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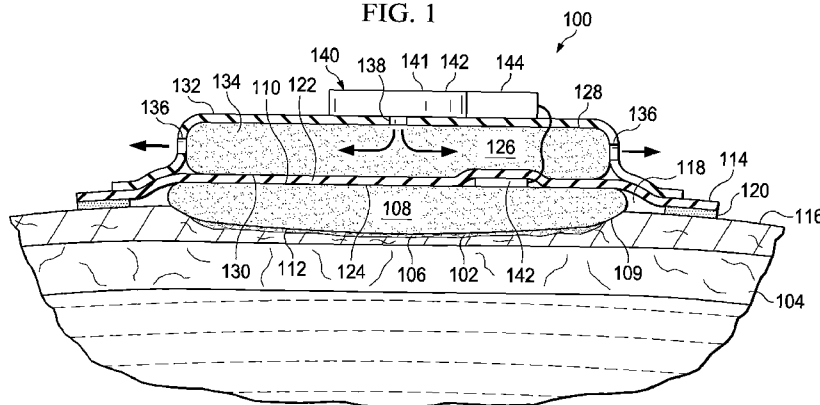
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(54) Title: ABSORBENT POLYMER DRESSINGS, SYSTEMS, AND METHODS EMPLOYING EVAPORATIVE DEVICES

FIG. 1



(57) Abstract: [0045] Wound treatment systems and methods are presented that involve treating a wound, such as a burn wound, with an absorbent polymer that helps maintain a desired moisture level and that also involve an evaporative subsystem that removes excess liquid from the absorbent polymer. Other systems, methods, and dressings are presented herein.

ABSORBENT POLYMER DRESSINGS, SYSTEMS, AND METHODS EMPLOYING EVAPORATIVE DEVICES

RELATED APPLICATIONS

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[0001] The present invention claims the benefit, under 35 USC § 119(e), of the filings of U.S. Provisional Patent Application Serial Number 61/529,735, entitled “ABSORBENT POLYMER DRESSINGS, SYSTEMS, AND METHODS EMPLOYING EVAPORATIVE DEVICES,” filed 31 August 2011, which is incorporated herein by reference for all purposes; 10 U.S. Provisional Patent Application Serial Number 61/529,722, entitled “REDUCED-PRESSURE DRESSINGS, SYSTEMS, AND METHODS WITH EVAPORATIVE DEVICES,” filed on 31 August 2011, which is incorporated herein by reference for all purposes; U.S. Provisional Patent Application Serial Number 61/529,709, entitled “EVAPORATIVE FLUID POUCH AND SYSTEMS FOR USE WITH BODY FLUIDS,” 15 filed 31 August 2011, which is incorporated herein by reference for all purposes; U.S. Provisional Patent Application Serial Number 61/529,751, entitled “REDUCED-PRESSURE INTERFACES, SYSTEMS, AND METHODS EMPLOYING A COANDA DEVICE,” filed on 31 August 2011, which is incorporated herein by reference for all purposes; and U.S. Patent Application Serial No. 13/084,813, entitled “DRESSINGS AND METHODS FOR 20 TREATING A TISSUE SITE ON A PATIENT,” filed on 12 April 2011, which is incorporated herein by reference for all purposes.

FIELD

[0002] The present disclosure relates generally to medical treatment systems, and more particularly, but not by way of limitation, to absorbent polymer dressings, systems, and 25 methods employing evaporative devices.

BACKGROUND

[0003] Managing fluids from a wound is given considerable attention in caring for many wounds. Some wounds, such as burns and grafts, require particular conditions to maximize healing. Efforts to present the right moisture balance for these types of wounds has 30 proven difficult.

SUMMARY

[0004] According to an illustrative embodiment, a wound treatment system involves treating a wound, such as a burn wound, with an absorbent polymer that helps maintain a desired moisture level and also involves an evaporative subsystem that removes excess liquid from the absorbent polymer.

[0005] According another illustrative embodiment, a wound treatment system for treating a wound on a patient includes an absorbent polymer having a first side and a second, patient-facing side. The second, patient-facing side of the absorbent polymer is for disposing proximate to the wound. The wound treatment system further includes a first sealing member for covering the first side of the absorbent polymer and a portion of intact skin to form a sealed space in which the absorbent polymer is disposed. The first sealing member comprises a high-moisture-vapor-transfer-rate member. The wound treatment system also includes an air-movement manifold disposed on the first sealing member, a second sealing member covering the air-movement manifold to form a channel space, and at least one port formed on the second sealing member for allowing the ingress or egress of air. The wound treatment system further includes a pressure source fluidly coupled to the air-movement manifold for producing an airflow in the air-movement manifold, a saturation sensor in communication with the absorbent polymer, and a controller operatively coupled to the pressure source for controlling the pressure source and operatively coupled to the saturation sensor. The controller and saturation sensor are operative to activate the pressure source to deliver air to the air-movement manifold when the absorbent polymer is saturated.

[0006] According to another illustrative embodiment, a method of treating a tissue site includes disposing an absorbent polymer proximate to the tissue site and covering the absorbent polymer and a portion of intact skin with a first sealing member to form a sealed space in which the absorbent polymer is disposed. The first sealing member comprises a high-moisture-vapor-transfer-rate member. The method also includes disposing an air-movement manifold on the first sealing member and covering the air-movement manifold with a second sealing member to form a channel space. The second sealing member has at least one port for allowing the ingress or egress of air. The method further includes fluidly coupling a pressure source to the air-movement manifold and activating the pressure source when the absorbent polymer is saturated to produce airflow in the air-movement manifold to create an enhanced humidity gradient across the first sealing member to facilitate liquid removal from the

absorbent polymer. The step of activating the pressure source when the absorbent polymer is saturated may include disposing a saturation sensor at a location to measure the saturation of the absorbent polymer and operatively coupling a controller to the pressure source for controlling the pressure source and operatively coupling the controller to the saturation sensor.

- 5 The controller is configured to monitor the saturation sensor and once detecting a threshold saturation to activate the pressure source.

