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CUSTOMIZABLE DRESSING WITH INTEGRATED BRIDGE

Abstract

A dressing for treating a tissue site with negative pressure may comprise a manifold layer having a first surface configured to face the tissue site, a second surface opposite the first surface, and a thickness extending between the first surface and the second surface. The manifold layer may comprise a tissue portion and a bridge portion. The bridge portion may be coupled to the tissue portion and may comprise a distal end configured to be extended away from the tissue portion. The dressing may also comprise a flexible drape configured to form a sealed space including the manifold layer at the tissue site.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS [0001] This application is a continuation of U.S. application Ser. No. 18/033,036, filed Apr. 20, 2023, which is a U.S. National Stage Entry of International Application No. PCT/IB 2021/058702, filed Sep. 23, 2021, which claims the benefit of priority to U.S. Provisional Application No. 63/094,778, filed on Oct. 21, 2020, each of which are incorporated herein by reference in their entirety.

TECHNICAL FIELD

[0002] The invention set forth in the appended claims relates generally to tissue treatment systems and more particularly, but without limitation, to dressings for tissue treatment with negative pressure and methods of using the dressings for tissue treatment with negative pressure.

BACKGROUND

[0003] Clinical studies and practice have shown that reducing pressure in proximity to a tissue site can augment and accelerate growth of new tissue at the tissue site. The applications of this phenomenon are numerous, but it has proven particularly advantageous for treating wounds. Regardless of the etiology of a wound, whether trauma, surgery, or another cause, proper care of the wound is important to the outcome. Treatment of wounds or other tissue with reduced pressure may be commonly referred to as “negative-pressure therapy,” but is also known by other names, including “negative-pressure wound therapy,” “reduced-pressure therapy,” “vacuum therapy,” “vacuum-assisted closure,” and “topical negative-pressure,” for example. Negative-pressure therapy may provide a number of benefits, including migration of epithelial and subcutaneous tissues, improved blood flow, and micro-deformation of tissue at a wound site. Together, these benefits can increase development of granulation tissue and reduce healing times.

[0004] While the clinical benefits of negative-pressure therapy are widely known, improvements to therapy systems, components, and processes may benefit healthcare providers and patients.

BRIEF SUMMARY

[0005] New and useful systems, apparatuses, and methods for treating tissue in a negative-pressure therapy environment are set forth in the appended claims. Illustrative embodiments are also provided to enable a person skilled in the art to make and use the claimed subject matter.

[0006] For example, in some embodiments, a dressing for treating tissue may be utilized to provide negative-pressure therapy to relatively challenging tissue sites. Such tissue sites may include, without limitation, those tissue sites having an anatomy, position, geometry, and/or dimensions that may cause difficulty in providing an effective and reliable route of fluid communication between the tissue site and a source of negative pressure. Challenging tissue sites might include an elbow or heel, for example, those tissue sites where it may be difficult to provide for attachment of a fluid conductor. More generally, some embodiments may comprise a dressing configured to provide for attachment for a fluid conductor at a location spaced away from the tissue site receiving negative pressure therapy.

[0007] In some embodiments, a dressing for treating a tissue site with negative pressure may comprise a manifold layer having a first surface configured to face the tissue site, a second surface opposite the first surface, and a thickness extending between the first surface and the second surface. The manifold layer may comprise a tissue portion and a bridge portion. The bridge portion may be coupled to the tissue portion and may comprise a distal end configured to be extended away from the tissue portion. For example, the bridge portion may provide for attachment for a fluid conductor at a location spaced away from the tissue site receiving negative pressure therapy, for example, by providing a route of fluid communication between the tissue portion and the site of

attachment for the fluid conductor. The dressing may also comprise a flexible drape configured to form a sealed space including the manifold layer at the tissue site.
[0008] In some embodiments, a system for treating a tissue site may comprise a dressing. The dressing may comprise a manifold layer having a first surface configured to face the tissue site, a second surface opposite the first surface, and a thickness extending between the first surface and the second surface. The manifold layer may comprise a tissue portion and a bridge portion. The bridge portion may be coupled to the tissue portion and may comprise a distal end configured to be extended away from the tissue portion. The dressing may also comprise a flexible drape configured to form a sealed space including the manifold layer at the tissue site. The system may also comprise a negative-pressure source fluidly coupled to the dressing.
[0009] In some embodiments, a method is for treating a tissue site with negative pressure with a dressing. The dressing may comprise a manifold layer having a first surface configured to face the tissue site, a second surface opposite the first surface, and a thickness extending between the first surface and the second surface. The manifold layer may comprise a tissue portion and a bridge portion. The bridge portion may be coupled to the tissue portion and may comprise a distal end configured to be extended away from the tissue portion. The dressing may also comprise a flexible drape configured to form a sealed space including the manifold layer at the tissue site. The method may comprise extending the bridge portion of the manifold layer of the dressing away from the tissue portion of the dressing. The method may also comprise positioning the manifold layer with respect to the tissue site such that the tissue portion is adjacent the tissue site and the bridge portion extends away from the tissue site. The method may also comprise sealing the manifold layer to epidermis adjacent to the tissue site. The method may also comprise fluidly coupling the dressing to a negative-pressure source via the bridge portion. The method may also comprise applying negative pressure from the negative-pressure source to the dressing.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0010] FIG. **1** is a block diagram of an example embodiment of a therapy system and a dressing that can provide tissue treatment in accordance with this specification;
[0011] FIG. **2** is an exploded view of an example of a tissue interface, illustrating additional details that may be associated with some example embodiments of the therapy system and the dressing of FIG. **1**;
[0012] FIG. **3** is a detailed view of an example configuration of fluid restrictions in a layer that may be associated with some embodiments of the tissue interface of FIG. **2**;
[0013] FIG. **4** is a perspective view the tissue interface of FIG. **2** in an extended position;
[0014] FIG. **5** is a perspective view of the tissue interface of FIG. **2** in another extended position;
[0015] FIG. **6** is an exploded view of another example of a tissue interface, illustrating additional details that may be associated with some example embodiments of the therapy system and the dressing of FIG. **1**;
[0016] FIG. **7** is a perspective view of the tissue interface of FIG. **6** in an extended position;
[0017] FIG. **8** is an exploded view of another example of a tissue interface, illustrating additional details that may be associated with some example embodiments of the therapy system and the dressing of FIG. **1**;
[0018] FIG. **9** is a perspective view of the tissue interface of FIG. **8** in an extended position;
[0019] FIG. **10** is a perspective view of the tissue interface of FIG. **8** in another extended position;
[0020] FIG. **11** is a partially-exploded view of an example of a dressing including the example tissue interface of FIG. **2** in an extended position;
[0021] FIG. **12** is a partially-exploded view of an example of a dressing including another example

of a tissue interface in an extended position;
[0022] FIG. **13** is a partially-exploded view of an example of a dressing including another example of a tissue interface in an extended position; and
[0023] FIG. **14** is a partial cross-sectional view of the therapy system of FIG. **1** positioned with respect to a tissue site.

