, with an exterior wall covering or exterior finishing materials then being applied directly over the weather barrier.

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Any one of numerous materials may be used for the exterior finishing materials of building structures such as brick, stucco, vinyl or aluminum siding, wood siding, exterior insulation and finish systems (EIFS), and the like.

While designed to provide an exterior aesthetic finish, the exterior finishing materials are also designed to minimize the transmission of moisture from the external environment into the building structure, thereby protecting the building structure and it contents from moisture. Over time, however, an exterior finish may develop a breach, such as a crack. If a breach or void, such as openings or cracks, exist in the exterior finish, then wind loads can potentially act as the driving mechanism to force water through the cracks or openings in the exterior finish. Incidental moisture may also enter the building structure though windows, compromised sealants, and the like. If excess water reaches the building wall substrate, i.e.- the sheathing material, then this exposure of the building wall substrate to the water may result in deterioration of the building wall substrate material, thus requiring replacement.

Weather barriers may be applied over the exterior surface of the building wall substrate as a means to accommodate incidental moisture that has breached the outermost surfaces of the building envelope. If the weather barrier contains significant voids, cuts, or gaps, any such water/moisture may find its way through or around the openings in the weather barrier, onto the sheathing material, and eventually into the wall to cause the deleterious effects described above.

Many commercial and residential building structures utilize exterior insulation and finish systems (EIFS) as the exterior wall covering. Typically, the exterior insulation and finish system includes an insulation board, a base coat, a reinforcing mesh, and a finish coat. The insulation board is attached over the building wall substrate, such as plywood sheathing. A base coat is applied to the exterior surface of the insulation board. Next, a reinforcing mesh material is embedded in the base coat. Finally, a finish coat is applied over the base coat and

reinforcing mesh material. A weather barrier can be attached to the sheathing prior to installation of the insulation board.

While attempts have been made to provide moisture drainage in the context of exterior finishing systems in the building and construction industry, there still exists a great need for an exterior finishing system having improved moisture drainage capabilities.

SUMMARY

An exterior finish system for building walls is provided, said system comprising a moisture drainable insulation layer having a plurality of openings or voids, and an exterior finish applied over said insulation layer.

A building wall is also provided, said building wall comprising a frame having an exterior surface, optionally, a sheathing attached to said exterior surface of said frame, a moisture drainable insulation layer having a plurality of openings or voids disposed over said exterior surface of said frame, or disposed over said sheathing if said sheathing is present, and an exterior finish disposed over said insulation layer.

According to certain embodiments, a weather barrier is attached over the building wall substrate prior to attaching the the moisture drainable insulation layer.

A process for finishing an exterior building wall is also provided, said process comprising attaching an insulation layer over a building wall substrate, said insulation layer comprising a moisture drainable insulation layer having a plurality of openings or voids, and applying exterior finishing materials over said insulation layer.

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According to certain embodiments, the process comprises attaching a weather barrier over the building wall substrate prior to attaching the moisture drainable insulation layer.

An exterior insulation and finish system is provided, said system comprising a moisture drainable insulation layer having a plurality of openings or voids, at least one base coat layer applied over said insulation layer, at least one reinforcing layer at least partially embedded within the base coat layer, and at least one finish coat layer applied over said base coat layer and said reinforcing layer.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1 is an exploded side view of one embodiment of the exterior finishing system.

FIG 2 is a fragmentary view of the moisture permeable insulation layer.

FIG 3 is a perspective view of one embodiment of a building wall incorporating an exterior finishing system.

FIG 4 is a side view of one embodiment of a building wall incorporating an exterior finishing system and a drainage cavity forming means.

DETAILED DESCRIPTION

An exterior finish system for building walls is provided. The exterior finish system includes a permeable insulation layer having a number of openings or voids and exterior finishing materials that are applied over the permeable insulation layer. The insulation layer is permeable to air and incidental moisture. The terms "moisture permeable insulation layer" and "moisture drainable insulation layer" are used interchangeably throughout the specification to refer to an insulation layer for an exterior finishing system for building walls that is capable of providing

insulation to the building wall and drainage of incidental moisture. The exterior finish system provides an exterior aesthetic finish to exterior building walls, while also providing moisture drainage capabilities.

As discussed in greater detail below, according to certain illustrative embodiments, the exterior finish system includes an insulation layer that is comprised of a plurality of discrete bodies that are bonded together at mutual points of contact. As the bodies are joined together only at points of contact, the resulting insulation layer includes a great number of openings or voids. These openings result in an insulation layer having interconnected voids that permit incidental moisture to drain through the insulation layer.

According to certain illustrative embodiments, the bodies of the insulation layer comprise discrete bead- or sphere- shaped bodies. The discrete beads of the insulation layer may be manufactured from a polymeric material. According to certain embodiments, the polymeric material utilized to manufacture the discrete beads of the insulation layer is a polyolefin material. The discrete beads of the insulation layer may be polyethylene beads, polypropylene beads, or a combination of polyethylene beads and polypropylene beads. According to other embodiments, the insulation layer of the exterior finishing system may comprise a plurality of discrete expanded polystyrene shapes, such as expanded polystyrene beads or spheres. It should be noted, however, that any polymeric material that provides an insulation layer having insulative and moisture drainage capabilities will be suitable for manufacture of the beads and that one having ordinary skill in the art, without undue experimentation, would be able to select a suitable polymeric material for manufacture of the beads of the insulation layer that is to be incorporated into the exterior finish system.

The discrete polymer beads of the insulation layer should not absorb a significant amount of moisture. The discrete beads that comprise the insulation layer of the exterior finish system may be manufactured from a moisture resistant polymeric material or may be provided with a water resistant coating on at least a

portion of the exterior surfaces of the discrete beads. According to certain embodiments having a water resistant coating, substantially all of the exterior surface of the individual polymeric beads are coated with a water resistant coating. As the beads are coated with a water resistant coating, the insulation layer is capable of prolonged exposure to moisture without the beads absorbing any significant amount of water or having any detrimental effects on the beads. Without limitation, water resistant coatings may be selected from water resistant urethanes, acrylics, styrene-butadiene, silicones, silanes, and like water resistant coatings.

