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(54) **CONCRETE CURING BLANKET AND METHOD**

BETONAUSHÄRTUNGSDECKE UND VERFAHREN

BÂCHE DE DURCISSEMENT DE BÉTON ET PROCÉDÉ ASSOCIÉ

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Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION:

[0001] This invention relates generally to a concrete curing blanket, and more particularly to a concrete curing blanket that includes an absorbent sheet that includes a wicking layer, a super absorbent material, and a tissue layer, laminated together, which is covered with a vapor barrier having a plurality of perforations.

DESCRIPTION OF RELATED ART:

[0002] Concrete strength and durability improves when the concrete is thoroughly hydrated during curing. If the concrete is kept wet for the first 7-10 days after setting, strength and durability thereof is increased 75% over ordinary aging of concrete in dry surface conditions.

[0003] To keep concrete hydrated, the concrete industry has come to rely on concrete curing blankets for covering wetted concrete and extending the duration of damp conditions on the curing surface of the concrete. An example of such a concrete curing blanket is disclosed in McDonald, U.S. 7,572,525, which teaches a curing blanket that includes a vapor barrier, and an airlaid layer consisting of a binder material and a natural cellulose bleached fluff pulp fiber derived from wood through Kraft processing. US 2010/0038818 discloses a concrete curing blanket which comprises a first fibrous airlaid layer comprising super absorbent fibers, a second vapour barrier layer and a third layer which includes a polymer release agent and kraft pulp fiber.

[0004] The prior art teaches the use of concrete curing blankets that include an airlaid layer that includes natural cellulose bleached fluff pulp fiber derived from wood through Kraft processing. However, the prior art does not teach a concrete curing blanket that includes an absorbent sheet that includes a wicking layer, a super absorbent material, and a tissue layer, laminated together, which is covered with a vapor barrier having a plurality of perforations. The present invention fulfills these needs and provides further advantages as described in the following summary.

SUMMARY OF THE INVENTION

[0005] The present invention teaches certain benefits in construction and use which give rise to the objectives described below.

[0006] The present invention provides a concrete curing blanket that includes an absorbent sheet comprising a wicking layer and a tissue layer with super absorbent materials positioned therebetween. The absorbent sheet is sized for being spread over a curing concrete slab. A vapor barrier is bonded to the tissue layer of the absorbent sheet to inhibit evaporation from the concrete curing

blanket.

[0007] In one embodiment the invention provides a method of curing concrete including the steps of providing the above-described concrete curing blanket, and covering the concrete with the concrete curing blanket. The concrete and the concrete curing blanket are soaked with water, to thoroughly hydrate the concrete and the concrete curing blanket. The concrete curing blanket includes an absorbent sheet comprising a wicking layer, super absorbent materials, and a tissue layer, with the super absorbent materials being positioned between the wicking layer and the tissue layer; and a vapor barrier bonded to the tissue layer of the absorbent sheet.

[0008] In one embodiment, the vapor barrier has a plurality of perforations. In another embodiment, the concrete curing blanket is at least 1 meter wide and 5 meters long, so as to be useful for covering concrete during the curing process.

[0009] A primary objective of the present invention is to provide a concrete curing blanket having advantages not taught by the prior art.

[0010] Another objective is to provide a concrete curing blanket that includes a combination of a wicking layer, a super absorbent material, and a tissue layer, that are laminated together to form an absorbent sheet.

[0011] Another objective is to provide a concrete curing blanket that has both superior wicking capabilities from the wicking layer, and also includes superior water holding capacity due to the inclusion of the super absorbent materials.

[0012] Another objective is to provide a concrete curing blanket that is sized and shaped to be spread over concrete, either vertically or horizontally, over a large area of concrete during the curing of the concrete.

[0013] Another objective is to provide a concrete curing blanket that has a vapor barrier having a plurality of perforations for maintaining water within the absorbent sheet, while also allowing the absorbent sheet to be soaked during installation, and also re-wetted periodically during the course of the curing process.