DESCRIPTION OF EXAMPLE EMBODIMENTS

[0024] The following description of example embodiments provides information that enables a person skilled in the art to make and use the subject matter set forth in the appended claims, and may omit certain details already well-known in the art. The following detailed description is, therefore, to be taken as illustrative and not limiting.
[0025] FIG. **1** is a block diagram of an example embodiment of a therapy system **100** that can provide negative-pressure therapy with instillation of topical treatment solutions to a tissue site in accordance with this specification.
[0026] The term "tissue site" in this context broadly refers to a wound, defect, or other treatment target located on or within tissue, including, but not limited to, bone tissue, adipose tissue, muscle tissue, neural tissue, dermal tissue, vascular tissue, connective tissue, cartilage, tendons, or ligaments. A wound may include chronic, acute, traumatic, subacute, and dehisced wounds, partial-thickness burns, ulcers (such as diabetic, pressure, or venous insufficiency ulcers), flaps, and grafts, for example. The term "tissue site" may also refer to areas of any tissue that are not necessarily wounded or defective, but are instead areas in which it may be desirable to add or promote the growth of additional tissue. For example, negative pressure may be applied to a tissue site to grow additional tissue that may be harvested and transplanted.
[0027] The therapy system **100** may include a source or supply of negative pressure, such as a negative-pressure source **105**, and one or more distribution components. A distribution component is preferably detachable and may be disposable, reusable, or recyclable. A dressing, such as a dressing **110**, and a fluid container, such as a container **115**, are examples of distribution components that may be associated with some examples of the therapy system **100**. As illustrated in the example of FIG. **1**, the dressing **110** may comprise a tissue interface **120**, a cover **125**, or both in some embodiments.
[0028] A fluid conductor is another illustrative example of a distribution component. A "fluid conductor," in this context, broadly includes a tube, pipe, hose, conduit, or other structure with one or more lumina or open pathways adapted to convey a fluid between two ends. Typically, a tube is an elongated, cylindrical structure with some flexibility, but the geometry and rigidity may vary. Moreover, some fluid conductors may be molded into or otherwise integrally combined with other components. Distribution components may also include or comprise interfaces or fluid ports to facilitate coupling and de-coupling other components. In some embodiments, for example, a dressing interface may facilitate coupling a fluid conductor to the dressing **110**. For example, such a dressing interface may be a SENSAT.R.A.C.™ Pad available from Kinetic Concepts, Inc. of San Antonio, Texas.
[0029] The therapy system **100** may also include a regulator or controller, such as a controller **130**. Additionally, the therapy system **100** may include sensors to measure operating parameters and provide feedback signals to the controller **130** indicative of the operating parameters. As illustrated in FIG. **1**, for example, the therapy system **100** may include a first sensor **135** and a second sensor **140** coupled to the controller **130**.
[0030] The therapy system **100** may also include a source of instillation solution. For example, a solution source **145** may be fluidly coupled to the dressing **110**, as illustrated in the example embodiment of FIG. **1**. The solution source **145** may be fluidly coupled to a positive-pressure source such as a positive-pressure source **150**, a negative-pressure source such as the negative-pressure source **105**, or both in some embodiments. A regulator, such as an instillation regulator **155**, may also be fluidly coupled to the solution source **145** and the dressing **110** to ensure proper

dosage of instillation solution (e.g. saline) to a tissue site. For example, the instillation regulator **155** may comprise a piston that can be pneumatically actuated by the negative-pressure source **105** to draw instillation solution from the solution source during a negative-pressure interval and to instill the solution to the dressing **110** during a venting interval. Additionally or alternatively, the controller **130** may be coupled to the negative-pressure source **105**, the positive-pressure source **150**, or both, to control dosage of instillation solution to a tissue site. In some embodiments, the instillation regulator **155** may also be fluidly coupled to the negative-pressure source **105** through the dressing **110**, as illustrated in the example of FIG. **1**.

[0031] Some components of the therapy system **100** may be housed within or used in conjunction with other components, such as sensors, processing units, alarm indicators, memory, databases, software, display devices, or user interfaces that further facilitate therapy. For example, in some embodiments, the negative-pressure source **105** may be combined with the controller **130**, the solution source **145**, and other components into a therapy unit.

[0032] In general, components of the therapy system **100** may be coupled directly or indirectly. For example, the negative-pressure source **105** may be directly coupled to the container **115** and may be indirectly coupled to the dressing **110** through the container **115**. Coupling may include fluid, mechanical, thermal, electrical, or chemical coupling (such as a chemical bond), or some combination of coupling in some contexts. For example, the negative-pressure source **105** may be electrically coupled to the controller **130** and may be fluidly coupled to one or more distribution components to provide a fluid path to a tissue site. In some embodiments, components may also be coupled by virtue of physical proximity, being integral to a single structure, or being formed from the same piece of material.

[0033] A negative-pressure supply, such as the negative-pressure source **105**, may be a reservoir of air at a negative pressure or may be a manual or electrically-powered device, such as a vacuum pump, a suction pump, a wall suction port available at many healthcare facilities, or a micro-pump, for example. “Negative pressure” generally refers to a pressure less than a local ambient pressure, such as the ambient pressure in a local environment external to a sealed therapeutic environment. In many cases, the local ambient pressure may also be the atmospheric pressure at which a tissue site is located. Alternatively, the pressure may be less than a hydrostatic pressure associated with tissue at the tissue site. Unless otherwise indicated, values of pressure stated herein are gauge pressures. References to increases in negative pressure typically refer to a decrease in absolute pressure, while decreases in negative pressure typically refer to an increase in absolute pressure. While the amount and nature of negative pressure provided by the negative-pressure source **105** may vary according to therapeutic requirements, the pressure is generally a low vacuum, also commonly referred to as a rough vacuum, between −5 mm Hg (−667 Pa) and −500 mm Hg (−66.7 kPa). Common therapeutic ranges are between −50 mm Hg (−6.7 kPa) and −300 mm Hg (−39.9 kPa).

[0034] The container **115** is representative of a container, canister, pouch, or other storage component, which can be used to manage exudates and other fluids withdrawn from a tissue site. In many environments, a rigid container may be preferred or required for collecting, storing, and disposing of fluids. In other environments, fluids may be properly disposed of without rigid container storage, and a re-usable container could reduce waste and costs associated with negative-pressure therapy.

[0035] A controller, such as the controller **130**, may be a microprocessor or computer programmed to operate one or more components of the therapy system **100**, such as the negative-pressure source **105**. In some embodiments, for example, the controller **130** may be a microcontroller, which generally comprises an integrated circuit containing a processor core and a memory programmed to directly or indirectly control one or more operating parameters of the therapy system **100**. Operating parameters may include the power applied to the negative-pressure source **105**, the pressure generated by the negative-pressure source **105**, or the pressure distributed to the tissue interface **120**, for example. The controller **130** is also preferably configured to receive one or more

input signals, such as a feedback signal, and programmed to modify one or more operating parameters based on the input signals.

[0036] Sensors, such as the first sensor **135** and the second sensor **140**, are generally known in the art as any apparatus operable to detect or measure a physical phenomenon or property, and generally provide a signal indicative of the phenomenon or property that is detected or measured. For example, the first sensor **135** and the second sensor **140** may be configured to measure one or more operating parameters of the therapy system **100**. In some embodiments, the first sensor **135** may be a transducer configured to measure pressure in a pneumatic pathway and convert the measurement to a signal indicative of the pressure measured. In some embodiments, for example, the first sensor **135** may be a piezo-resistive strain gauge. The second sensor **140** may optionally measure operating parameters of the negative-pressure source **105**, such as a voltage or current, in some embodiments. Preferably, the signals from the first sensor **135** and the second sensor **140** are suitable as an input signal to the controller **130**, but some signal conditioning may be appropriate in some embodiments. For example, the signal may need to be filtered or amplified before it can be processed by the controller **130**. Typically, the signal is an electrical signal, but may be represented in other forms, such as an optical signal.