The moisture drainable insulation layer should be raspable. By "raspable" it is meant that the insulation layer may be manipulated by mechanical means to substantially remove surface irregulatries in the exteriorly facing surface of the insulation layer. By rasping the exteriorly facing surfaces of the insulation layer, a substantially even surface can be attained for application of the EIFS base, reinforcing mesh, and finish coats, or other finishing materials, such as stucco layer(s). Thus, the rasped moisture drainable insulation has a substantially even or smooth surface for application of the exterior finishing materials.

The exterior finish system includes exterior finishing materials that are applied the drainable insulation layer. Without limitation, exterior finishing materials may be selected from brick, wood siding, vinyl siding, aluminum siding, stucco, and exterior insulation and finish systems. According to certain embodiments, the exterior finishing materials comprise exterior insulation and finish system materials. According to other embodiments, the exterior finishing material comprises at least one layer of a cementitious-based stucco material.

For embodiments utilizing an exterior insulation and finish system, the exterior insulation and finish system generally includes the moisture drainable insulation layer, a base coat applied over the insulation layer, a reinforcing mesh layer or layers at least partially embedded in the base coat layer, and at least one finish coat layer that is applied over the base coat and reinforcing mesh layers.

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The base coat layers of the exterior insulation and finish system are generally polymer-modified cementitious compositions that adhere to the exterior surface of the insulation layer. The base coat layer can support a reinforcing mesh layer and which, in turn, supports the finish coat layer. Without limitation, suitable base coats for use in the exterior insulation and finish system include base coats commerically available from Degussa Wall Systems, Inc. (Jacksonville, Florida) under the trade designations Alpha Base Coat and Alpha Dry Base Coat. Alpha Base Coat is a water based, 100% acrylic base coat having adhesive properties. Alpha Base Coat is typically field-mixed with Types I or II Portland cement to provide a trowelable base coat. Alpha Dry Base Coat is a dry-mix polymer base coat containing Portland cement. The Alpha Dry Base Coat is field-mixed with water to provide a trowelable base coat.

The reinforcing layer, without limitation, may be selected from reinforcing fabrics and meshes. The reinforcing meshes are typically woven or knitted meshes of fibers. The fibers of the reinforcing mesh may include organic or inorganic fibers. The only practical limitations on the type of fibers used to manufacture the reinforcing mesh is that the resulting reinforcing mesh be embeddable in the base coat, that it have sufficient strength to support the finish coat layers of the exterior insulation and finish system, and that it be chemically resistant or inert to the base and finish coats. According to certain embodiments, the reinforcing mesh of the exterior insulation and finish system is a woven fiberglass mesh.

A building wall incorporating the exterior finish system is also provided. The building wall comprises a building wall substrate, a moisture drainable insulation layer having interconnected voids that is attached to the exterior surface of the building wall substrate, and exterior finishing materials applied over the insulation layer. According to certain embodiments, the building wall also includes a weather resistant barrier that is applied to the surface of the building wall substrate prior to attaching the moisture drainable insulation layer to the building wall.

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The building wall substrate, without limitation, may be selected from plywood sheathing, wafer board, particle board, oriented strand board, cement board, gypsum board, concrete block, and masonry block. In one embodiment, the building wall substrate is a layer of plywood sheathing. According to other embodiments, the building wall substrate may be a layer of masonry block.

In general, the building wall substrate is attached to a building wall frame having an exterior surface. However, it should be noted that for embodiments employing concrete or masonry block as the building wall substrate, the concrete or masonry block is not attached to a frame. The moisture drainable insulation layer is then attached to the exterior–facing surface of the building wall substrate. The insulation layer may be attached to the building wall substrate by any suitable attachment means, such as, for example, nails, screws, staples, tacks, rivets and adhesives. According to certain embodiments, a weather barrier material, such as building papers, polymeric sheets, and trowel and roller applied materials may be applied to the exterior-facing surface of the building wall substrate prior to attaching the moisture drainable insulation layer to the substrate.

The weather barrier may be a conventional weather barrier that is used in building construction, such as building paper or tar paper, although other materials can be used. The weather barrier is a building code recognized product which is typically sold on a roll. Weather barriers resist the transmission of water therethrough and likewise control the transmission of moisture vapor therethrough. An example of a weather barrier which is well known in the art is Jumbo Tex® Vapor Permeable Weather Resistive Barrier manufactured by Fortifiber® Corporation of Incline Village, Nevada.

The weather barrier may also comprise a polymeric material. Preferably, the weather barrier is comprised of a non-woven sheet of polymeric fibers. The weather barrier may comprise a non-woven sheet of polyolefin fibers. Without limitation, the polyolefin fibers that are useful in the preparation of the weather barrier may be selected from polypropylene fibers and high density polyethylene

fibers. According to certain embodiments, the weather barrier may comprise a non-woven sheet of spun-bonded high density polyethylene fibers. Without limitation, suitable non-woven sheets of spun-bonded high density polyethylene fibers are commercially available from E.I. DuPont de Nemours & Co., Inc. (Wilmington, Delaware) under the trademarks Tyvek® HomeWrap™, Tyvek® StuccoWrap™ and Tyvek® CommercialWrap™. The non-woven structure provides excellent resistance to water and air penetration. In addition, the non-woven structure has excellent strength and tear resistance. It should be noted that the polymeric weather barrier is not limited to those commercially available from E.I. DuPont de Nemours & Co., Inc., as any commercially available polymeric sheet material possessing the desired weather resistant properties may be used.

Without limitation, trowel and roller applied weather barriers suitable for use in the present invention may include those weather barrier materials commercially available from Degussa Wall Systems, Inc. (Jacksonville, Florida) under the trade designations SENERSHIELD and SENERSHIELD-R. SENERSHIELD is a 100% acrylic-based, fiber reinforced weather resistive barrier material. SENERSHIELD is a trowel-applied continuous membrane. SENERSHIELD is suitable for direct application to gypsum sheathing, cement board, poured concrete substrates, unit masonry, and the like. SENERSHIELD-R is a flexible, liquid coating material. SENERSHIELD-R provides a roller- or brush-applied continuous membrane that is suitable for direct application to a wide variety of approved building wall substrates, such as plywood sheathing, cement board, gypsum sheathing, oriented strand board and the like.