[0014] A further objective is to provide a concrete curing blanket that is inexpensive to manufacture, easy to use, resistant to tearing, and provides superior hydration for extended periods of time.

[0015] Another objective is to provide a method for curing concrete using a concrete curing blanket that is sized and shaped to be spread over concrete, either vertically or horizontally, over a large area of concrete during the curing of the concrete.

[0016] Other features and advantages of the present invention will become apparent from the following more detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The accompanying drawings illustrate the

present invention. In such drawings:

FIGURE 1 is a perspective view of a concrete curing blanket according to one embodiment of the present invention, illustrating the concrete curing blanket being positioned on a concrete slab while water is poured onto the concrete slab and into the concrete curing blanket;

FIGURE 2 is a sectional view of the concrete curing blanket taken along line 2-2 in Figure 1, illustrating the four layers of construction of the concrete curing blanket in the embodiment of Fig. 1;

FIGURE 3 is a side elevational view of a first step of manufacture of the concrete curing blanket, wherein a wicking layer and a tissue layer are laminated together to contain the super absorbent polymers therebetween, and thereby form an absorbent sheet; and

FIGURE 4 is a perspective view of a second step of manufacture of the concrete curing blanket, wherein the absorbent sheet formed in Fig. 3 is bonded to a vapor barrier to form the concrete curing blanket of Figs. 1 and 2.

DETAILED DESCRIPTION OF THE INVENTION

[0018] The above-described drawing figures illustrate the invention, a method for curing concrete using a concrete curing blanket 10 that is used for providing hydration to concrete such as a concrete slab C during the curing process, to provide concrete that has superior strength and durability.

[0019] FIGURE 1 is a perspective view of one embodiment of the concrete curing blanket 10, illustrating the concrete curing blanket 10 being positioned on the concrete slab C. As illustrated in Fig. 1, the concrete curing blanket 10 is manufactured in a roll that is sized for being unrolled over the concrete slab C to effectively cover the concrete slab C. The concrete curing blanket 10 is at least about 1 meter wide, and about 10 meters long. In a typical embodiment, the concrete curing blanket 10 is 1-3 meters wide (in this case about 2.5 meters wide), and about 30-60 (or more) meters long. In alternative embodiments, the measurements may vary according to the needs of the user, but they will be sufficiently large to be useful in covering concrete slabs, which may be of considerable size. As used in this application, the term "about" is hereby defined to include +/- 10%.

[0020] As illustrated in Fig. 1, before and while the concrete curing blanket 10 is being positioned on the concrete slab C, water is poured in large amounts onto the concrete slab C and into and over the concrete curing blanket 10, so that the concrete slab C remains thoroughly hydrated, and the concrete curing blanket 10 is thoroughly soaked. Once saturated, the concrete curing blanket 10 maintains an optimal amount of water in contact

with the surface of the concrete slab C, which optimizes the strength and durability of the concrete when cured.

[0021] While one form of concrete slab C is illustrated herein, the term "concrete" or "concrete slab" is hereby defined to include any form of structure that may require this form of hydration, including cement walls, pillars, and other structures known in the art. Indeed, due to the superior water carrying characteristics of the present invention, the concrete curing blanket 10 is particularly useful when used on angled or vertical cement structures, which might otherwise be difficult to keep hydrated.

[0022] FIGURE 2 is a sectional view of the concrete curing blanket 10 taken along line 2-2 in Figure 1. Fig. 2 illustrates the four layers of construction of the concrete curing blanket 10 in the embodiment of Fig. 1. As shown in Fig. 2, the concrete curing blanket 10 comprises an absorbent sheet 22 comprising a wicking layer 20 and a tissue layer 26 with super absorbent materials 24 laminated therebetween. The concrete curing blanket 10 further comprises a vapor barrier 30 bonded to the tissue layer 26 of the absorbent sheet 22.