[0037] The tissue interface **120** can be generally adapted to partially or fully contact a tissue site. The tissue interface **120** may take many forms, and may have many sizes, shapes, or thicknesses, depending on a variety of factors, such as the type of treatment being implemented or the nature and size of a tissue site. For example, the size and shape of the tissue interface **120** may be adapted to the contours of deep and irregular shaped tissue sites. Any or all of the surfaces of the tissue interface **120** may have an uneven, coarse, or jagged profile.

[0038] In some embodiments, the tissue interface **120** may include or be formed from a manifold. A manifold in this context may comprise a means for collecting or distributing fluid relative to a tissue site under pressure. For example, a manifold may be adapted to receive negative pressure from a source and distribute negative pressure through multiple apertures, which may have the effect of collecting fluid from across a tissue site and drawing the fluid toward the source. In some embodiments, the fluid path may be reversed or a secondary fluid path may be provided to facilitate delivering fluid, such as fluid from a source of instillation solution, across a tissue site.

[0039] The tissue interface **120** may include either hydrophobic or hydrophilic components. In an example in which the tissue interface **120** may be hydrophilic, the tissue interface **120** may also wick fluid away from a tissue site, while continuing to distribute negative pressure to the tissue site. The wicking properties of the tissue interface **120** may draw fluid away from a tissue site by capillary flow or other wicking mechanisms. An example of a hydrophilic material that may be suitable is a polyvinyl alcohol, open-cell foam such as V.A.C. WHITEFOAM™ dressing available from Kinetic Concepts, Inc. of San Antonio, Texas. Other hydrophilic foams may include those made from polyether. Other foams that may exhibit hydrophilic characteristics include hydrophobic foams that have been treated or coated to provide hydrophilicity.

[0040] In some embodiments, the tissue interface **120** may be include bioresorbable materials. Suitable bioresorbable materials may include, without limitation, a polymeric blend of polylactic acid (PLA) and polyglycolic acid (PGA). The polymeric blend may also include, without limitation, polycarbonates, polyfumarates, and capralactones. The tissue interface **120** may further serve as a scaffold for new cell-growth, or a scaffold material may be used in conjunction with the tissue interface **120** to promote cell-growth. A scaffold is generally a substance or structure used to enhance or promote the growth of cells or formation of tissue, such as a three-dimensional porous structure that provides a template for cell growth. Illustrative examples of scaffold materials include calcium phosphate, collagen, PLA/PGA, coral hydroxy apatites, carbonates, or processed allograft materials.

[0041] In some embodiments, the cover **125** may be a sealing layer comprising or formed from a soft, pliable material suitable for providing a fluid seal with a tissue site, and may have a

substantially flat surface. The cover **125** may provide a bacterial barrier and protection from physical trauma. The cover **125** may also be constructed from a material that can reduce evaporative losses and provide a fluid seal between two components or two environments, such as between a therapeutic environment and a local external environment. The cover **125** may comprise or be formed from, for example, an elastomeric film or membrane that can provide a seal adequate to maintain a negative pressure at a tissue site for a given negative-pressure source. The cover **125** may have a high moisture-vapor transmission rate (MVTR) in some applications. For example, the MVTR may be at least 250 grams per square meter per twenty-four hours in some embodiments, measured using an upright cup technique according to ASTM E 96/E 96M Upright Cup Method at 38° C. and 10% relative humidity (RH). In some embodiments, an MVTR up to 5,000 grams per square meter per twenty-four hours may provide effective breathability and mechanical properties.

[0042] In some example embodiments, the cover **125** may be a polymer drape, such as a polyurethane film, that is permeable to water vapor but impermeable to liquid. Such drapes typically have a thickness in the range of 25-50 microns. For permeable materials, the permeability generally should be low enough that a desired negative pressure may be maintained. The cover **125** may comprise, for example, one or more of the following materials: polyurethane (PU), such as hydrophilic polyurethane; cellulosics; hydrophilic polyamides; polyvinyl alcohol; polyvinyl pyrrolidone; hydrophilic acrylics; silicones, such as hydrophilic silicone elastomers; natural rubbers; polyisoprene; styrene butadiene rubber; chloroprene rubber; polybutadiene; nitrile rubber; butyl rubber; ethylene propylene rubber; ethylene propylene diene monomer; chlorosulfonated polyethylene; polysulfide rubber; ethylene vinyl acetate (EVA); co-polyester; and polyether block polyamide copolymers. Such materials are commercially available as, for example, Tegaderm® drape, commercially available from 3M Company, Minneapolis Minnesota; polyurethane (PU) drape, commercially available from A very Dennison Corporation, Pasadena, California; polyether block polyamide copolymer (PEBAX), for example, from Arkema S.A., Colombes, France; and Inspire 2301 and Inspire 2327 polyurethane films, commercially available from Exopack Advanced Coatings, Wrexham, United Kingdom. In some embodiments, the cover **125** may comprise Inspire 2301 having an MVTR (upright cup technique) of 2600 grams per square meter per twenty-four hours and a thickness of about 30 microns.

[0043] An attachment device may be used to attach the cover **125** to an attachment surface, such as undamaged epidermis, a gasket, or another cover. The attachment device may take many forms. For example, an attachment device may be a medically-acceptable, pressure-sensitive adhesive configured to bond the cover **125** to epidermis around a tissue site. In some embodiments, for example, some or all of the cover **125** may be coated with an adhesive, such as an acrylic adhesive, which may have a coating weight of about 25-65 grams per square meter (g.s.m.). Thicker adhesives, or combinations of adhesives, may be applied in some embodiments to improve the seal and reduce leaks. Other example embodiments of an attachment device may include a double-sided tape, paste, hydrocolloid, hydrogel, silicone gel, or organogel.

[0044] The solution source **145** may also be representative of a container, canister, pouch, bag, or other storage component, which can provide a solution for instillation therapy. Compositions of solutions may vary according to a prescribed therapy, but examples of solutions that may be suitable for some prescriptions include hypochlorite-based solutions, silver nitrate (0.5%), sulfur-based solutions, biguanides, cationic solutions, and isotonic solutions.

[0045] In operation, the tissue interface **120** may be placed within, over, on, or otherwise proximate to a tissue site. If the tissue site is a wound, for example, the tissue interface **120** may partially or completely fill the wound, or it may be placed over the wound. The cover **125** may be placed over the tissue interface **120** and sealed to an attachment surface near a tissue site. For example, the cover **125** may be sealed to undamaged epidermis peripheral to a tissue site. Thus, the dressing **110** can provide a sealed therapeutic environment proximate to a tissue site, substantially isolated from the external environment, and the negative-pressure source **105** can reduce pressure in the sealed