[0007] According to another illustrative embodiment, a wound treatment system for treating a wound on a patient includes an absorbent polymer having a first side and a second, patient-facing side. The second, patient-facing side of the absorbent polymer is for disposing proximate to the wound. The wound treatment system further includes a wicking member having a first side and a second, patient-facing side. The second, patient-facing side of the wicking member is disposed proximate to the first side of the absorbent polymer. The wicking member is less hydrophilic than the absorbent polymer. The wound treatment system also includes a first sealing member for covering the first side of the wicking member and a portion of intact skin to form a sealed space in which the absorbent polymer and wicking member are disposed. The first sealing member comprises a high-moisture-vapor-transfer-rate member. The wound treatment system further includes an air-movement manifold disposed on the first sealing member, a second sealing member covering the air-movement manifold to form a channel space, and at least one port formed on the second sealing member for allowing the ingress or egress of air. The wound treatment system further includes a pressure source fluidly coupled to the air-movement manifold for producing an airflow in the air-movement manifold.

[0008] According to another illustrative embodiment, a method of treating a tissue site includes disposing an absorbent polymer proximate to the tissue site and disposing a wicking member on the absorbent polymer. The wicking member is less hydrophilic than the absorbent polymer. The method further includes covering the absorbent polymer, wicking member, and a portion of intact skin with a first sealing member to form a sealed space in which the absorbent polymer and wicking member are disposed. The first sealing member comprises a high-moisture-vapor-transfer-rate member. The method also includes disposing an air-movement manifold on the first sealing member and covering the air-movement manifold with a second sealing member to form a channel space. The second sealing member has at least one port for allowing the ingress or egress of air. The method also includes fluidly coupling a pressure source to the air-movement manifold and activating the pressure source to delivering air into the air-movement manifold.

[0009] According to another illustrative embodiment, a method of manufacturing a wound treatment system for treating a wound on a patient includes forming an absorbent polymer having a first side and a second, patient-facing side. The second, patient-facing side of the absorbent polymer is for disposing proximate to the wound. The method also includes forming a wicking member having a first side and a second, patient-facing side. The second, patient-facing side of the wicking member is disposed proximate to the first side of the absorbent polymer. The wicking member is formed to be less hydrophilic than the absorbent polymer. The method further includes providing a first sealing member. The first sealing member comprises a high-moisture-vapor-transfer-rate member. The methods also involve covering the first side of the wicking member with the first sealing member, providing an air-movement manifold, and disposing the air-movement manifold on the first sealing member over the wicking member, providing a second sealing member, and covering the air-movement manifold with the second sealing member to form a channel space. The method further includes forming at least one port formed on the second sealing member for allowing the ingress or egress of air and fluidly coupling a pressure source to the air-movement manifold for producing an airflow in the air-movement manifold.

[0010] Other aspects, features, and advantages of the illustrative embodiments will become apparent with reference to the drawings and detailed description that follow.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] FIGURE 1 is a schematic cross section of an illustrative embodiment of a wound treatment system for treating a wound on a patient;

[0012] FIGURE 2 is a schematic, plan view of the wound treatment system of
5 FIGURE 1;

[0013] FIGURE 3 is a schematic diagram of a wound treatment system for treating a wound on a patient; and

[0014] FIGURE 4 is a schematic cross section of an illustrative embodiment of a wound treatment system for treating a wound on a patient.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0015] In the following detailed description of the illustrative, non-limiting embodiments, reference is made to the accompanying drawings that form a part hereof. These embodiments are described in sufficient detail to enable those skilled in the art to practice the invention, and it is understood that other embodiments may be utilized and that logical structural, mechanical, electrical, and chemical changes may be made without departing from the spirit or scope of the invention. To avoid detail not necessary to enable those skilled in the art to practice the embodiments described herein, the description may omit certain information known to those skilled in the art. The following detailed description is not to be taken in a limiting sense, and the scope of the illustrative embodiments are defined only by the appended claims.

[0016] Referring now to the drawings and primarily to FIGURE 1, an illustrative embodiment of a wound treatment system 100 for treating a wound 102 on a patient 104 is presented. The wound treatment system 100 is particularly well suited for treating wounds that are sensitive to fluid, such as burns and grafts. For illustration purposes, the wound 102 is shown at the epithelialization stage of healing having already formed granulation tissue 106. The wound treatment system 100 maintains the desired moisture on the granulation tissue 106, presents a smooth surface, and efficiently processes the liquids produced by the wound 102.

[0017] The wound treatment system 100 includes an absorbent polymer 108 having a first side 110 and a second, patient-facing side 112. The second, patient-facing side 112 of the absorbent polymer 108 is for disposing proximate to the wound 102. The absorbent polymer 108 may be a hydrogel, hydrocolloid, small-celled hydrophilic foam, or other absorbent polymer. The absorbent polymer 108 may be selected for its absorbent quality and for its ability to bio-mimic. The absorbent polymer 108 may overlap the wound edge 109.

[0018] A first sealing member 114 covers the first side 110 of the absorbent polymer 108 and typically a portion of intact skin 116. The first sealing member 114 alone or with the second sealing member 132 form a sealed space 118. The absorbent polymer 108 is disposed in the sealed space 118. At least a portion of the first sealing member 114 may be releasably attached to the intact skin 116 by an attachment device 120, e.g., a medically acceptable, pressure-sensitive adhesive that extends about a periphery, a portion, or the entire first sealing member 114; a double-sided drape tape; paste; hydrocolloid; hydrogel; or other sealing

devices or elements. The first sealing member 122 has a first side and a second, patient-facing side 124.

[0019] The first sealing member 114 comprises a high-moisture-vapor-transfer-rate member. The "Moisture Vapor Transmission Rate" or "MVTR" represents the amount of moisture that can pass through a material in a given period of time. The high-moisture-vapor-transfer-rate member allows vapor to egress from the sealed space 118 but not liquids. The high-moisture-vapor-transfer-rate member may comprise any of numerous materials, such as any of the following: hydrophilic polyurethane, cellulose including cellulose esters, hydrophilic polyamides, , hydrophilic acrylics, hydrophilic silicone polymers, polyvinyl alcohol and copolymers with polyvinyl acetate. As one specific, illustrative, non-limiting embodiment, the high-moisture-vapor-transfer-rate member may be formed from a breathable cast matt polyurethane film sold under the name INSPIRE 2301 from Expopack Advanced Coatings of Wrexham, United Kingdom. This illustrative film has a MVTR (inverted cup technique) of 14500 - 14600 g/m²/24 hours. See www.exopackadvancedcoatings.com. The first sealing member 114, which is the high-moisture-vapor-transfer-rate member, may have various thicknesses, such as 10 to 40 microns (μm), e.g., 15, 20, 25, 30, 35, 40 microns or any number in the stated range.