[0023] The wicking layer 20 of Fig. 2 is a layer of material that is able to quickly wick up water from the pool of water formed on the concrete slab C (as shown in Fig. 1) as it is rolled onto the concrete slab C, so that the water is quickly and efficiently drawn into the concrete curing blanket 10. Water may also be poured directly onto the roll of the concrete curing blanket 10, to assure that the concrete curing blanket 10 is thoroughly hydrated. In the current embodiment, the wicking layer 20 is a nonwoven fabric, in this case a spunlaced nonwoven fabric comprising viscose. The wicking layer 20 may further comprise a polymer such as polyethylene, polypropylene, and/or polyester, which are useful in the bonding/lamination process, as discussed in greater detail below. In one embodiment, the wicking layer 20 comprises a combination of viscose and polyethylene.

[0024] In one embodiment, the wicking layer 20 comprises a cellulose precipitated from an organic solution in which no substitution of the hydroxyl groups takes place and no chemical intermediates are formed (e.g., Lyocell). In alternative embodiments, alternative or equivalent wicking materials may also be used, using formulations that would be known to those skilled in the art, and such alternative or equivalent formulations should be considered within the scope of the present invention.

[0025] The super absorbent materials 24 may include super absorbent polymers, super absorbent fibers, or other similar or equivalent materials. As used in the present application, the term "super absorbent polymers" ("SAP") is defined to include polymers that can absorb and retain extremely large amounts of liquid relative to their own mass. Water absorbing SAP, classified as hydrogels, when cross linked, absorb aqueous solutions through hydrogen bonding with water molecules. A SAP's ability to absorb water is a factor of the ionic concentration of the aqueous solution. In deionized and dis-

tilled water, a SAP may absorb 500 times its weight (30-60 times its own volume), although this ability drops to only about 10% of this amount when salt is present.

[0026] The total absorbency and swelling capacity are controlled by the type of and degree of cross-links used to make the gel. Low density cross-linking have a higher absorbency, which higher cross-link density exhibits lower absorbent capacity and swell, but greater gel strength and firmness.

[0027] SAPs are commonly made from the polymerization of acrylic acid bended with sodium hydroxide in the presence of an initiator to form a poly-acrylic acid sodium salt, sometimes referred to as sodium polyacrylate. Other materials known in the art may also be used in this manner. In the present embodiment, the super absorbent materials 24 include a sodium polyacrylate polymer, and may further include additional additives, as discussed in greater detail below.

[0028] As shown in Fig. 2, the concrete curing blanket 10 further includes the tissue layer 26, which in the present embodiment is a tissue fabric that is suitable forming a bond between the absorbent sheet 22 and the vapor barrier 30. The tissue layer 26 is a good surface for forming a good, strong, stable bond, and for preventing any bonding agents (glues, cements, bonding agents, etc.) from contaminating the super absorbent materials 24, and interfering with the ability of the super absorbent materials 24 from absorbing water. For purposes of this application, the term "tissue layer" is defined to include tissue fabric, and also any other materials known to those skilled in the art that is able to provide a good bonding attachment between the absorbent sheet and the vapor barrier.

[0029] The vapor barrier 30 of Fig. 2 is a film comprising polyethylene or polypropylene or other material that is substantially vapor impervious, to prevent dehydration of the concrete curing blanket 10. The vapor barrier 30 may include perforations 32 so that water may be added from the top of the concrete curing blanket 10, so long as the perforations 32 are not large enough to enable excessive drying of the concrete curing blanket 10.

[0030] FIGURE 3 is a side elevational view of a first step of manufacture of the concrete curing blanket 10, wherein the wicking layer 20 and the tissue layer 26 are laminated together to contain the super absorbent polymers therebetween, and thereby form the absorbent sheet 22. In this embodiment, the super absorbent materials 24 further include a heat activated bonding agent, which facilitates the lamination of the three sheets together in the presence of heat and pressure. In this embodiment, the wicking layer 20, the super absorbent materials 24, and the tissue layer 26 are all laminated together under heat and pressure, such as via one or more rollers 40. Either the rollers 40 themselves may be heated, or a separate heater (not shown) may be included to apply suitable heat to the substrate moving through the rollers 40.