Once the insulation layer is attached to the building wall substrate, then the exterior finish materials are applied over the insulation layer. The exterior finish materials that may be used in conjunction with the construction of the building wall include, without limitation, brick, wood siding, vinyl siding, aluminum siding, stucco, and exterior insulation and finish system materials. According to certain embodiments, the exterior finish material used in conjunction with the building wall is an exterior insulation and finish system. As described above, the exterior

insulation and finish system that may be incorporated into the building wall includes the moisture drainable insulation layer, a base coat applied over the insulation layer, one or more reinforcing mesh layers substantially embedded in the base coat layer, and at least one finish coat layer is applied over the base coat and reinforcing mesh layers.

According to other embodiments, a process for finishing an exterior building wall is further provided. The process includes attaching a moisture drainable insulation layer having interconnected voids over a building wall substrate, and applying exterior finishing materials over the drainable insulation layer. According to certain embodiments, the process for finishing an exterior building wall also includes applying a weather resistant barrier to the surface of the building wall substrate prior to attaching the mositure drainable insulation layer to the building wall.

With respect to the building wall incorporating the exterior finish system, the moisture drainable insulation layer may be attached to the building wall substrate by means of an adhesive attachment, by means of a mechanical attachment, or by a combination of an adhesive and a mechanical attachment.

According to other embodiments, the exterior finish system and building wall incorporating the same may also include a drainage space located between the insulation layer and the exteriorly-facing surface of the building wall substrate to provide additional water and moisture vapor drainage. The drainage space may be created by an open, three-dimensional spacing means. The spacing means may be provided in the form of an open, three-dimensional mat.

The mat is preferably manufactured from a polymeric material. A particularly well-suited polymeric material that can be used to manufacture the mat includes a thermoplastic polyamide resin such as nylon 6, although other materials may be used without departing from the spirit of the present invention. Such other materials that can be used to manufacture mat include, but are not limited to,

polyolefin fibers, such as polypropylene, high density polyethylene, polyvinylchloride, polystyrene fibers and polyester fibers.

The polymeric mat is preferably of a type described and manufactured in accordance with U.S. Patent Nos. 4,212,692, 3,691,004, and/or 3,687,759, although other configurations are possible.

The filaments of the polymeric mat form a peak and valley structure undulating in the longitudinal and/or transverse directions, preferably to provide a waffle-like structure. Due to its filamentatious structure, the polymeric mat contains a great number of mutually interconnected voids which allow gases and liquids to flow freely therethrough.

The polymeric mat has a crush resistance allowing it to withstand a level of compressive load without crushing the peak and valley configuration thereof. Thus, air and water can still flow directly and transversely through the mat, even when the mat is under a compressive load. The ability of the mat to withstand a given compressive load must necessarily vary with factors such as the filament diameter, the material of which the mat is composed, the extent to which self-bonding has occurred, the height of the peaks and valleys, as well as a plurality of other such variables. Thus, the crush-resistant properties of the mat, while inherent in the design of the mat, vary with numerous parameters regarding the construction of the mat.

The exterior finish system and building wall will now be described in greater detail with reference to FIGS. 1-4. It should be noted that the invention is not limited to the illustrative embodiments shown in FIGS. 1-4, but should be construed in accordance with the appended claims.

With reference to FIG. 1, an exterior finish system 10 is shown. The exterior finish system 10 includes a moisture drainable insulation layer 11 and an exterior finish layer applied over the insulation layer 11. According to the embodiment shown in FIG. 1, the exterior finish layer includes exterior insulation

and finish system materials. Base coat 12 is applied uniformly over the exterior surface of insulation layer 11. Once the base coat layer 12 is applied over the insulation layer, then the reinforcing means 13, which is shown as a reinforcing mesh layer 13, is substantially embedded in the base coat layer 12. The finish coat layer 14 of the exterior insulation and finish system 12 is applied over the base coat 12 and reinforcing mesh layer 13.

Referring to FIG. 2, a portion of the insulation layer 11 is shown. The insulation layer 11, includes a plurality of discrete beads having exterior surfaces. Illustrative discrete beads 22 and 23 are shown as having exterior surfaces 24 and 25, respectively. Discrete beads 22 and 23 are bonded or joined together at mutual points 26 of contact on their exterior surfaces. By this construction, an insulation layer 11 having a number of openings 27 or voids created by the bond points of the spheres is provided. These openings 27 provide the insulation layer 11 with the capability of draining incidental moisture that has breached the exterior finishing materials or the outermost surface of the building envelope. Due to the openings, the insulation layer is capable of draining incidental moisture vertically to weep holes or other vent means provided near the bottom of the building wall, or at other desired locations.

A building wall 30 incorporating an exterior finish system having a moisture permeable insulation layer is shown in FIG. 3. As shown in illustrated FIG. 3, Building wall 30 is of a typical 2x4 frame construction, although other construction techniques and configurations are equally suitable.

Building wall 30 is generally constructed of a frame, a building wall substrate, the moisture drainable insulation layer, and an exterior finish. The frame typically includes a plurality of studs 31, which are members of wood or steel having nominal dimensions of 2" x 4". Studs 31 are vertically oriented and are parallel and spaced apart a distance of typically 16" or 24", although these dimensions are merely illustrative. Studs 31 are each typically fixedly attached at upper and lower ends to a horizontal plate, with the plate typically being a member

of similar dimension to studs 31 and oriented horizontally such that multiple vertical studs 31 in a wall 30 are fixedly attached to a single plate running along their bottom edges and also to another single plate running along their top edges. Studs 31 are usually fixedly attached to the plate by means of mechanical fasteners such as nails and/or screws (not shown). Moreover, studs 31 are each typically attached to a lower sill plate (not shown) which is of a similar construction. Typically, a building wall substrate 33 is attached to the exterior surface of the framed wall.

A starter track 34 may be mounted along the bottom edge of the wall 30 and may extend along substantially the entire length of the bottom edge of the wall 30. The starter track 34 may be provided as a rigid L-shaped structure, formed of a non-corrosive material, such as aluminum or UV-resistant polyvinyl chloride. The starter track 34 is mounted onto the wall 30 in a position that is substantially parallel to the foundation of the building structure. The starter track 34 may be applied or mounted onto the wall 30 by means of adhesives or mechanical fasteners. A sealing membrane 35 may be utilized in conjunction with the starter track 34 to prevent the flow of incidential moisture behind the starter track 34. The sealing membrane 35 may be a composite membrane or a trowel-applied membrane. According to certain embodiments, the self-adhering membrane 35 is a composite membrane comprising a rubberized asphalt layer and a polyester layer.