[0020] An air-movement manifold 126 disposed on the first side 122 of the first sealing member 114. The air-movement manifold 126 has a first side 128 and a second, patient-facing side 130. The air-movement manifold 126 provides open pathways for airflow even when under compression developed by the wound treatment system 100. The air-movement manifold 126 may be any substance that carries out these functions. The air-movement manifold 126 may be, for example, one or more of the following: open cell foam, non-wovens such as Libeltex TDL2, woven fabrics including 3D or spacer fabrics (Baltex, Ilkeston, Derby, UK), or other suitable material.

[0021] A second sealing member 132 covers the air-movement manifold 126 and forms a channel space 134 in which the air-movement manifold 126 is disposed. The second sealing member 132 may be formed from the same materials as the first sealing member 114 or may be formed from other materials that adequately control air transmission. The second sealing member 132 has at least one port 136 formed on the second sealing member 132 for allowing the ingress or egress of air. More typically, a plurality of ports 136 are formed on the second sealing member 132. The ports 136 may be covered with a bacteria filter. An aperture 138 is formed through the second sealing member 132 to allow the ingress or egress of fluid.

[0022] The first sealing member 114 may be adhered to the intact skin 116 by an attachment device 120, e.g., an adhesive, and to the first side 110 of the absorbent polymer 108 and intact skin 116. The performance of the first sealing member 114 with respect to MVTR may be enhanced by only covering a limited surface area of the second, patient-facing side 124 of the first sealing member 114 with the attachment device 120. For example, only the peripheral edge of the first sealing member 114 may be covered or a limited pattern may be used. In the latter situation, according to one illustrative embodiment, only 30 to 60 percent of the surface area is covered with the attachment device 120. The limited coverage by the attachment device 120 on the second, patient-facing side 124 may be accomplished by applying the attachment device 120 in a pattern, e.g., grid, spaced dots, swirls, or other patterns. In another embodiment, the first sealing member 114 may be coupled by welding (e.g., ultrasonic or RF welding), bonding, stitching, staples, or another coupling device to the first side 110 of the absorbent polymer 108. The attachment device 120 may be applied only to a peripheral portion of the first sealing member 114.

[0023] An attachment device (not explicitly shown) may be used to couple the sealing member 132 to the first side 128 of the air-movement manifold 126 or first side 122 of the first sealing member 114. Analogous comments to those in the previous paragraph related to the first sealing member 114 apply for coupling the second sealing member 132 to the first side 128 of the air-movement manifold 126 or first side 122 of the first sealing member 114. In other embodiments, an attachment device may be disposed only on the peripheral edge of the second sealing member 132 or another coupling technique used.

[0024] A pressure source 140 or air mover is fluidly coupled to the air-movement manifold 126 for producing an airflow in the air-movement manifold 126. The pressure source 140 may be from a remote source delivered by a conduit (not shown) or a micro-pump 141 as shown. The pressure source 140 may be any device for supplying a reduced pressure or positive pressure, such as a vacuum pump, wall suction, micro-pump, Coanda device, or other source. For example, the pressure source 140 may be a piezoelectric micro-pump, such as the one shown in United States Patent Publication 2009/0240185 (application 12/398,904; filed 5 March 2009), entitled, "Dressing and Method for Applying Reduced Pressure To and Collecting And Storing Fluid from a Tissue Site," which is incorporated herein for all purposes. The pressure source 140 may be configured to pull air from the aperture 138 or push air into the aperture 138. If the pressure source 140 provides reduced pressure, air will be pulled through the ports 136 and into the air-movement manifold 126 and ultimately to the

pressure source 140. If the pressure source 140 provides positive pressure, air will be pushed into the aperture 138, through the air-movement manifold 126 and out of the ports 136.

[0025] A saturation sensor 142 is in operative communication with the absorbent polymer 108 and is typically on a portion of the absorbent polymer 108 as shown. The saturation sensor 142 is operatively coupled to a controller 144. The saturation sensor 142 may be any device that allows for monitoring of the saturation of the absorbent polymer 108. For example, without limitation, the saturation sensor 142 may be a resistive element that changes resistance when liquid covers the sensor, a galvanic cell that creates a voltage when covered with liquid from a wound or delivered from an instillation device, or a capacitance sensor that changes properties when liquids are nearby.

[0026] The controller 144 is operatively coupled to the pressure source 140 for controlling the pressure source 140 and operatively coupled to the saturation sensor 142. The controller 144 and saturation sensor 142 are operative to activate the pressure source 140 to deliver air to the air-movement manifold 126 when the absorbent polymer 108 is saturated. Saturated typically implies wet beyond a threshold or designed amount. The controller 144 and saturation sensor 142 are further operative to deactivate the pressure source 140 to cease delivery of air to the air-movement manifold 126 when the absorbent polymer 108 is no longer saturated.

[0027] In operation, according to one illustrative embodiment, the absorbent polymer 108 is disposed proximate to the wound 102 or tissue site. The absorbent polymer 108 and a portion of intact skin 116 are covered with the first sealing member 114 to form the sealed space 118 in which the absorbent polymer 108 is disposed. The air-movement manifold 126 is disposed on the first side 122 of the first sealing member 114. The air-movement manifold 126 is covered with the second sealing member 132 to form the channel space 134. The pressure source 140 is fluidly coupled to the air-movement manifold 126 through aperture 138. The pressure source 140 is activated to create an airflow in the air-movement manifold 126 to create a strong or enhanced relative humidity gradient across the first sealing member 114 that helps remove liquid or moisture from the absorbent polymer 108.