[0031] While the present embodiment uses heat, other

forms of bonding agents (e.g., contact cement, hot melt adhesive, etc.) may be used during rolling of the substrate, and may include rollers 40 that are not heated, or may omit the rollers entirely, so that the different layers are assembled in another manner known in the art.

[0032] FIGURE 4 is a perspective view of a second step of manufacture of the concrete curing blanket 10, wherein the absorbent sheet 22 formed in Fig. 3 is bonded to a vapor barrier 30 to form the concrete curing blanket 10 of Figs. 1 and 2. A plurality of the absorbent sheets 22 may be disposed adjacent each other to form the concrete curing blanket 10. In this embodiment, three of the absorbent sheets 22 are arranged side-by-side (or slightly overlapping) to be bonded to the vapor barrier 30, in this case also using rollers 40, although this is not necessarily required, as discussed above. As described above, heat, a heat activated bonding agent, contact cement, or other suitable adhesive or bonding element may be used to bond these two elements together to form the final concrete curing blanket 10.

[0033] In use, the wicking layer 20 picks up water from the concrete slab C, as shown in Fig. 1, and from the wicking layer 20 the water is picked up (more slowly) by the super absorbent materials 24. While the wicking layer 20 can pick up the water quickly, it cannot store as much water, and while the super absorbent materials 24 take longer to absorb the water, they can in the end act as a reservoir for much larger amounts of water.

[0034] Following installation, as the wicking layer 20 dries, water wicks from the super absorbent materials 24 back into the wicking layer 20, to maintain the proper hydration of the wicking layer 20 and the concrete slab C.

[0035] As used in this application, the words "a," "an," and "one" are defined to include one or more of the referenced item unless specifically stated otherwise. Also, the terms "have," "include," "contain," and similar terms are defined to mean "comprising" unless specifically stated otherwise.

Claims

1. A concrete curing blanket (10) comprising:
 - an absorbent sheet (22) comprising a wicking layer (20) and a tissue layer (26) with super absorbent materials (24) positioned therebetween; a vapor barrier (30) bonded to the tissue layer (26) of the absorbent sheet (22); and wherein the concrete curing blanket (10) is at least 1 meter wide and 5 meters long.
2. The concrete curing blanket (10) of claim 1, wherein the wicking layer (20) is a nonwoven fabric.
3. The concrete curing blanket (10) of claim 1, wherein the wicking layer (20) is a spunlaced nonwoven fabric comprising viscose.

4. The concrete curing blanket (10) of claim 3, wherein the wicking layer (20) further comprises polyethylene, polypropylene, or polyester.
5. The concrete curing blanket (10) of claim 1, wherein in the wicking layer (20) is fiber composed of Lyocell.
6. The concrete curing blanket (10) of claim 1, wherein the wicking layer (20) comprises viscose and polyethylene.
7. The concrete curing blanket (10) of claim 1, wherein the vapor barrier (30) is a film that includes a plurality of perforations.
8. The concrete curing blanket (10) of claim 1, wherein the vapor barrier (30) is a film comprising polyethylene or polypropylene.
9. The concrete curing blanket (10) of claim 1, wherein the super absorbent materials (24) include a super absorbent polymer comprising sodium polyacrylate polymer.
10. The concrete curing blanket (10) of claim 1, wherein the super absorbent materials (24) include a super absorbent polymer, and a heat activated bonding agent, and wherein the wicking layer, the super absorbent materials, and the tissue layer are all laminated together under heat and pressure.
11. A method of curing concrete, the method comprising the steps of:
 - providing a concrete curing blanket (10) comprising:
 - an absorbent sheet (22) comprising a wicking layer (20), super absorbent materials (24), and a tissue layer (26), with the super absorbent materials (24) being positioned between the wicking layer (20) and the tissue layer (26); and
 - a vapor barrier (30) bonded to the tissue layer (26) of the absorbent sheet (22);
 - covering the concrete with the concrete curing blanket (10); and
 - soaking the concrete and the concrete curing blanket (10) with water.