therapeutic environment.
[0046] The process of reducing pressure may be described illustratively herein as “delivering,” “distributing,” or “generating” negative pressure, for example. In general, exudate and other fluid flow toward lower pressure along a fluid path. Thus, the term “downstream” typically refers to a location in a fluid path relatively closer to a source of negative pressure or further away from a source of positive pressure. Conversely, the term “upstream” refers to a location in a fluid path relatively further away from a source of negative pressure or closer to a source of positive pressure. Similarly, it may be convenient to describe certain features in terms of fluid “inlet” or “outlet” in such a frame of reference. This orientation is generally presumed for purposes of describing various features and components herein. However, the fluid path may also be reversed in some applications, such as by substituting a positive-pressure source for a negative-pressure source, and such a description should not be construed as limiting.
[0047] Negative pressure applied across the tissue site through the tissue interface **120** in the sealed therapeutic environment can induce macro-strain and micro-strain in the tissue site. Negative pressure can also remove exudate and other fluid from a tissue site, which can be collected in the container **115**.
[0048] In some embodiments, the controller **130** may receive and process data from one or more sensors, such as the first sensor **135**. The controller **130** may also control the operation of one or more components of the therapy system **100** to manage the pressure delivered to the tissue interface **120**. In some embodiments, the controller **130** may include an input for receiving a desired target pressure and may be programmed for processing data relating to the setting and inputting of the target pressure to be applied to the tissue interface **120**. In some example embodiments, the target pressure may be a fixed pressure value set by an operator as the target negative pressure desired for therapy at a tissue site and then provided as input to the controller **130**. The target pressure may vary from tissue site to tissue site based on the type of tissue forming a tissue site, the type of injury or wound (if any), the medical condition of the patient, and the preference of the attending physician. After selecting a desired target pressure, the controller **130** can operate the negative-pressure source **105** in one or more control modes based on the target pressure and may receive feedback from one or more sensors to maintain the target pressure at the tissue interface **120**.
[0049] FIG. **2** is an exploded view of an example of the tissue interface **120** of FIG. **1**, illustrating additional details that may be associated with some embodiments in which the tissue interface **120** comprises more than one layer. In the example of FIG. **2**, the tissue interface **120** comprises a manifold layer **210** and a fluid management layer **205**. The manifold layer **210** may be disposed adjacent to the fluid management layer **205**. For example, the manifold layer **210** and the fluid management layer **205** may be stacked so that the manifold layer **210** is in contact with the fluid management layer **205**. In some embodiments, the manifold layer **210** and the fluid management layer **205** may also be bonded, for example, via an adhesive.
[0050] The manifold layer **210** may generally comprise a first surface **211**, a second surface **213**, and a thickness extending between the first surface **211** and the second surface **213**. In some embodiments, the first surface and/or the second surface may be generally characterized as planar surfaces, for example, although not necessarily perfectly flat, being generally recognizable as flat or capable of being laid flat. For example, a planar surface may include minor undulations and/or deviations from a single geometric plane.
[0051] In some illustrative embodiments, the manifold layer **210** may comprise a plurality of pathways, which can be interconnected to improve distribution or collection of fluids. In some embodiments, the manifold layer **210** may comprise or be formed from a porous material having interconnected fluid pathways. For example, open-cell foam, reticulated foam, porous tissue collections, and other porous material such as gauze or felted mat generally include pores, edges, and/or walls adapted to form interconnected fluid channels. Liquids, gels, and other foams may also include or be cured to include apertures and fluid pathways. In some embodiments, the

manifold layer **210** may additionally or alternatively comprise projections that form interconnected fluid pathways. For example, the manifold layer **210** may be molded to provide surface projections that define interconnected fluid pathways. Any or all of the surfaces of the manifold layer **210** may have an uneven, coarse, or jagged profile

[0052] In some embodiments, the manifold layer **210** may comprise or be formed from a reticulated foam having pore sizes and free volume that may vary according to needs of a prescribed therapy. For example, a reticulated foam having a free volume of at least 90% may be suitable for many therapy applications, and a foam having an average pore size in a range of 400-600 microns (40-50 pores per inch) may be particularly suitable for some types of therapy. The tensile strength of the manifold layer **210** may also vary according to needs of a prescribed therapy. For example, the tensile strength of a foam may be increased for instillation of topical treatment solutions. The 25% compression load deflection of the manifold layer **210** may be at least 0.35 pounds per square inch, and the 65% compression load deflection may be at least 0.43 pounds per square inch. In some embodiments, the tensile strength of the manifold layer **210** may be at least 10 pounds per square inch. The manifold layer **210** may have a tear strength of at least 2.5 pounds per inch. In some embodiments, the manifold layer **210** may be a foam comprised of polyols such as polyester or polyether, isocyanate such as toluene diisocyanate, and polymerization modifiers such as amines and tin compounds. In one non-limiting example, the manifold layer **210** may be a reticulated polyurethane ether foam such as used in a V.A.C.® GRANUFOAM™ Dressing or a V.A.C.® VERAFLO™ Dressing, both available from KCI of San Antonio, Texas.

[0053] The thickness of the manifold layer **210** may also vary according to needs of a prescribed therapy. For example, the thickness of the manifold layer **210** may be decreased to relieve stress on other layers and to reduce tension on peripheral tissue. The thickness of the manifold layer **210** can also affect the conformability of the manifold layer **210**. In some embodiments, a thickness in a range of about 4 millimeters to 10 millimeters may be suitable.

[0054] The fluid management layer **205** may comprise a means for controlling or managing fluid flow. In some embodiments, the fluid management layer **205** may comprise or be formed from a liquid-impermeable, elastomeric material. For example, the fluid management layer **205** may comprise or be formed from a polymer film. The fluid management layer **205** may also have a smooth or matte surface texture in some embodiments. A glossy or shiny finish better or equal to a grade B3 according to the SPI (Society of the Plastics Industry) standards may be particularly advantageous for some applications. In some embodiments, variations in surface height may be limited to acceptable tolerances. For example, the surface of the fluid management layer **205** may have a substantially flat surface, with height variations limited to 0.2 millimeters over a centimeter.

[0055] In some embodiments, the fluid management layer **205** may be hydrophobic. The hydrophobicity of the fluid management layer **205** may vary, but may have a contact angle with water of at least ninety degrees in some embodiments. In some embodiments, the fluid management layer **205** may have a contact angle with water of no more than 150 degrees. For example, in some embodiments, the contact angle of the fluid management layer **205** may be in a range of at least 90 degrees to about 120 degrees, or in a range of at least 120 degrees to 150 degrees. Water contact angles can be measured using any standard apparatus. Although manual goniometers can be used to visually approximate contact angles, contact angle measuring instruments can often include an integrated system involving a level stage, liquid dropper such as a syringe, camera, and software designed to calculate contact angles more accurately and precisely, among other things. Non-limiting examples of such integrated systems may include the FTÅ 125, FTÅ 200, FTÅ 2000, and FTÅ 4000 systems, all commercially available from First Ten Angstroms, Inc., of Portsmouth, VA, and the DTA25, DTA30, and DTA100 systems, all commercially available from Kruss GmbH of Hamburg, Germany. Unless otherwise specified, water contact angles herein are measured using deionized and distilled water on a level sample surface for a sessile drop added from a height of no more than 5 cm in air at 20-25° C. and 20-50%

relative humidity. Contact angles reported herein represent averages of 5-9 measured values, discarding both the highest and lowest measured values. The hydrophobicity of the fluid management layer **205** may be further enhanced with a hydrophobic coating of other materials, such as silicones and fluorocarbons, either as coated from a liquid, or plasma coated.

[0056] The fluid management layer **205** may also be suitable for welding to other layers, including the manifold layer **210**. For example, the fluid management layer **205** may be adapted for welding to polyurethane foams using heat, radio frequency (RF) welding, or other methods to generate heat such as ultrasonic welding. RF welding may be particularly suitable for more polar materials, such as polyurethane, polyamides, polyesters and acrylates. Sacrificial polar interfaces may be used to facilitate RF welding of less polar film materials, such as polyethylene.

[0057] The area density of the fluid management layer **205** may vary according to a prescribed therapy or application. In some embodiments, an area density of less than 40 grams per square meter may be suitable, and an area density of about 20-30 grams per square meter may be particularly advantageous for some applications.