Still referring to FIG. 3, the insulation layer and exterior finish are attached to the building wall substrate 33. According to FIG. 3, the exterior finishing material is an exterior insulation and finish system (40-43). Optionally, a weather barrier 50 is applied over the exterior surface of the building wall substrate 33, prior to the installation of the insulation layer. The weather barrier 50, may be selected from building papers or polymeric sheet barriers. Although a pre-formed sheet weather barrier may be utilized, the weather barrier 50 may also comprises a roller, brush- or trowel-applied material barrier layer.

The exterior finish is applied over the weather barrier 50. The exterior insulation and finish system typically includes, the insulation layer 40, a base coat

41, a reinforcing mesh 42, and a finish coat 43. The base coat 41 is applied directly to the exterior surface of the insulation layer. The insulation layer 40 is generally provided in the form of an insulation board. The reinforcing mesh 42 is applied to and substantially embedded within the base coat 41 layer. Once the base coat 41 has dried, the exterior finish coat 43 is applied over the dried base coat 41 and mesh 42 to provide an aesthetically pleasing exterior finished surface.

With reference to FIG. 4, a cavity forming or spacer means 60 may optionally be positioned between the exterior surface of the building wall substrate 30 and the insulation layer 40.

EXPERIMENTAL

The following test results set forth to describe exterior finish system in further detail. It shouuld be noted, however, that the test results should not be construed as limiting the exterior finish system, building wall incorporating the exterior finish system or assocaited processes in any manner.

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A sample of a type of moisture drainable insulation was evaluated for core density, water absorption, compressive properties, shear properties, water vapor permeance, tensile properties, dimensional stability, and freeze-thaw tensile adhesion.

Core Density Testing

A layer of the moisture permeable insulation was evaluated for core density in accordance with the ASTM C303 test method. The results of the core density testing are reported in Table I below.

TABLE I

	Results
No Drying	2.22 ± 0.02 lb/ft^3
Dried for 2 hours at 105°C	2.14 ± 0.03 lb/ft^3
Dried for 24 hours at 50°C	2.15 ± 0.04 lb/ft^3

Water Absorption Testing

A layer of the moisture drainable insulation was evaluated for water absorption in accordance with the ASTM C272/C578 test method. The results of the water absorption testing of the moisture drainable insulation layer having interconnected voids was compared to a layer of standard expanded polystyrene foam insulation. The water absorption of the insulation layer is expressed as a function of the percent weight gain of the insulation layer, due to the absorption of water. The moisture permeable insulation layer exhibited an average weight gain of $61 \pm 4\%$. Standard expanded polystyrene insulation board exhibited a weight gain of 206 ± 19.

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Compressive Resistance Properties Testing

The moisture drainable insulation was evaluated for compressive resistance properties in accordance with the ASTM D1621 test method. The results of the compressive resistance properties testing are reported in Table II below.

TABLE II

Compressive Resistance Property	**Results**
Stress at 0.5% Strain	0.6 ± 0.3 psi
Stress at 1% Strain	0.7 ± 0.3 psi
Stress at 10% Strain	4.1 ± 0.1 psi
Modulus of Elasticity	840 ± 215 psi

Shear Properties Testing

The moisture drainable insulation was evaluated for shear resistance in accordance with the ASTM C273 test method. The results of the shear resistance testing for the moisture permeable insulation layer were compared to standard expanded polystyrene (EPS), and are reported in Table III below.

TABLE III

Shear Properties	**EPS**	**Air/Moisture Permeable Insulation**
Shear Strength	11 ± 1 psi	27 ± 1 psi
Shear Modulus	58 ± 4 psi	33 ± 1 psi

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Water Vapor Permeance Testing

The moisture drainable insulation was evaluated for water vapor permeance in accordance with the ASTM E96 test method. The results of the water vapor testing for the moisture drainable insulation were compared to standard expanded polystyrene (EPS), and are reported in Table IV below.

TABLE IV

Sample	**Method**	**Results**
Inventive 1	Dry Cup	6.3 ± 0.7 perms
Inventive 2	Wet Cup	20.2 ± 1.9 perms
Inventive 3	Dry Cup	6.5 ± 0.6 perms
Inventive 4	Wet Cup	22.9 ± 1.6 perms
Standard EPS 6	Dry Cup	2.9 ± 0.2 perms
Standard EPS 7	Wet Cup	5.2 ∀ 0.8 perms

Tensile Properties Testing

The moisture drainable insulation was evaluated for tensile properties in accordance with the ASTM C297 test method. The results of the tensile properties testing for the moisture permeable insulation were compared to standard expanded polystyrene (EPS), and are reported in Table V below.

TABLE V

Sample	**Tensile Property**	**Results**
Inventive	Tensile Strength	30 ± 3 psi
Inventive	Elongation at Max. Stress	27 ± 2%
Comparative EPS	Tensile Strength	16 ± 1 psi
Comparative EPS	Elongation at Max. Stress	18 ± 1 %

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Dimensional Stability Testing

The moisture drainable insulation was evaluated for dimensional stability in accordance with the ASTM D2126 test method. The results of the dimensional stability testing for the moisture drainable insulation were compared to standard expanded polystyrene (EPS), and are reported in Table VI below.

TABLE VI

Sample	**Method**	**Results**
Inventive	-26°C	0%
Inventive	38°C/95% relative humidity	9.7 ± 0.3%
Comparative EPS	-26°C	0%
Comparative EPS	38°C/95% relative humidity	1.8 ± 0.5%

Freeze-Thaw Tensile Adhesion Testing

The moisture drainable insulation was evaluated for freeze-thaw resistance in accordance with the criteria set forth in International Conference of Building Officials (ICBO) AC24, and also for tensile adhesion in accordance with the ASTM C297 test method.

With respect to the freeze-thaw testing, exterior insulation and finish systems were constructed. Each system included the moisture drainable insulation layer having interconnected voids, a base coat applied for the insulation layer, a reinforcing mesh embodied in the base coat layer, and a finish coat layer applied over the base coat layer and reinforcing mesh. Two different base coats were used in the testing, namely, Alpha Base Coat and Alpha Dry Base Coat, both commercially available from Degussa Wall Systems, Inc. of Jacksonville, Florida.