Patentansprüche

1. Betonhärtungsmatte (10), umfassend:
 - eine absorbierende Lage (22), die eine Saugschicht (20) und eine Gewebeschicht (26) mit

dazwischen angeordneten superabsorbierenden Materialien (24) umfasst;
eine Dampfsperre (30), die mit der Gewebeschicht (26) der absorbierenden Lage (22) verbunden ist; und
wobei die Betonaushärtungsdecke (10) mindestens 1 Meter breit und 5 Meter lang ist.

2. Betonhärtungsmatte (10) nach Anspruch 1, bei der die Saugschicht (20) ein Vliesstoff ist.
3. Betonhärtungsmatte (10) nach Anspruch 1, bei der die Saugschicht (20) ein Spinnvlies ist, das Viskose umfasst.
4. Betonhärtungsmatte (10) nach Anspruch 3, bei der die Saugschicht (20) ferner Polyethylen, Polypropylen oder Polyester umfasst.
5. Betonhärtungsmatte (10) nach Anspruch 1, bei der sich in der Saugschicht (20) Fasern aus Lyocell befinden.
6. Betonhärtungsmatte (10) nach Anspruch 1, bei der die Saugschicht (20) Viskose und Polyethylen enthält.
7. Betonhärtungsmatte (10) nach Anspruch 1, bei der die Dampfsperre (30) eine Folie ist, die eine Mehrzahl von Perforationen aufweist.
8. Betonhärtungsmatte (10) nach Anspruch 1, bei der die Dampfsperre (30) eine Folie ist, die Polyethylen oder Polypropylen enthält.
9. Betonhärtungsmatte (10) nach Anspruch 1, bei der die superabsorbierenden Materialien (24) ein superabsorbierendes Polymer umfassen, das Natriumpolyacrylatpolymer enthält.
10. Betonhärtungsmatte (10) nach Anspruch 1, bei der die superabsorbierenden Materialien (24) ein superabsorbierendes Polymer und ein wärmeaktiviertes Bindemittel umfassen, und bei der die Saugschicht, die superabsorbierenden Materialien und die Gewebeschicht alle unter Wärme und Druck zusammenlaminiert werden.
11. Verfahren zum Aushärten von Beton, wobei das Verfahren die folgenden Schritte umfasst:
Bereitstellen einer Betonhärtungsmatte (10), umfassend:
 - eine absorbierende Lage (22), die eine Saugschicht (20), superabsorbierende Materialien (24) und eine Gewebeschicht (26) umfasst, wobei die superabsorbierenden Materialien (24) zwischen der Saugschicht (20) und der Gewe-

beschicht (26) angeordnet sind; und eine Dampfsperre (30), die mit der Gewebeschicht (26) der absorbierenden Lage (22) verbunden ist;

Abdecken des Betons mit der Betonhärtungsmatte (10); und

Tränken des Betons und der Betonhärtungsmatte (10) mit Wasser.

Revendications

1. Couverture de durcissement de béton (10) comprenant :

une feuille absorbante (22) comprenant une couche à effet de mèche (20) et une couche de tissu (26) avec des matériaux super absorbants (24) positionnés entre celles-ci ;

un pare-vapeur (30) lié à la couche de tissu (26) de la feuille absorbante (22) ; et

où la couverture de durcissement de béton (10) a au moins une largeur de 1 mètre et une longueur de 5 mètres.

2. Couverture de durcissement de béton (10) de la revendication 1, dans laquelle la couche à effet de mèche (20) est un tissu non tissé.

3. Couverture de durcissement de béton (10) de la revendication 1, dans laquelle la couche à effet de mèche (20) est un tissu non tissé lacé par filage comprenant de la viscose.

4. Couverture de durcissement de béton (10) de la revendication 3, dans laquelle la couche à effet de mèche (20) comprend en outre du polyéthylène, du polypropylène ou du polyester.

5. Couverture de durcissement de béton (10) de la revendication 1, dans laquelle la couche à effet de mèche (20) est une fibre composée de Lyocell.