[0058] In some embodiments, for example, the fluid management layer **205** may comprise or be formed from a hydrophobic polymer, such as a polyethylene film. The simple and inert structure of polyethylene can provide a surface that interacts little, if any, with biological tissues and fluids, providing a surface that may encourage the free flow of liquids and low adherence, which can be particularly advantageous for many applications. More polar films suitable for laminating to a polyethylene film include polyamide, co-polyesters, ionomers, and acrylics. To aid in the bond between a polyethylene and polar film, tie layers may be used, such as ethylene vinyl acetate, or modified polyurethanes. An ethyl methyl acrylate (EMA) film may also have suitable hydrophobic and welding properties for some configurations.

[0059] As illustrated in the example of FIG. **2**, the fluid management layer **205** may have one or more fluid restrictions **220**, which can be distributed uniformly or randomly across the fluid management layer **205**. The fluid restrictions **220** may be bi-directional and pressure-responsive. For example, the fluid restrictions **220** can generally comprise an elastic passage that is normally unstrained to substantially reduce liquid flow, and can expand in response to a pressure gradient or deformation of the fluid management layer **205**. In some embodiments, the fluid restrictions **220** may comprise perforations in the fluid management layer **205**. Perforations may be formed by removing material from the fluid management layer **205**. For example, perforations may be formed by cutting through the fluid management layer **205**, which may also deform the edges of the perforations in some embodiments. In the absence of a pressure gradient across the perforations or deformation of the fluid management layer **205**, the passages may be sufficiently small to form a seal or flow restriction, which can substantially reduce or prevent liquid flow. Additionally or alternatively, one or more of the fluid restrictions **220** may be an elastomeric valve that is normally closed when unstrained to substantially prevent liquid flow, and can open in response to a pressure gradient or deformation of the fluid management layer **205**. A fenestration in the fluid management layer **205** may be a suitable valve for some applications. Fenestrations may also be formed by removing material from the fluid management layer **205**, but the amount of material removed and the resulting dimensions of the fenestrations may be an order of magnitude less than perforations, and may not deform the edges.

[0060] FIG. **3** is a schematic view of an example of the fluid management layer **205**, illustrating additional details that may be associated with some embodiments. For example, some embodiments of the fluid restrictions **220** may comprise one or more slots or combinations of slots in the fluid management layer **205**. In some examples, the fluid restrictions **220** may comprise linear slots having a length less than 4 millimeters and a width less than 1 millimeter. The length may be at least 2 millimeters, and the width may be at least 0.4 millimeters in some embodiments. A length of about 3 millimeters and a width of about 0.8 millimeter may be particularly suitable for many applications. As illustrated in the example of FIG. **3**, the fluid restrictions **220** may each

consist essentially of one or more linear slots having a length of about 3 millimeters. A tolerance of about 0.1 millimeter may also be acceptable. Such dimensions and tolerances may be achieved with a laser cutter, for example. Slots of such configurations may function as imperfect valves that substantially reduce liquid flow in a normally closed or resting state. For example, such slots may form a flow restriction without being completely closed or sealed. The slots can expand or open wider in response to a pressure gradient or deformation of the fluid management layer **205** to allow increased liquid flow.

[0061] FIG. **3** additionally illustrates an example of a uniform distribution pattern of the fluid restrictions **220**. In FIG. **3**, the fluid restrictions **220** configured to be substantially coextensive with the fluid management layer **205**, and are distributed across the fluid management layer **205** in a grid of parallel rows and columns, in which the slots are also mutually parallel to each other. In some embodiments, the rows may be spaced about 3 millimeters on center, and the fluid restrictions **220** within each of the rows may be spaced about 3 millimeters on center as illustrated in the example of FIG. **3**. The fluid restrictions **220** in adjacent rows may be aligned or offset. For example, adjacent rows may be offset, as illustrated in FIG. **3**, so that the fluid restrictions **220** are aligned in alternating rows and separated by about 6 millimeters. The spacing of the fluid restrictions **220** may vary in some embodiments to increase the density of the fluid restrictions **220** according to therapeutic requirements.

[0062] One or more of the components of the dressing **110** may additionally be treated with an antimicrobial agent in some embodiments. For example, the manifold layer **210** may be a foam, mesh, or non-woven coated with an antimicrobial agent. In some embodiments, one or more components may be treated with antimicrobial elements, such as fibers coated with an antimicrobial agent. Additionally or alternatively, in some embodiments, one or more components may be may be a polymer coated or mixed with an antimicrobial agent. In other examples, other components such as the fluid conductor may additionally or alternatively be treated with one or more antimicrobial agents. Suitable antimicrobial agents may include, for example, metallic silver, PHMB, iodine or its complexes and mixes such as povidone iodine, copper metal compounds, chlorhexidine, or some combination of these materials.

[0063] Two or more components of the dressing **110**, for example, the fluid management layer **205** and the manifold layer **210**, may be bonded or otherwise secured to one another with a solvent or non-solvent adhesive, or with thermal welding.

[0064] In some embodiments, the tissue interface **120** may be configured to provide for attachment for a fluid conductor at a location spaced away from the tissue site receiving negative pressure therapy. For example, the tissue interface **120** may include both a tissue portion generally configured to be placed within, over, or otherwise proximate to the tissue site and a bridge portion configured to be extended away from the tissue portion, for example, to provide a location apart from the tissue site at which a connection to the negative-pressure source **105** can be made. In various embodiments, one or more of the layers that make up the tissue interface **120** may include both the tissue portion and the bridge portion.

[0065] For example, referring again to the embodiment of FIG. **2**, the manifold layer **210** may comprise both a tissue portion **212** and a bridge portion **214**. The bridge portion **214** may be coupled to the tissue portion **212**. Also, the bridge portion **214** may comprise a distal end **216** configured to be extended away from the tissue portion **212** while the bridge portion **214** remains coupled to the tissue portion **212**.

[0066] For example, in some embodiments, the manifold layer **210** may comprise one or more lines of detachment **219** generally separating the tissue portion **212** and the bridge portion **214**. In the embodiment of FIG. **2**, the one or more lines of detachment **219** of the manifold layer **210** may include or may be perforations **215**. Additionally or alternatively, in some embodiments, lines of detachment **219** in the manifold layer **210** may include slits or other suitable lines of weakness along which the manifold layer **210** can be separated. Additionally or alternatively, in some

embodiments, lines of detachment **219** in the manifold layer **210** may include a cut or void-space at least partially separating the tissue portion **212** from the bridge portion **214**. In various embodiments, any suitable number of lines of detachment **219** may be used to form a desired configuration of the manifold layer **210**. For example, in the embodiment of FIG. **2**, a single line of the perforations **215** in the manifold layer **210** define the tissue portion **212** and the bridge portion **214**, although in some embodiments, multiple lines of detachment **219** may be present in the manifold layer **210**.

[0067] Also in the embodiment of FIG. **2**, the fluid management layer **205** may likewise include both a tissue portion **222** and a bridge portion **224** having a distal end **226** and separated from the tissue portion **222** by one or more lines of detachment, such as perforations **225**. In some embodiments, the fluid management layer **205** may be coupled to the manifold layer **210** such that the tissue portion **212**, the bridge portion **214**, and the perforations **215** in the manifold layer **210** are substantially aligned with, or generally coextensive with, the tissue portion **222**, the bridge portion **224**, and the perforations **225** in the fluid management layer **205**. Additionally or alternatively, in some embodiments, the fluid management layer **205** may cover only a portion of the first surface or second surface of the manifold layer **210**. For example, in some embodiments, the fluid management layer **205** may include only the tissue portion **222**. In some embodiments, the bridge portion **224** of the fluid management layer **205** may be removable to more-fully expose the bridge portion **214** of the manifold layer **210**. For example, the bridge portion **224** of the fluid management layer **205** may be relatively weakly-coupled to the bridge portion **214** of the manifold layer **210** to enable the removal of the bridge portion **224**.