The exterior insulation and finish systems were assembled and the assembled systems were subjected to freeze-thaw cycles, in accordance with ICBO AC24. No

surface changes or delaminations were noticed after exposure to freeze-thaw cycling.

The results of the tensile adhesion testing before and after freeze-thaw cycling are reported in Table VII below. The building wall substrate utilized in the illustrative testing was a building sheathing material commercially available from Georgia Pacific under the trade designation Dens Glass Gold.

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TABLE VII

Sample	Test Method	Results
Inventive insulation layer adhered to wall substrate with Base Coat 1	Flatwise Tensile Adhesion No freeze-thaw cycling	27 ± 3 psi
Inventive insulation layer adhered to wall substrate with Base Coat 2	Flatwise Tensile Adhesion No freeze-thaw cycling	27 ± 1 psi
Full EIFS with inventive insulation layer adhered to wall substrate with Base Coat 1	Flatwise Tensile Adhesion No freeze-thaw cycling	27 ± 3 psi
Full EIFS with inventive insulation layer adhered to wall substrate with Base Coat 2	Flatwise Tensile Adhesion No freeze-thaw cycling	28 ± 1 psi
Full EIFS with inventive insulation layer adhered to wall substrate with Base Coat 1	Flatwise Tensile Adhesion After freeze-thaw cycling	27 ± 3 psi
Full EIFS with inventive insulation layer adhered to wall substrate with Base Coat 2	Flatwise Tensile Adhesion After freeze-thaw cycling	25 ± 3 psi

Base Coat 1 = Alpha Base Coat from Degussa Wall Systems, Inc.

Base Coat 2 = Alpha Dry Base Coat from Degussa Wall Systems, Inc.

While various illustrative embodiments have been described above and shown in the various figures, it should be understood that other similar embodiments may be used or modifications and additions may be made to the described embodiments for performing the same functions without deviating

therefrom. Further, all embodiments disclosed are not necessarily in the alternative, as various embodiments may be combined to provide the desired characteristics. Variations can be made by one having ordinary skill in the art without departing from the spirit and scope of the disclosure. Therefore, the exterior finish system, building wall, and process should not be limited to any single embodiment, but rather construed in breadth and scope in accordance with the recitation of the attached claims.

I CLAIM:

1. An exterior finish system for building walls comprising:

a weather barrier;

a polymeric, raspable, moisture drainable insulation layer having a plurality of openings applied directly to a surface of the weather barrier; and

an above-grade aesthetic exterior finish layer applied to a surface of said drainable insulation layer, wherein the exterior finish system is vertically disposed on a building wall.

2. The exterior finish system of claim 1, wherein said insulation layer comprises a plurality of discrete beads manufactured from a polymeric material.

3. The exterior finish system of claim 2, wherein said polymeric material is selected from the group consisting of polyolefin and polystyrene materials.

4. The exterior finish system of claim 3, wherein said polyolefin material is selected from polyethylene, polypropylene, and mixtures thereof.

5. The exterior finish system of claim 3, wherein said polymeric material is expanded polystyrene.

6. The exterior finish system of claim 2, wherein said plurality of discrete beads are coated with a water resistant coating.

7. The exterior finish system of claim 2, wherein said plurality of discrete beads are bonded at points of contact.

8. The exterior finish system of claim 1, wherein said exterior finish layer is selected from the group consisting of brick, wood siding, vinyl siding, aluminum siding, stucco, and exterior insulation and finish system materials.

9. The exterior finish system of claim 8, wherein said exterior finish layer is stucco.

10. The exterior finish system of claim 8, wherein said exterior finish layer is exterior insulation and finish system materials.

11. The exterior finish system of claim 10, wherein said exterior insulation and finish system materials comprise said moisture drainable insulation layer, at least one base coat layer, at least one reinforcing layer, and at least one finish coat layer.

12. The exterior finish system of claim 11, wherein said base coat is selected from cementitious base coats, polymer base coats, and polymer-modified cementitious base coats.

13. The exterior finish system of claim 11, wherein said reinforcing layer is selected from the group consisting of reinforcing fabrics and meshes.

14. The exterior finish system of claim 13, wherein said reinforcing mesh is a woven mesh of glass fibers.

15. The exterior finish system of claim 11, wherein said at least one finish coat layer is selected from the group consisting of cementitious finish coats, polymer based finish coats, and polymer-modified cementitious finish coats.

16. A building wall comprising:

a building wall substrate;

a weather resistant barrier attached to said building wall substrate;

a polymeric, raspable, moisture drainable insulation layer having a plurality of openings applied to a surface of said weather resistant barrier; and

an above-grade aesthetic exterior finish layer applied to a surface of said drainable insulation layer.

17. The wall of claim 16, wherein said building wall substrate is selected from the group consisting of plywood sheathing, oriented strand board, wafer board, particle board, cement board, and gypsum board.

18. The wall of claim 16, wherein said insulation layer comprises a plurality of discrete beads manufactured from a polymeric material.

19. The wall of claim 18, wherein said polymeric material comprises polyolefin materials.

20. The wall of claim 18, wherein said polymeric material comprises expanded polystyrene materials.

21. The wall of claim 18, wherein said plurality of discrete beads are bonded at points of contact.

22. The wall of claim 16, wherein said exterior finish layer is selected from the group consisting of brick, wood siding, vinyl siding, aluminum siding, stucco, and exterior insulation and finish system materials.

23. The wall of claim 22, wherein said exterior finish layer comprises exterior insulation and finish system materials.

24. The wall of claim 23, wherein said exterior insulation and finish system materials comprise said moisture drainable insulation layer, at least one base coat layer, a reinforcing layer, and at least one finish coat layer.

25. The wall of claim 24, wherein said base coat is selected from cementitious base coats, polymer base coats, and polymer-modified cementitious base coats.

26. The wall of claim 24, wherein said reinforcing layer is woven mesh of glass fibers.

27. The wall of claim 24, wherein said at least one finish coat layer is selected from the group consisting of cementitious finish coats, polymer finish coats, and polymer-modified cementitious finish coats.