6. Couverture de durcissement de béton (10) de la revendication 1, dans laquelle la couche à effet de mèche (20) comprend de la viscose et du polyéthylène.

7. Couverture de durcissement de béton (10) de la revendication 1, dans laquelle le pare-vapeur (30) est un film qui comporte une pluralité de perforations.

8. Couverture de durcissement de béton (10) de la revendication 1, dans laquelle le pare-vapeur (30) est un film comprenant du polyéthylène ou du polypropylène.

9. Couverture de durcissement de béton (10) de la revendication 1, dans laquelle les matériaux super ab-

sorbants (24) comportent un polymère super absorbant comprenant un polymère de polyacrylate de sodium.

10. Couverture de durcissement de béton (10) de la revendication 1, dans laquelle les matériaux super absorbants (24) comportent un polymère super absorbant, et un liant thermoactivé, et dans laquelle la couche à effet de mèche, les matériaux super absorbants et la couche de tissu sont tous stratifiés ensemble à chaud et sous pression.

11. Procédé de durcissement de béton, le procédé comprenant les étapes consistant à :

fournir une couverture de durcissement de béton (10) comprenant :

une feuille absorbante (22) comprenant une couche à effet de mèche (20), des matériaux super absorbants (24) et une couche de tissu (26), les matériaux super absorbants (24) étant positionnés entre la couche à effet de mèche (20) et la couche de tissu (26) ; et

un pare-vapeur (30) lié à la couche de tissu (26) de la feuille absorbante (22) ;

recouvrir le béton avec la couverture de durcissement de béton (10) ; et
détremper le béton et la couverture de durcissement de béton (10) avec de l'eau.