[0068] Also, in some embodiments, the lines of detachment may vary between the manifold layer **210** and the fluid management layer **205**. For example, in some embodiments, the lines of detachment in the manifold layer **210** may include cuts or void-spaces while the lines of detachment in the fluid management layer **205** include perforations or slits.

[0069] In various embodiments, the bridge portion **214** of the manifold layer **210** may take any suitable shape or form in which the distal end **216** of the bridge portion **214** can be extended away from the tissue portion **212**. Likewise, the bridge portion **224** of the fluid management layer **205** may take any suitable shape of form in which the distal end **226** of the bridge portion **224** can be extended away from the tissue portion **222**.

[0070] In the embodiment of FIG. **2**, the bridge portions **214**, **224** are illustrated in a first position in which the bridge portions **214**, **224** are not extended away from the tissue portions **212**, **222**. In the first position illustrated in FIG. **2**, the bridge portions **214**, **224** may be disposed adjacent to edges **217**, **227** of the respective tissue portions **212**, **222**.

[0071] In various embodiments, the bridge portions **214**, **224** may be configured to be extended away from the tissue portions **212**, **222** by rotation of the bridge portions **214**, **224** about one or more axes with respect to the respective tissue portions **212**, **222**. For example, the bridge portions **214**, **224** may be configured to be rotated with respect to the respective tissue portions **212**, **222** in a direction substantially parallel to the first surface and the second surface of the manifold layer **210** and/or the respective surfaces of the fluid management layer **205**. Additionally or alternatively, the bridge portions **214**, **224** may be configured to be rotated with respect to the tissue portions **212**, **222** in a direction substantially perpendicular to the first surface and the second surface.

[0072] For example, FIG. **4** is a perspective view of the tissue interface **120** of FIG. **2** in another position. In the embodiment of FIG. **4**, the bridge portions **214**, **224** are illustrated having been rotated to a second position in which the distal ends **216**, **226** of the respective bridge portions **214**, **224** may be further away from the respective tissue portions **212**, **222** than in the first position. The bridge portions **214**, **224** may be rotated in a direction substantially parallel to the first surface and/or the second surface of the manifold layer **210** and/or the respective surfaces of the fluid management layer **205**. For example, the bridge portions **214**, **224** may be configured to be rotated about an axis substantially perpendicular to the first surface and/or the second surface of the

manifold layer **210** and/or the respective surfaces of the fluid management layer **205**. In some embodiments, such as illustrated in FIGS. **2** and **4**, the manifold layer **210** may include a pivot zone **218** and/or the fluid management layer **205** may include a pivot zone **228** generally configured to allow the bridge portions **214**, **224** to be rotated in a direction substantially parallel to the first surface and/or the second surface of the manifold layer **210** and/or the respective surfaces of the fluid management layer **205**, for example, without substantial bunching or tearing. For example, the pivot zones **218**, **228** may include one or more holes, slots, perforations, or combinations thereof, enabling the bridge portions **214**, **224** to be rotated to the second position.

[0073] Additionally or alternatively, FIG. **5** is a perspective view of the tissue interface **120** of FIG. **2** in another position. In the embodiment of FIG. **5**, the bridge portions **214**, **224** are illustrated having been rotated to a second position in which the distal ends **216**, **226** of the bridge portions **214**, **224** may be further away from the respective tissue portions **212**, **222** than in the first position. In the second position illustrated in FIG. **5**, the bridge portions **214**, **224** may be rotated in a direction substantially perpendicular to the first surface and the second surface of the manifold layer **210** and/or the respective surfaces of the fluid management layer **205**. For example, the bridge portions **214**, **224** may be configured to be rotated about an axis substantially parallel to the first surface and/or the second surface of the manifold layer **210** and/or the respective surfaces of the fluid management layer **205**. For example, the bridge portions **214**, **224** may be configured to be folded, for example, about 180 degrees, such that the distal ends **216**, **226** of the bridge portions **214**, **224** are disposed further away from the respective tissue portions **212**, **222**.

[0074] Additionally or alternatively, FIG. **6** is an exploded view of another example of the tissue interface **120** likewise including a manifold layer **610** and a fluid management layer **605**. In the embodiment of FIG. **6**, the bridge portions **614**, **624** are illustrated in a first position in which the bridge portions **614**, **624** are not extended away from the respective tissue portions **612**, **622**. In the first position illustrated in FIG. **6**, the bridge portions **614**, **624** may at least partially circumscribe the respective tissue portions **612**, **622**. For example, in the first position illustrated in FIG. **6**, respective portions the bridge portion **614** of the manifold layer **610** may be disposed adjacent to two or more edges **617** of the tissue portion **612** of the manifold layer **610** and, likewise, respective portions the bridge portion **624** of the fluid management layer **605** may be disposed adjacent to two or more edges **627** of the tissue portion **622** of the fluid management layer **605**. The bridge portions **614**, **624** may be separated from the respective tissue portions **612**, **622** by perforations **615** the manifold layer **610** and perforations **625** in the fluid management layer **605**, respectively.

[0075] FIG. **7** is a perspective view of the tissue interface **120** of FIG. **6** in another position. In the embodiment of FIG. **7**, the bridge portions **614**, **624** are illustrated having been rotated to a second position in which the distal ends **616**, **626** of the respective bridge portions **614**, **624** may be further away from the respective tissue portions **612**, **622** than in the first position. The bridge portions **614**, **624** may be rotated in one or more directions substantially parallel to the first surface and/or the second surface of the manifold layer **610** and/or the respective surfaces of the fluid management layer **605**. For example, the bridge portions **614**, **624** may be configured to be rotated about one or more axes substantially perpendicular to the first surface and/or the second surface of the manifold layer **610** and/or the respective surfaces of the fluid management layer **605**. In the embodiment of FIGS. **6** and **7**, the manifold layer **610** may include multiple pivot zones **618** and/or the fluid management layer **605** may include multiple pivot zones **628** generally configured to allow the bridge portions **614**, **624** or portions thereof to be rotated in one or more directions substantially parallel to the first surface and/or the second surface of the manifold layer **210** and/or the respective surfaces of the fluid management layer **605**.

[0076] Additionally or alternatively, FIG. **8** is an exploded view of another example of the tissue interface **120** likewise including a manifold layer **810** and a fluid management layer **805**. In the embodiment of FIG. **8**, the bridge portions **814**, **824** are illustrated in a first position in which the bridge portions **814**, **824** are not extended away from the respective tissue portions **812**, **824**. In the

first position of the embodiment illustrated in FIG. **8**, the bridge portion **814** of the manifold layer **810** may be disposed adjacent to an edge **817** of the tissue portion **812** and, likewise, the bridge portion **824** of the fluid management layer **805** may be disposed adjacent to an edge **827** of the tissue portion **822**. The bridge portions **814**, **824** may be separated from the respective tissue portions **812**, **822** by perforations **815** in the manifold layer **810** and perforations **825** in the fluid management layer **805**, respectively. In the embodiment of FIG. **8**, the bridge portions **814**, **824** comprise a serpentine pattern formed by additional perforations **815**, **825** disposed within the bridge portions **814**, **824**.