28. The wall of claim 16, wherein said moisture drainable insulation layer is attached to said weather resistant barrier and/or said building wall substrate, by attaching means selected from the group consisting of (i) an adhesive attachment, (ii) mechanical fasteners, and (iii) a combination of an adhesive and mechanical fasteners.

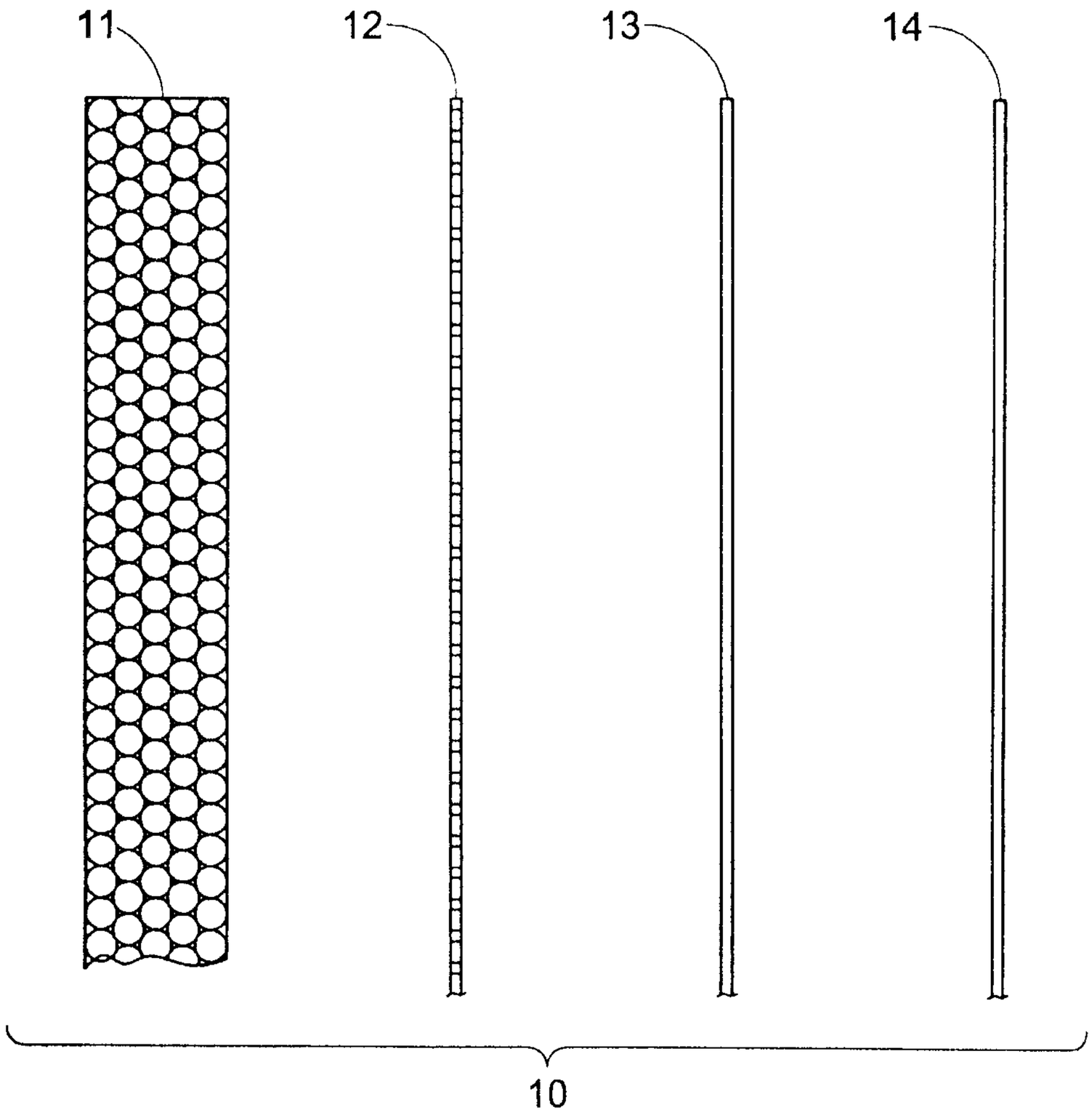

FIG. 1

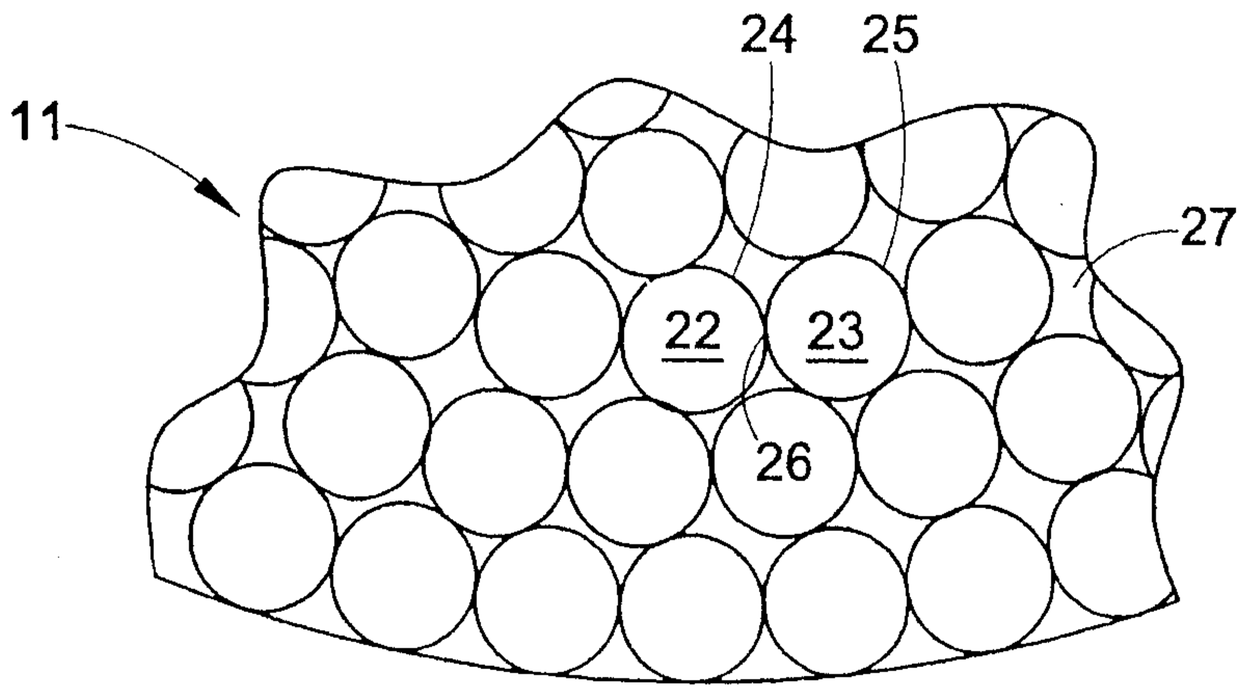

FIG. 2

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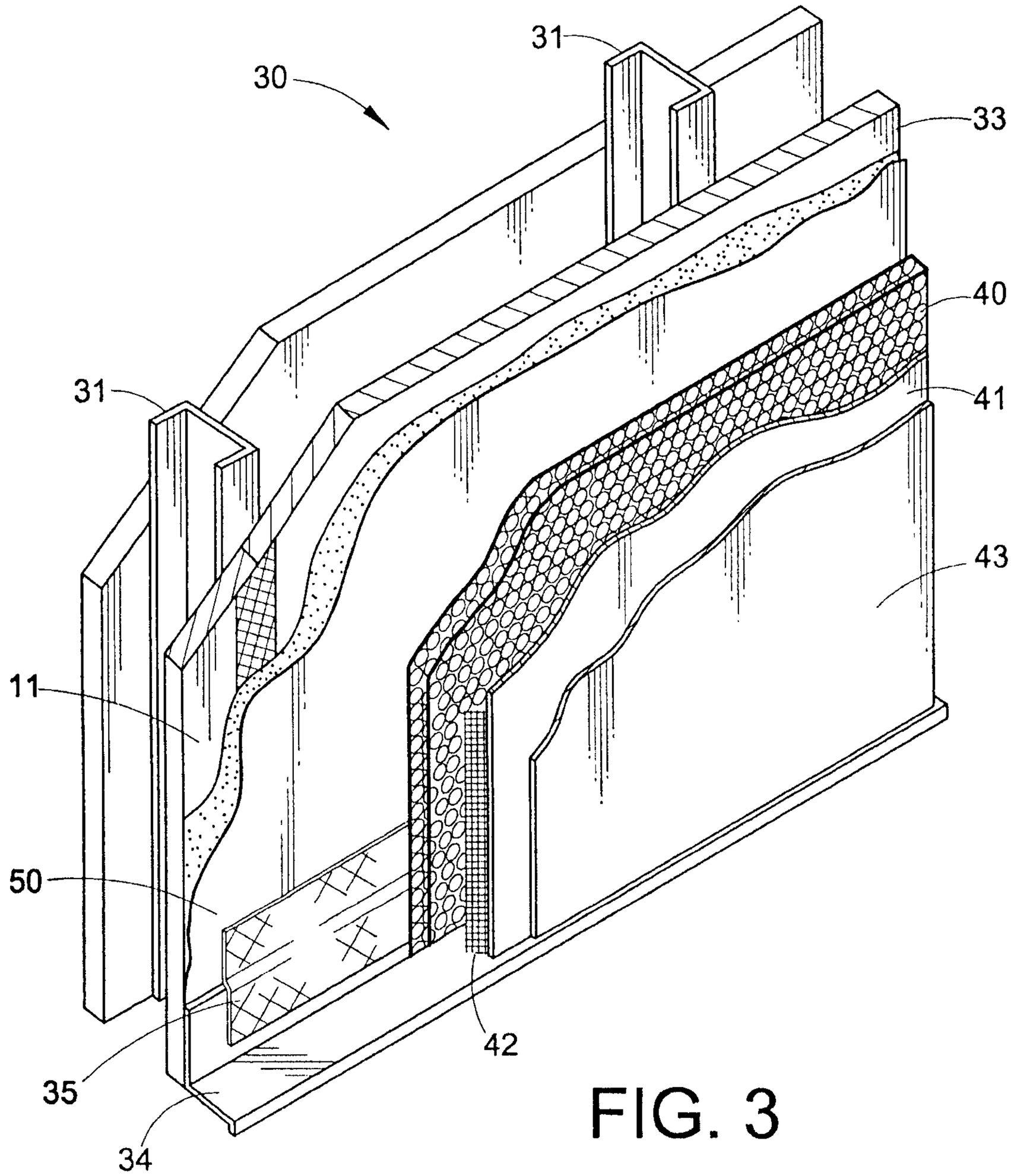