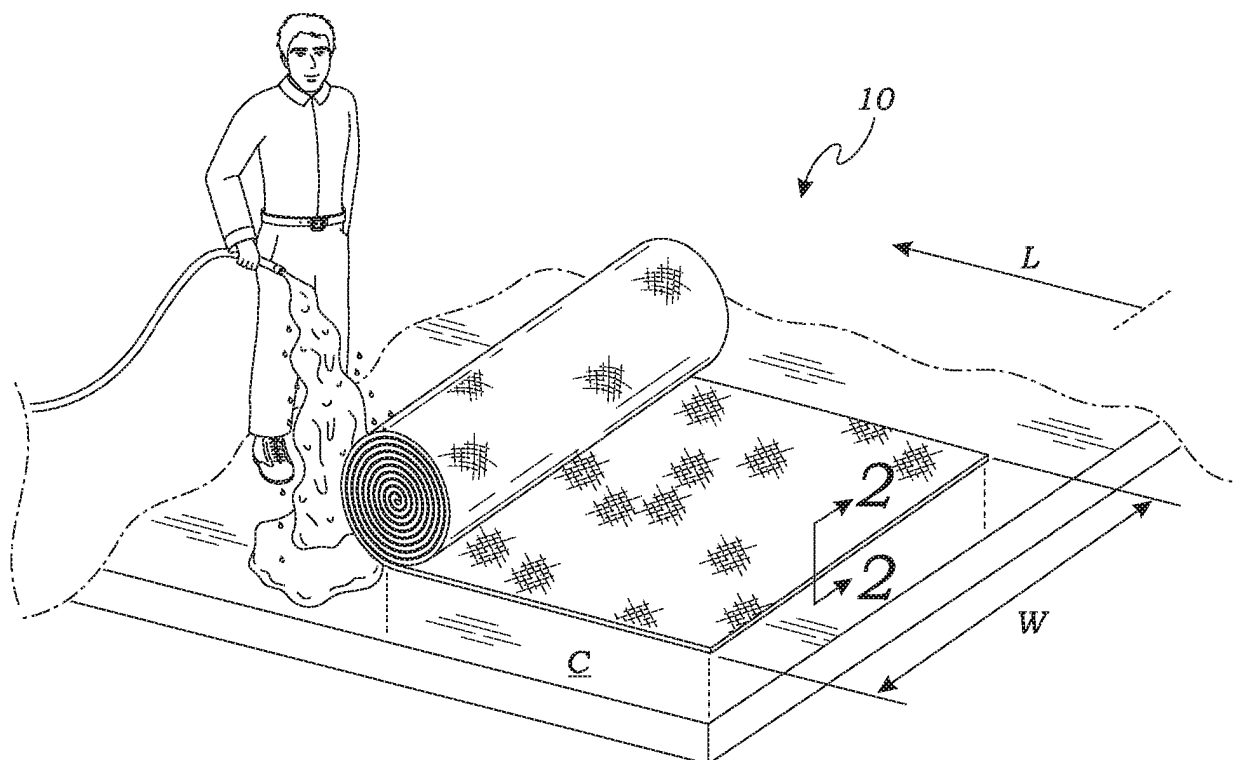


Fig. 1

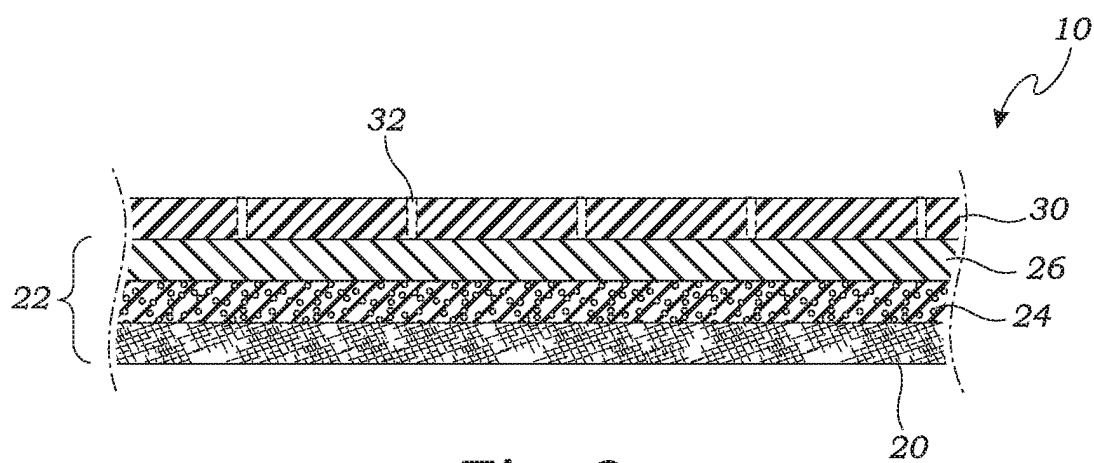


Fig. 2

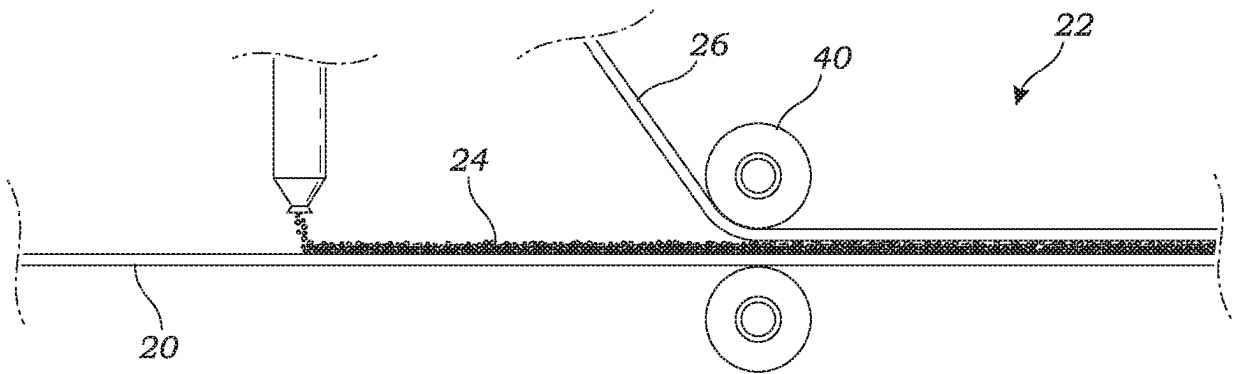


Fig. 3