[0028] In this embodiment, the pressure source 140 is not activated until the absorbent polymer 108 is saturated as determined by the saturation sensor 142 and controller 144. Likewise, the saturation sensor 142 and controller 144 may be configured to determine when the absorbent polymer 108 is no longer saturated and in response to deactivate the pressure

source 140. This active control keeps the absorbent polymer 108 at a balanced moisture equilibrium.

[0029] It should be noted that while the pressure source 140 and aperture 138 are shown in a central portion of the second sealing member 132, the pressure source 140 may be located at any location on the second sealing member 132. Typically, it will be desirable to maximize the distance between the pressure source 140 and the one or more ports 136.

[0030] Referring now primarily to FIGURE 3, the operation of aspects of wound treatment system 100 will be further explained. The absorbent polymer 108, e.g., a hydrogel, is disposed proximate to the tissue or wound 102. Exudate or other fluids are given off as suggested by arrow 146 and are absorbed by the absorbent polymer 108. As the absorbent polymer 108 exceeds its designed moisture equilibrium, moisture is given off as suggested by arrow 148. The moisture is transmitted or diffused through first sealing member 114, or membrane, as suggested by arrow 149. Air moving (assuming the air mover or pressure source 140 is activated) in the air-movement manifold 126 carries off the moisture that is against the first sealing member 114. The moisture is transported out of the system 110 as suggested by arrows 150. The second sealing member 132 helps direct air from the pressure source 140 and in some embodiments may allow the egress of moisture as well directly across the second sealing member 132.

[0031] Referring now primarily to FIGURE 4, another illustrative embodiment of a wound treatment system 100 for treating a wound 102 on a patient 104 is presented. The wound treatment system 100 is analogous in many respects to the wound treatment system 100 of FIGURE 1, and accordingly, some parts are labeled but not further discussed. The wound treatment system 100 of FIGURE 4 differs primarily in that the embodiment does not have active control components (e.g., controller 144 and saturation sensor 142), but nonetheless regulates the moisture of the absorbent polymer 108. In addition, this embodiment includes a wicking member 152.

[0032] The wicking member 152 has a first side 154 and a second, patient-facing side 156. The second, patient-facing side 156 of the wicking member 152 is disposed proximate to the first side 110 of the absorbent polymer 108. The wicking member 152 may comprise one or more of the following: non woven such as Libeltex TDL2, or a woven fabric, or a hydrophilic porous member, such as an open celled foam. The wicking member 152 is less hydrophilic than the absorbent polymer 108. The wicking member 152 may be treated to increase or decrease the hydrophilicity of the wicking member 152 relative to the absorbent

polymer 108. Treatments may include plasma, corona, coating or other methods of modifying the properties of the wicking member 152. Plasma and corona can be used to add polar groups (oxidation) to the surface to increase hydrophilicity. Furthermore, plasma treatments may incorporate active gases that are chemically bound to the treated surface, for example binding
5 a hydrophilic polymer to the treated surface.

[0033] The first sealing member 114 covers the first side 154 of the wicking member 152 and alone or with the second sealing member 132 forms a sealed space 118 in which the absorbent polymer 108 and wicking member 152 are disposed. As in the previous embodiments, the first sealing member 114 comprises a high-moisture-vapor-transfer-rate
10 member.

[0034] The pressure source 140 may be activated continuously or intermittently. In addition, in another illustrative embodiment, the active control components of FIGURE 3 may also be applied to the wound treatment system 100 of FIGURE 4 and the pressure source 140 actively controlled.

[0035] In operation according to one embodiment, the system 100 is deployed in a manner analogous to the system 100 of FIGURES 1-2. The wound 102 exudes into the absorbent polymer 108. The absorbent polymer 108 absorbs the exudate, which includes liquids, and will eventually saturate the absorbent polymer 108. As the absorbent polymer 108 becomes saturated, the absorbent polymer 108 will begin to transfer liquid to the wicking
20 member 152, which has been selected or created to be less hydrophilic than the absorbent polymer 108. As such, the wicking member 152 will only take the liquids that the absorbent polymer 108 cannot incorporate. Once the wicking member 152 is also saturated, the fluid will begin to diffuse through the first sealing member 114 where the water molecules will be collected on the boundary layer of the first sealing member 114 and on the air-movement
25 manifold 126. The fluid will be evaporated at a rate linked to the surface area of the first sealing member 114. The evaporation rate may be on the order of 3-4 ml/hour. When the fluid balance of the absorbent polymer 108 has been adequately reduced, there will no longer be a transfer of fluids to the wicking member 152.

[0036] In other words, the diffusion through the first sealing member 114 will slow
30 until the available fluids on the wicking member 152 have reached a balance with the fluids on the boundary layer of the first sealing member 114, i.e., the wicking member 152 is adequately dry. At this time, due to the fact that the absorbent polymer 108 is more hydrophilic than the wicking member 152, the remaining fluids at the correct balance level will be retained by the

absorbent polymer 108 and not transported to the wicking member 152 unless the wound 102 once more produces more than the absorbent polymer 108 can absorb, in which case the transport process will start again.

5 **[0037]** With all the embodiments herein that involve active control, additives may be added to the absorbent polymer 108 such that the saturation sensor 142 may more easily detect saturation. For example, without limitation, a salt may be added to the absorbent polymer 108 that will assist with detection of changes in the electrical properties of the saturation sensor 142. In addition, the absorbent polymer 108 may be formulated with additives that act as humectants, such as glycerine and polyethylene glycols, which will not permit the absorbent
10 polymer 108 to fully dry out.

[0038] While the wound treatment systems 100 are presented in the context of wounds 102, it should be understood that the liquid processing presented herein may also be used with other body fluids. For example, the wound treatment systems 100 may be used with urine.

[0039] The embodiments herein offer a number of perceived advantages. A few
15 examples follows. The wound treatment systems 100 may be readily used with low severity, high liquid wounds. In addition, the wound treatment systems 100 allow more liquid to be processed than would otherwise be possible. At the same time, the wound treatment system 100 will not dry out the absorbent polymer 108. The wound treatment system 100 may be able to stay in place longer than other dressing and thereby require fewer changes.