FIG. 3

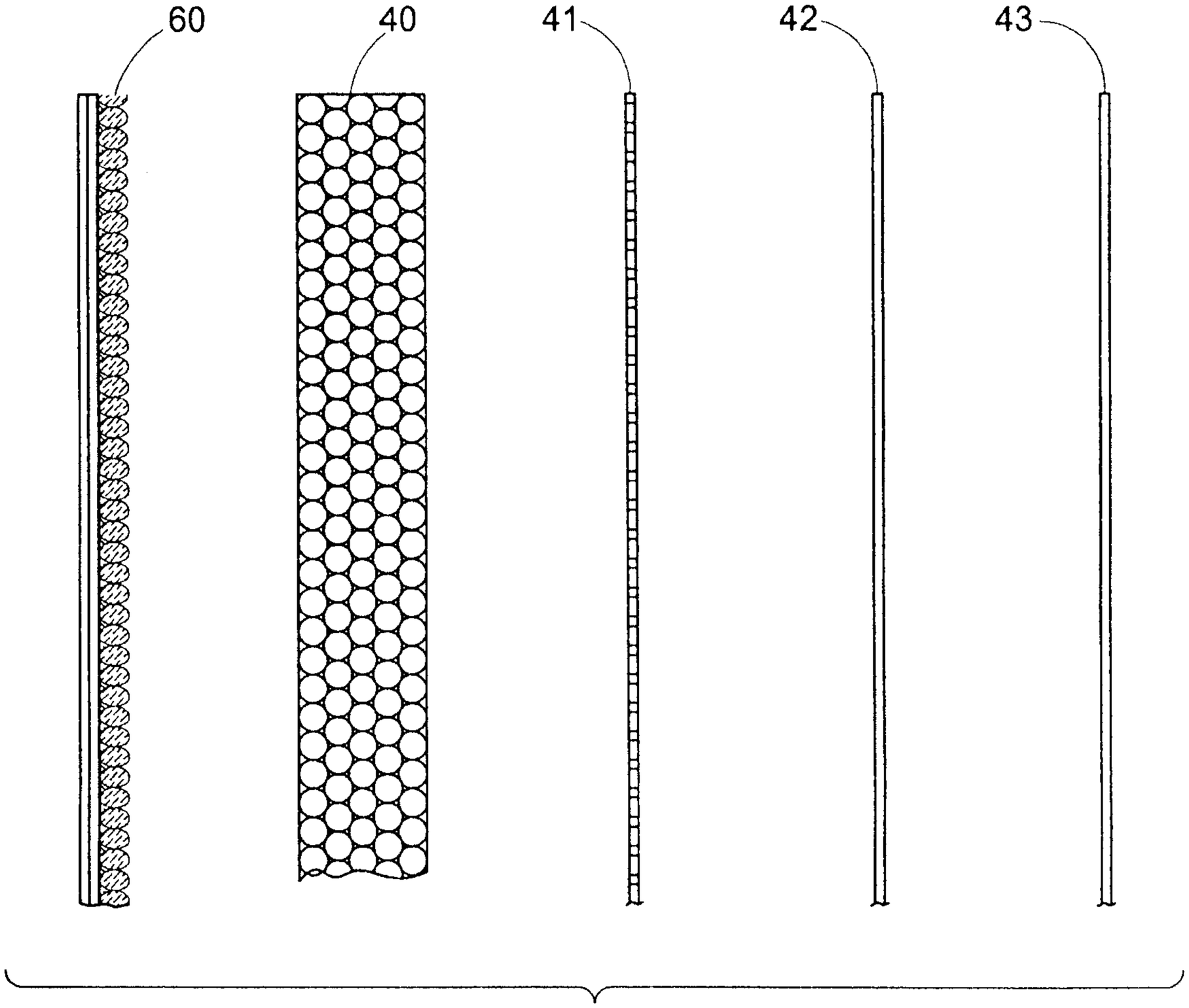
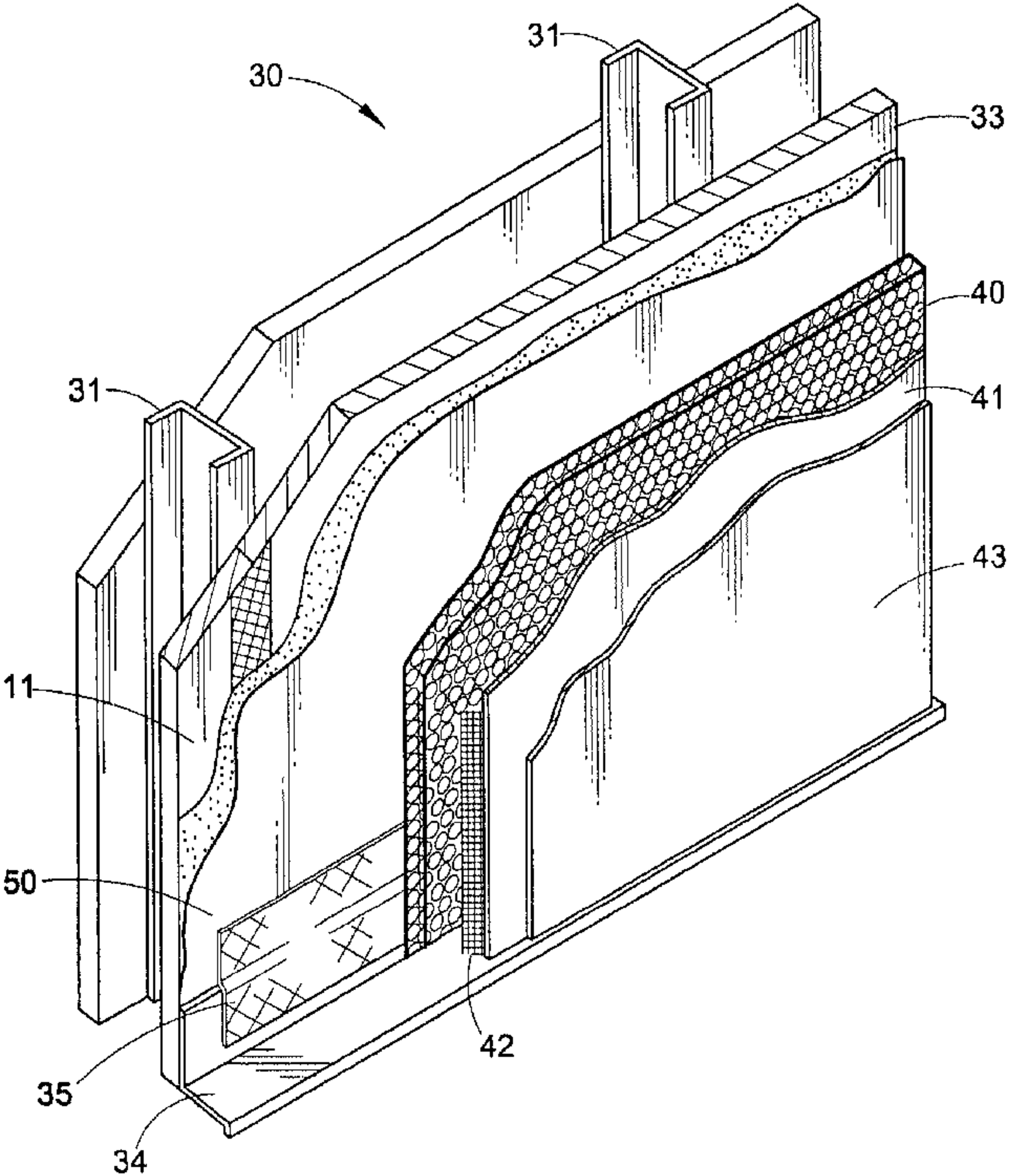


FIG. 4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