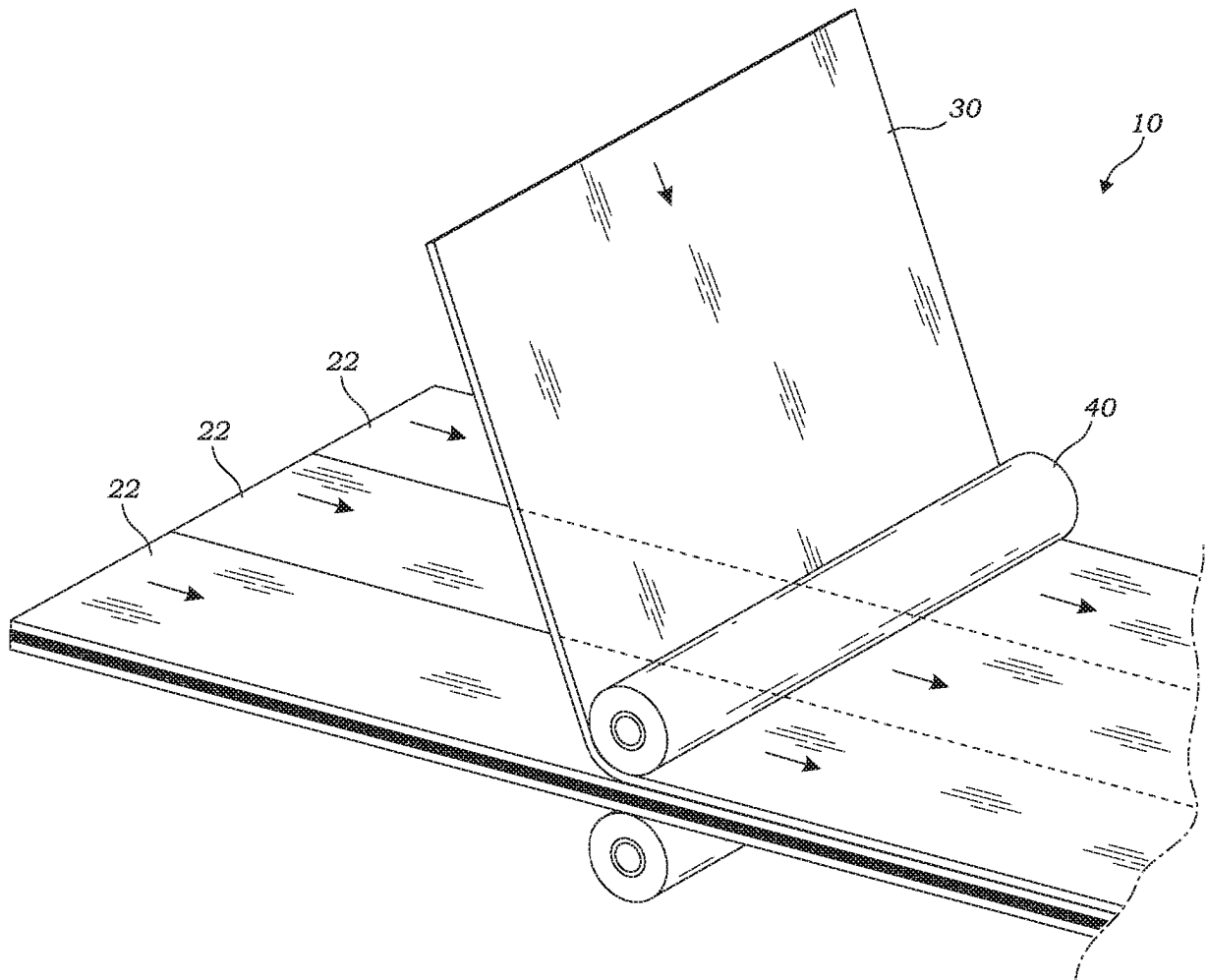


Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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