20 **[0040]** Although the present invention and its advantages have been disclosed in the context of certain illustrative, non-limiting embodiments, it should be understood that various changes, substitutions, permutations, and alterations can be made without departing from the scope of the invention as defined by the appended claims. It will be appreciated that any feature that is described in connection to any one embodiment may also be applicable to any
25 other embodiment.

[0041] It will be understood that the benefits and advantages described above may relate to one embodiment or may relate to several embodiments. It will further be understood that reference to “an” item refers to one or more of those items.

[0042] The steps of the methods described herein may be carried out in any suitable
30 order, or simultaneously where appropriate.

[0043] Where appropriate, aspects of any of the embodiments described above may be combined with aspects of any of the other embodiments described to form further examples having comparable or different properties and addressing the same or different problems.

[0044] It will be understood that the above description of preferred embodiments is given by way of example only and that various modifications may be made by those skilled in the art. The above specification, examples and data provide a complete description of the structure and use of exemplary embodiments of the invention. Although various embodiments of the invention have been described above with a certain degree of particularity, or with reference to one or more individual embodiments, those skilled in the art could make numerous alterations to the disclosed embodiments without departing from the scope of the claims.

CLAIMS

We claim:

1. A wound treatment system for treating a wound on a patient, the wound treatment system comprising:
 - 5 an absorbent polymer having a first side and a second, patient-facing side, wherein the second, patient-facing side of the absorbent polymer is for disposing proximate to the wound;
 - a first sealing member for covering the first side of the absorbent polymer and a portion of intact skin to form a sealed space in which the absorbent polymer
 - 10 is disposed, wherein the first sealing member comprises a high-moisture-vapor-transfer-rate member;
 - an air-movement manifold disposed on the first sealing member;
 - a second sealing member covering the air-movement manifold to form a channel space;
 - 15 at least one port formed on the second sealing member for allowing the ingress or egress of air;
 - a pressure source fluidly coupled to the air-movement manifold for producing an airflow in the air-movement manifold;
 - a saturation sensor in communication with the absorbent polymer;
 - 20 a controller operatively coupled to the pressure source for controlling the pressure source and operatively coupled to the saturation sensor; and
 - wherein the controller and saturation sensor are operative to activate the pressure source to deliver air to the air-movement manifold when the absorbent polymer is saturated.
- 25 2. The wound treatment system of claim 1, wherein the controller and saturation sensor are further operative to deactivate the pressure source to cease delivery of air to the air-movement manifold when the absorbent polymer is no longer saturated.

3. The wound treatment system of claim 1, wherein the absorbent polymer comprises a material selected from hydrogel and a hydrocolloid.
4. The wound treatment system of claim 1, wherein the saturation sensor comprises one or more resistive members that are monitoring for change in resistance.
- 5 5. The wound treatment system of claim 1, wherein the saturation sensor comprises a galvanic cell.
6. The wound treatment system of claim 1, wherein the pressure source comprises a micro-pump coupled to the second sealing member.
7. The wound treatment system of claim 1, wherein the pressure source comprises a Coanda
10 device coupled to the second sealing member and fluidly coupled to a pressure conduit.
8. A wound treatment system for treating a wound on a patient, the wound treatment system comprising:
 - an absorbent polymer having a first side and a second, patient-facing side, wherein
the second, patient-facing side of the absorbent polymer is for disposing
15 proximate to the wound;
 - a wicking member having a first side and a second, patient-facing side, wherein the
second, patient-facing side of the wicking member is disposed proximate to
the first side of the absorbent polymer, wherein the wicking member is less
hydrophilic than the absorbent polymer;
 - 20 a first sealing member for covering the first side of the wicking member and a
portion of intact skin to form a sealed space in which the absorbent polymer
and wicking member are disposed, wherein the first sealing member
comprises a high-moisture-vapor-transfer-rate member;
 - an air-movement manifold disposed on the first sealing member;
 - 25 a second sealing member covering the air-movement manifold to form a channel
space;
 - at least one port formed on the second sealing member for allowing the ingress or
egress of air; and
 - a pressure source fluidly coupled to the air-movement manifold for producing an
30 airflow in the air-movement manifold.

9. The wound treatment system of claim 8, wherein the absorbent polymer comprises a material from selected from hydrogel and a hydrocolloid.
10. The wound treatment system of claim 8, further comprising:
a saturation sensor in communication with the absorbent polymer;
5 a controller operatively coupled to the pressure source for controlling the pressure source and operatively coupled to the saturation sensor; and
wherein the controller and saturation sensor are operative to activate the pressure source to deliver air to the air-movement manifold when the absorbent polymer is saturated.
- 10 11. A method of manufacturing a wound treatment system for treating a wound on a patient, the method comprising:
forming an absorbent polymer having a first side and a second, patient-facing side, wherein the second, patient-facing side of the absorbent polymer is for disposing proximate to the wound;
15 forming a wicking member having a first side and a second, patient-facing side, wherein the second, patient-facing side of the wicking member is disposed proximate to the first side of the absorbent polymer, wherein the wicking member is formed to be less hydrophilic than the absorbent polymer;
providing a first sealing member, wherein the first sealing member comprises a
20 high-moisture-vapor-transfer-rate member;
covering the first side of the wicking member with the first sealing member;
providing an air-movement manifold;
disposing the air-movement manifold on the first sealing member over the wicking member;
25 providing a second sealing member;
covering the air-movement manifold with the second sealing member to form a channel space;
forming at least one port formed on the second sealing member for allowing the ingress or egress of air; and
30 fluidly coupling a pressure source to the air-movement manifold for producing an airflow in the air-movement manifold.

12. The method of claim 11, wherein the step of forming a wicking member comprises

providing a wicking member and treating the wicking member to adjust the hydrophilicity to be less than the hydrophilicity of the absorbent polymer.

13. The method of claim 12, wherein the step of treating the wicking member comprises treating the wicking member with a plasma treatment.

5 14. The method of claim 12, wherein the step of treating the wicking member comprises treating the wicking member with a corona treatment.