[0077] FIG. **9** is a perspective view of the tissue interface **120** of FIG. **8** in another position. In the embodiment of FIG. **9**, the bridge portions **814**, **824** are illustrated having been rotated to a second position in which the distal ends **816**, **826** of the respective bridge portions **814**, **824** may be further away from the respective tissue portions **812**, **822** than in the first position. The bridge portions **814**, **824** may be rotated in one or more directions substantially parallel to the first surface and/or the second surface of the manifold layer **810** and/or the respective surfaces of the fluid management layer **805**. For example, the bridge portions **814**, **824** may be configured to be rotated about one or more axes substantially perpendicular to the first surface and/or the second surface of the manifold layer **810** and/or the respective surfaces of the fluid management layer **805**. In the embodiment of FIGS. **8** and **9**, the manifold layer **810** may include multiple pivot zones **818** and/or the fluid management layer **805** may include multiple pivot zones **828** generally configured to allow the bridge portions **814**, **824** or portions thereof to be rotated in one or more directions substantially parallel to the first surface and/or the second surface of the manifold layer **210** and/or the respective surfaces of the fluid management layer **805**.

[0078] Additionally or alternatively, FIG. **10** is a perspective view of the tissue interface **120** of FIG. **8** in another position. In the embodiment of FIG. **10**, the bridge portions **814**, **824** are illustrated having been rotated to a second position in which the distal ends **816**, **826** of the bridge portions **814**, **824** may be further away from the respective tissue portions **812**, **822** than in the first position. In the second position illustrated in FIG. **10**, the bridge portions **814**, **824** may be rotated in one or more directions substantially perpendicular to the first surface and the second surface of the manifold layer **810** and/or the respective surfaces of the fluid management layer **805**. For example, the bridge portions **814**, **824** may be configured to be rotated about one or more axes substantially parallel to the first surface and/or the second surface of the manifold layer **810** and/or the respective surfaces of the fluid management layer **805**. For example, the bridge portions **814**, **824** may be configured to be folded, for example, about 180 degrees, such that the distal ends **816**, **826** of the bridge portions **814**, **824** are disposed further away from the respective tissue portions **812**, **822**.

[0079] FIG. **11** is an exploded view of an embodiment of the dressing **110**, including the embodiment of the tissue interface **120** disposed in a second, extended position, for example, as discussed with respect to FIG. **4**. In the embodiment of FIG. **11** the dressing **110** illustrates the cover **125** positioned with respect to the tissue interface **120**.

[0080] In some embodiments, the cover **125** may be sized to extend over the entirety of the tissue interface **120** and enclose the tissue interface **120** at a tissue site. The cover **125** may have a periphery **1130** surrounding or around an interior portion **1135**. The interior portion **1135** may correspond to a surface area of the tissue interface **120** (for example, the manifold layer **210** and fluid management layer **205**). For example, the cover **125** may be sized such that the interior portion **1135** is sufficient to cover the tissue interface **120** in a second position in which the distal end **216** is extended away from the tissue portion **212**. Alternatively, in some embodiments, two or more of the covers **125** each extending over a portion of the tissue interface **120** may be used together to cover the tissue interface **120** and enclose the tissue interface **120** at a tissue site.

[0081] In the example of FIG. **11**, the dressing **110** may further include an attachment device, such as an adhesive **1150**. The adhesive **1150** may be a layer and may be applied to a surface of the

cover **125**, for example, the periphery **1130** of the cover **125**, a portion of the cover **125**, or the entire cover **125**. In some embodiments, the adhesive **1150** may be continuous or discontinuous. Discontinuities in the adhesive **1150** may be provided by apertures or holes (not shown) in the adhesive **1150**. The apertures or holes in the adhesive **1150** may be formed after application of the adhesive **1150** or by coating the adhesive **1150** in patterns on a carrier layer, such as, for example, a side of the cover **125**. A pertures or holes in the adhesive **1150** may also be sized to enhance the MVTR of the dressing **110** in some example embodiments.

[0082] FIG. **11** also illustrates an example of a fluid conductor **1165** and a dressing interface **1170**. As shown in the example of FIG. **11**, the fluid conductor **1165** may be a flexible tube, which can be fluidly coupled on one end to the dressing interface **1170**. The dressing interface **1170** may be an elbow connector, as shown in the example of FIG. **11**, which can be placed over an aperture **1175** in the cover **125** to provide a fluid path between the fluid conductor **1165** and the tissue interface **120** when the cover **125** is positioned with respect to the tissue interface **120**. In some embodiments, for example, as illustrated in FIG. **11**, the aperture **1175** may be disposed in the cover **125** near the periphery **1130** of the cover **125**. For example, disposition of the aperture **1175** at a position within or relatively near the periphery **1130** may enable the aperture to be disposed over the distal ends **216**, **226** of the bridge portions **214**, **224** of the layer of the tissue interface **120** when the tissue interface **120** is positioned in a second, extended position.

[0083] FIG. **12** is an exploded view of an embodiment of the dressing **110**, including another embodiment of the tissue interface **120** disposed in a second, extended position. Referring to FIG. **12**, in some embodiments, the tissue interface **120** may further comprise a barrier layer **1210** coupled to the manifold layer **210** opposite the fluid management layer **205**. In some embodiments, the barrier layer **1210** may be a sealing layer comprising or formed from a soft, pliable material suitable for providing a fluid seal over at least a portion of the manifold layer **210**. In some embodiments, the barrier layer **1210** may comprise one or more of the materials previously disclosed with respect to the fluid management layer **205**. For example, the barrier layer **1210** may comprise a film of a polyethylene, a polyamide, a co-polyester, an ionomer, or an acrylic. As also disclosed with respect to the fluid management layer **205**, the barrier layer **1210** may also be suitable for welding to other layers, including the manifold layer **210**.

[0084] Additionally, as shown in FIG. **12**, the barrier layer **1210** may also include both a tissue portion **1212** and a bridge portion **1214** having a distal end **1216**. In some embodiments, the distal end **1216** of the bridge portion **1214** of the barrier layer **1210** may include a fluid aperture **1219** generally configured to provide a route of unrestricted fluid communication through the barrier layer **1210**. Additionally or alternatively, in some embodiments, the bridge portion **1214** of the barrier layer **1210** may be removable to more-fully expose the bridge portion **1214** of the manifold layer **210**. For example, the bridge portion **1214** of the barrier layer **1210** may be relatively weakly-coupled to the bridge portion **214** of the manifold layer **210** to enable the removal of the bridge portion **224**. In some embodiments, the barrier layer **1210** may allow for use of a cover **125** generally configured to seal the edges of the barrier layer **1210** to a tissue site. For example, as shown in FIG. **12**, the cover **125** may comprise a strip of material generally configured to extend around a perimeter of the tissue interface **120** to seal the tissue interface **120** to a tissue site. The strip of material may be continuous or discontinuous. For example, in some embodiments, the cover **120** may include multiple strips of material configured to seal the tissue interface **120** to a tissue site. As similarly disclosed with respect to FIG. **11**, FIG. **12** also illustrates an embodiment including the fluid conductor **1165** and the dressing interface **1170** placed with respect to the tissue interface **120**.

[0085] Also, in some embodiments, the barrier layer **1210** may be configured to extend beyond the edges of the manifold layer **210**. Any portions of the barrier layer **1210** extending beyond the manifold layer **210** may be folded around the manifold layer **210** such that the manifold layer **210** does not have any exposed edges. Not intending to be bound by theory, configuring the barrier

layer **1210** to cover the edges of the manifold layer **210**, such that the edges of the manifold layer **210** are not exposed, may reduce the potential for irritation of the tissue site or peripheral tissue resulting from exposure to the manifold layer **210**. Additionally or alternatively, in some embodiments, the fluid management layer **205** (or, in some embodiments, fluid management layer **605** or fluid management layer **805**) may similarly be configured to extend beyond the edges of the manifold layer **210** (or, in respective embodiments, manifold layer **610** or manifold layer **810**) such that the manifold layer **210** does not have exposed edges.