15. A method of treating a tissue site, the method comprising:

disposing an absorbent polymer proximate to the tissue site;

10 covering the absorbent polymer and a portion of intact skin with a first sealing member to form a sealed space in which the absorbent polymer is disposed, wherein the first sealing member comprises a high-moisture-vapor-transfer-rate member;

disposing an air-movement manifold on the first sealing member;

15 covering the air-movement manifold with a second sealing member to form a channel space, wherein the second sealing member has at least one port for allowing the ingress or egress of air;

fluidly coupling a pressure source to the air-movement manifold; and

20 activating the pressure source when the absorbent polymer is saturated to produce airflow in the air-movement manifold to create an enhanced humidity gradient across the first sealing member to facilitate liquid removal from the absorbent polymer.

16. The method of claim 15, wherein the step of activating the pressure source when the absorbent polymer is saturated comprises:

25 disposing a saturation sensor at a location to measure the saturation of the absorbent polymer;

operatively coupling a controller to the pressure source for controlling the pressure source and operatively coupling the controller to the saturation sensor; and

wherein the controller is configured to monitor the saturation sensor and once detecting a threshold saturation to activate the pressure source.

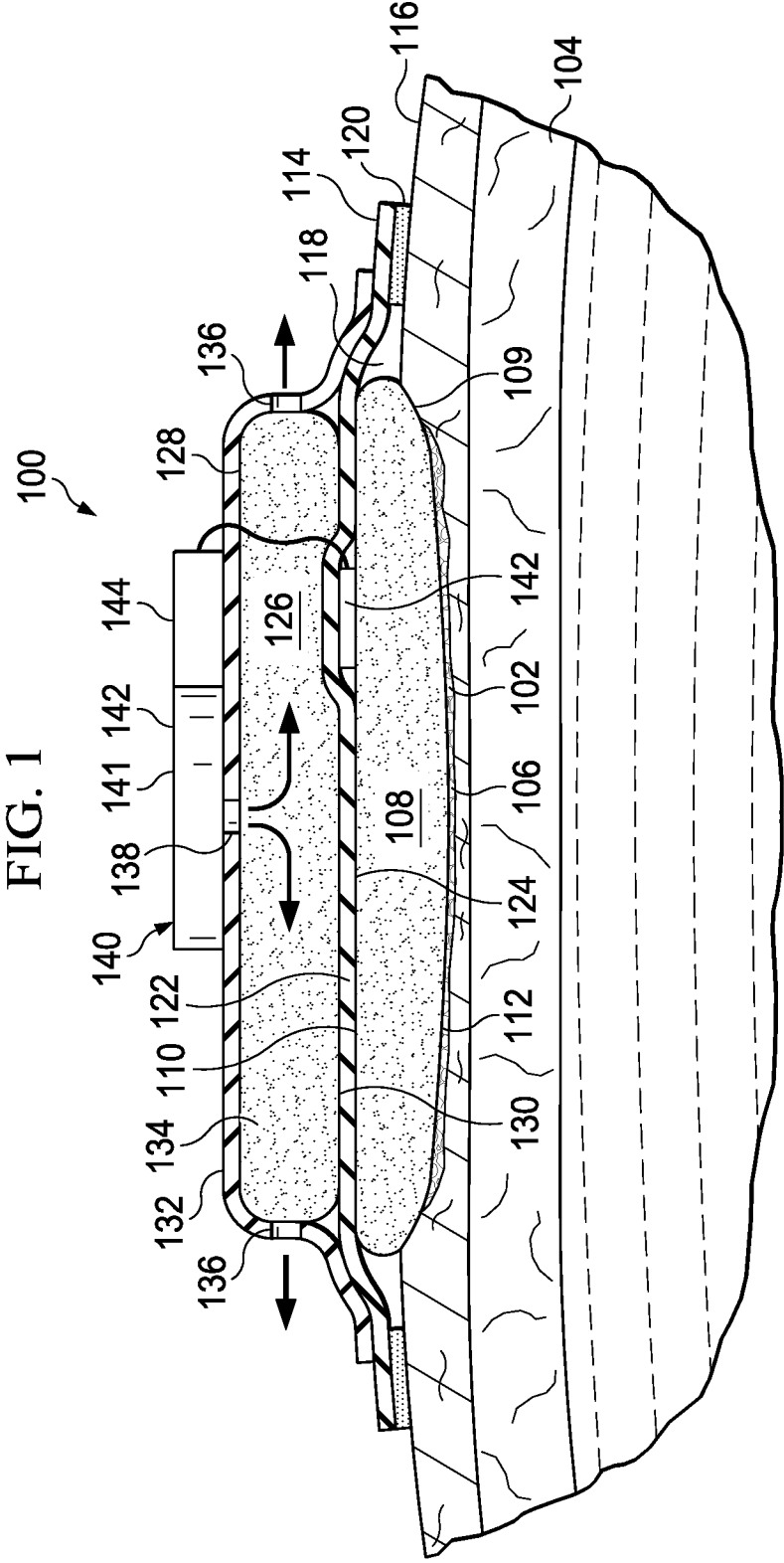
30 17. The method of claim 15, further comprising deactivating the pressure source when the

absorbent polymer is no longer saturated.

18. The method of claim 17, wherein the step of deactivating the pressure source comprises monitoring the saturation sensor with the controller and upon sensing saturation below a threshold level deactivating the pressure source.
- 5 19. The method of claim 15, wherein the absorbent polymer comprises a material from selected from hydrogel and a hydrocolloid.
20. The method of claim 15, wherein the saturation sensor comprises one ore more resistive members that are monitoring for change in resistance.
21. The wound treatment system of claim 15, wherein the saturation sensor comprises a
10 galvanic cell.
22. The method of claim 15, wherein the pressure source comprises a micro-pump coupled to the second sealing member.
23. The method of claim 15, wherein the pressure source comprises a Coanda device coupled to the second sealing member and fluidly coupled to a pressure conduit.
- 15 24. A method of treating a tissue site, the method comprising:
 - disposing an absorbent polymer proximate to the tissue site;
 - disposing a wicking member on the absorbent polymer, wherein the wicking
member is less hydrophilic than the absorbent polymer;
 - covering the absorbent polymer, wicking member, and a portion of intact skin with
20 a first sealing member to form a sealed space in which the absorbent
polymer and wicking member are disposed, wherein the first sealing
member comprises a high-moisture-vapor-transfer-rate member;
 - disposing an air-movement manifold on the first sealing member;
 - covering the air-movement manifold with a second sealing member to form a
25 channel space, wherein the second sealing member has at least one port for
allowing the ingress or egress of air;
 - fluidly coupling a pressure source to the air-movement manifold;
 - activating the pressure source to delivering air into the air-movement manifold.
25. The method of claim 24, further comprising: activating the pressure source when the

absorbent polymer is saturated to produce airflow in the air-movement manifold to create an enhanced humidity gradient across the first sealing member to facilitate liquid removal from the absorbent polymer.

26. The method of claim 25, wherein the step of activating the pressure source when the
5 absorbent polymer is saturated comprises:
disposing a saturation sensor at a location to measure the saturation of the absorbent
polymer;
operatively coupling a controller to the pressure source for controlling the pressure
source and operatively coupling the controller to the saturation sensor; and
10 wherein the controller is configured to monitor the saturation sensor and once
detecting a threshold saturation to activate the pressure source.
27. The method of claim 25, further comprising deactivating the pressure source when the
absorbent polymer is no longer saturated.
28. The method of claim 27, wherein the step of deactivating the pressure source comprises
15 monitoring the saturation sensor with the controller and upon sensing saturation below a
threshold level deactivating the pressure source.



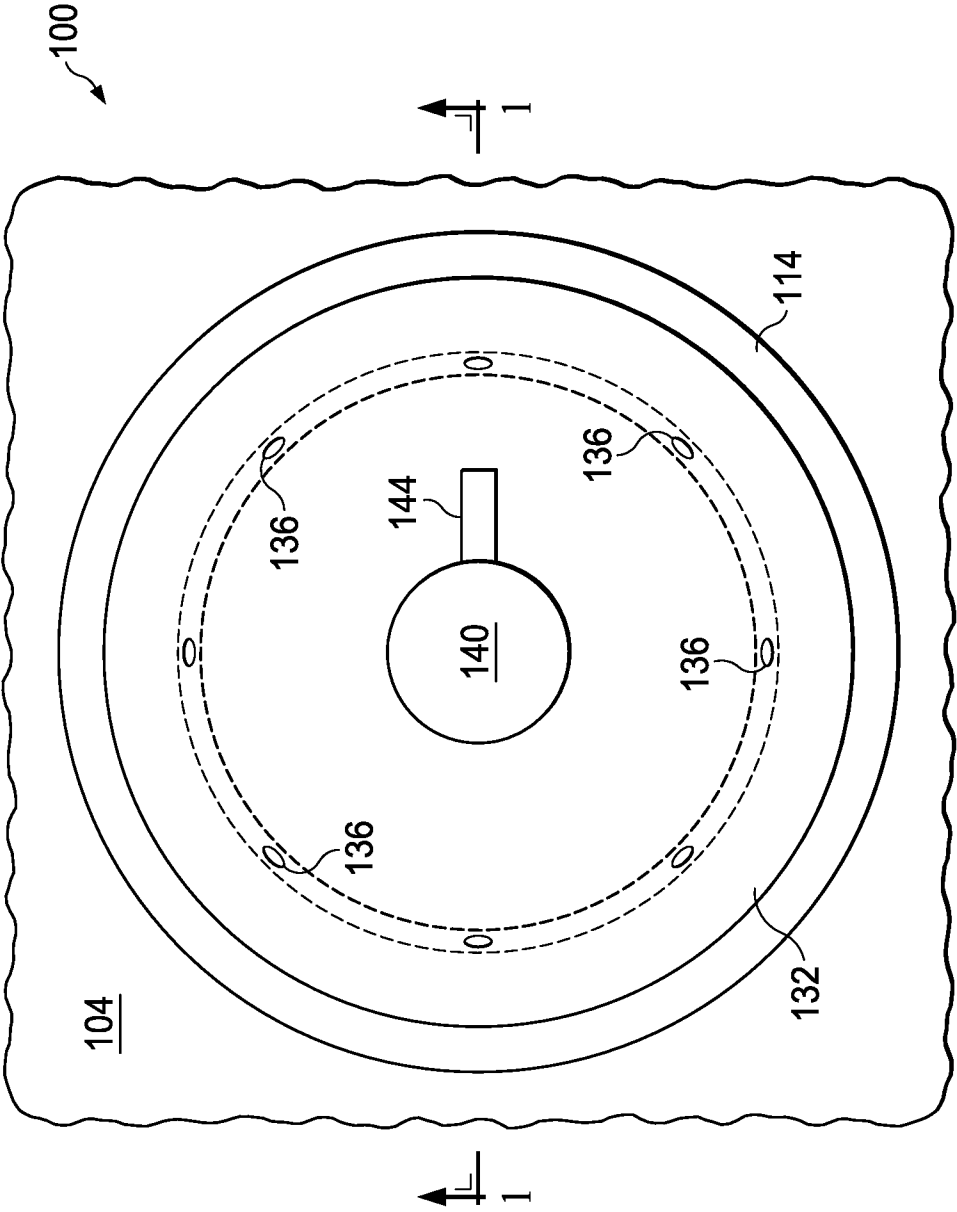


FIG. 2

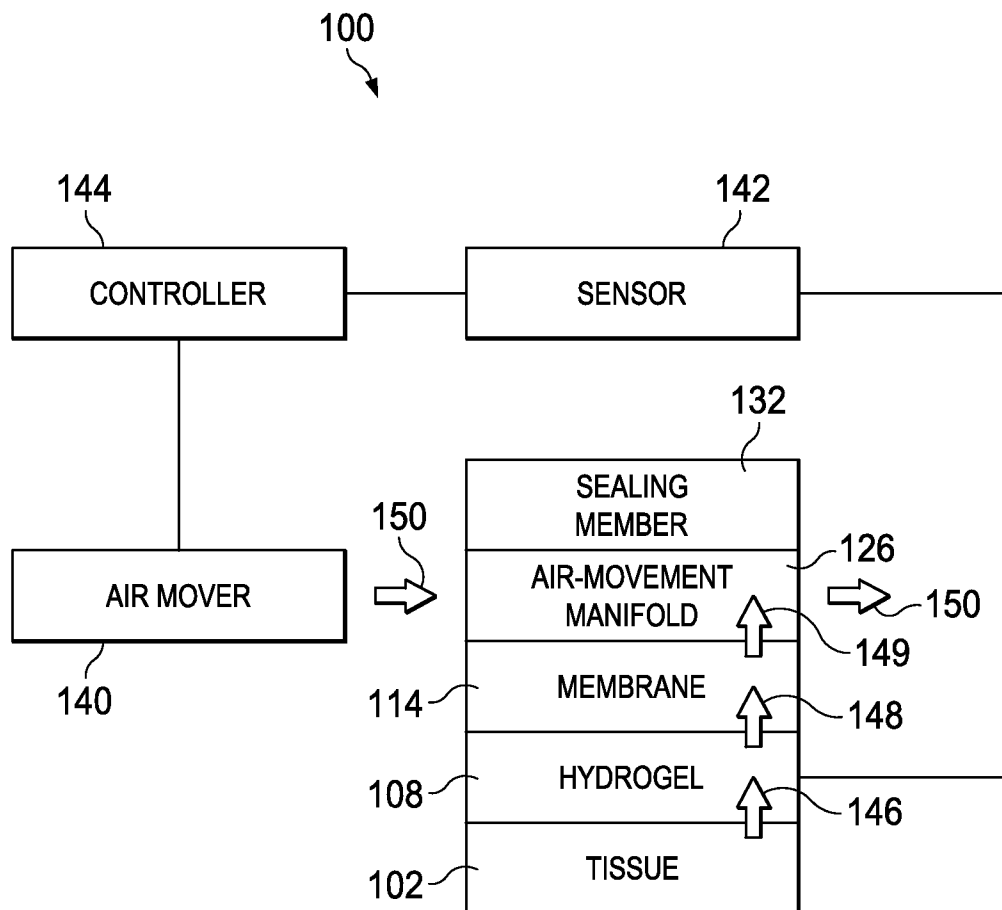
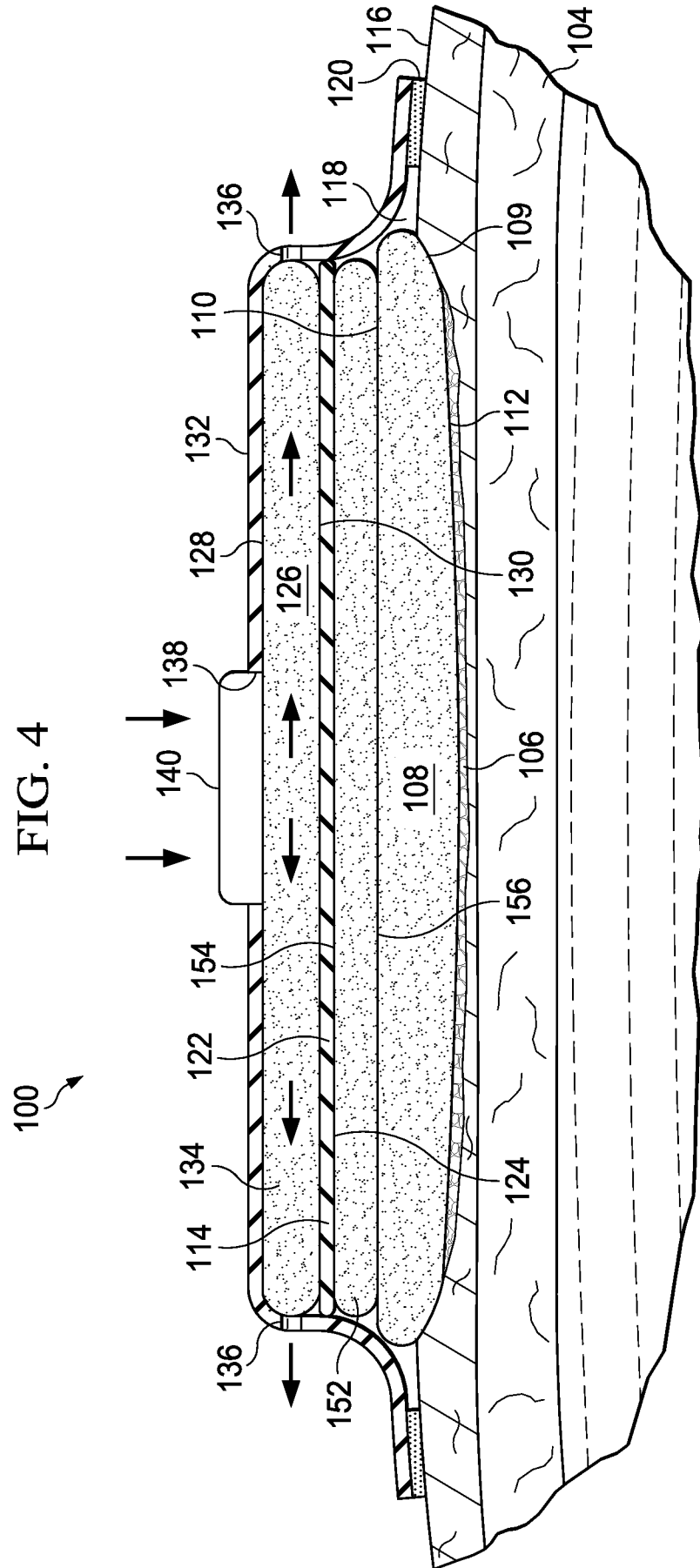


FIG. 3

FIG. 4



INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/032789

A. CLASSIFICATION OF SUBJECT MATTER

INV. A61F13/02 A61M1/00 A61M27/00 A61F13/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61F A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

19 September 2012

Date of mailing of the international search report

01/10/2012

Name and mailing address of the ISA/

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Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/032789

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: **15-28**
because they relate to subject matter not required to be searched by this Authority, namely:
A meaningful search is not possible on the basis of all claims because claims 15-28 are directed to Rule 39.1(iv) PCT - Method for treatment of the human or animal body by therapy.
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of Item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/032789

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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