[0086] FIG. **13** is an exploded view of an embodiment of the dressing **110**, including another embodiment of the tissue interface **120** disposed in a second, extended position. Referring to FIG. **13**, in some embodiments, in some embodiments, the tissue interface **120** may further comprise a second fluid management layer **1305** coupled to the manifold layer **210** opposite the fluid management layer **205**. As similarly disclosed with respect to the fluid management layer **205**, second fluid management layer **1305** may include one or more fluid restrictions **220**, which can be distributed uniformly or randomly across the second fluid management layer **1305**. Embodiments of the tissue interface **120** including both the fluid management layer **205** and the second fluid management layer **1305** disposed on the surfaces of the manifold layer **210** may provide additional placement options for the tissue interface **120** with respect to a tissue site. For example, in such embodiments, the tissue interface **120** may be disposed with either side facing the tissue site because negative pressure can be distributed across both surfaces of the tissue interface **120**.

[0087] FIG. **14** depicts an example of the therapy system **100** implemented in the treatment of a tissue site **1404** of a patient. The tissue site **1404** may extend through or otherwise involve an epidermis **1406**, a dermis **1408**, and a subcutaneous tissue **1410**. In some embodiments, the tissue site **1404** may include a sub-surface portion that extends below the surface of the epidermis **1406**. Additionally or alternatively, in some embodiments, the tissue site **1404** may include a surface portion that predominantly resides on the surface of the epidermis **1406**, such as, for example, an incision. The therapy system **100** may provide therapy to, for example, the epidermis **1406**, the dermis **1408**, and the subcutaneous tissue **1410**, regardless of the positioning of the therapy system **100** or the type of tissue site. In some embodiments, the tissue site **1404** may be disposed in a location in which it is difficult to provide fluid connection to the negative-pressure source **105**. For example, the tissue site **1404** might be part of a patient's foot, such as the patient's heel, or another difficult location, such as an elbow. The therapy system **100** may also be utilized, without limitation, at other tissue sites. The geometry and dimensions of the tissue interface **120**, the cover **125**, or both may vary to suit a particular application or anatomy. For example, the geometry or dimensions of the tissue interface **120** and the cover **125** may be adapted to provide an effective and reliable seal against challenging anatomical surfaces, such as an elbow or heel, at and around a tissue site.

[0088] In some embodiments, for example, in the embodiment of FIG. **14**, the therapy system **100** may include an optional tissue interface component, such as an interface manifold **1420**. The interface manifold **1420** is an optional component that may be omitted for different types of tissue sites or different types of therapy using reduced pressure, such as, for example, epithelialization, tissue closure, incision treatment, and others. If present, the interface manifold **1420** may be adapted to be positioned proximate to or adjacent to the tissue site **1404**, such as, for example, by cutting or otherwise shaping the interface manifold **1420** in any suitable manner to fit the tissue site **1404**. The interface manifold **1420** may be adapted to be positioned in fluid communication with the tissue site **1404** to distribute reduced pressure to the tissue site **1404**. In some embodiments, the interface manifold **1420** may be positioned in direct contact with the tissue site **1404**. The interface manifold **1420** may be formed from any manifold material or flexible bolster material that provides a vacuum space, or treatment space, such as, for example, a porous and permeable foam or foam-like material, a member formed with pathways, a graft, or a gauze. As a more specific, non-limiting example, the interface manifold **1420** may be a reticulated, open-cell polyurethane or polyether

foam that allows good permeability of fluids while under a reduced pressure. One such foam material is used in the V.A.C.® GRANUFOAM™ Dressing available from Kinetic Concepts, Inc. (KCI) of San Antonio, Texas. A material with a higher or lower density than the material of the V.A.C.® GRANUFOAM™ Dressing may be desirable for the interface manifold **1420** depending on the application. Among the many possible materials, the following may be used: the material in the V.A.C.® GRANUFOAM™ Dressing, a molded bed of nails structures, a patterned grid material such as those manufactured by Sercol Industrial Fabrics, 3D textiles such as those manufactured by Baltex of Derby, U.K., a gauze, a flexible channel-containing member, a graft, etc. In some instances, ionic silver may be added to the interface manifold **1420** by, for example, a micro bonding process. Other substances, such as anti-microbial agents, may be added to the interface manifold **1420** as well. In some embodiments, the interface manifold **1420** may comprise a porous, hydrophobic material. The hydrophobic characteristics of the interface manifold **1420** may prevent the interface manifold **1420** from directly absorbing fluid, such as exudate, from the tissue site **1404**, but allow the fluid to pass through.

[0089] The tissue interface **120** may be prepared for placement with respect to the tissue site **1404**, for example, by separating the bridge portions **214**, **224** from the respective tissue portions **212**, **222** and extending the distal ends **216**, **226** of the bridge portions **214**, **224** away from the respective tissue portions **212**, **222** to a desired distance, for example, as may be dependent upon the location of the tissue site **1404**.

[0090] The tissue interface **120** may be positioned with respect to the tissue site **1404** such that the tissue portions **212**, **222** are positioned at or proximate to the tissue site **1404** and/or the interface manifold **1420** and such that the bridge portions **214**, **224** extend away from the tissue site **1404**, for example, over peripheral tissue surrounding the tissue site **1404**. In this manner, for example, the tissue interface **120** may be in fluid communication with the interface manifold **1420** and/or the tissue site **1404**.

[0091] A release liner (if included) may be removed to expose the adhesive **1150** and the cover **125** may be applied over the interface manifold **1420**, the tissue site **1404**, and the optional interface manifold **1420** to provide a fluid seal and a sealed space **1430** between the tissue site **1404** and the cover **125** of the dressing **110**. For example, the periphery **1130** of the cover **125** may be positioned in contact with tissue surrounding the tissue site **1404** to provide the sealed space **1430**, such that the adhesive **1150** may also be positioned at least between the periphery **1130** of the cover **125** and tissue, such as the epidermis **1406**, surrounding the tissue site **1404**. The adhesive **1150** may be disposed on a surface of the cover **125** adapted to face the tissue site **1404** such that the adhesive **1150** is effective to seal the cover **125** to various tissue.

[0092] The cover **125** may extend over both the tissue portion **212** and the bridge portion **214** and other tissue, such as a portion of the epidermis **1406**, surrounding the tissue site **1404** to provide the fluid seal between the cover **125** and the tissue site **1404**. For example, the sealed space **1430** may include both the tissue portion **212** and the bridge portion **214** such that fluid may be communicated there-between. In some embodiments, the cover **125** may be positioned over the tissue interface **120** such that the aperture **1175** in the cover **125** and the dressing interface **1170** placed with respect to the aperture **1175** are disposed over the bridge portion **214**. As such, the bridge portion **214** may provide at least a portion of a route of fluid communication between the fluid conductor **1165** and the tissue portion **212**. In this way, the combination of the tissue portion **212** and the bridge portion **214** may also allow for attachment of the fluid conductor **1165** at a position apart from the tissue site **1404**.

[0093] With the dressing **110** secured to the patient, the fluid conductor **1165** may be attached to the negative-pressure source **105** and to the dressing interface **1170** to provide a route of fluid communication between the negative-pressure source **105** and the dressing **110**. The negative-pressure source **105** may be operated to provide negative-pressure therapy to the tissue site **1404**.

[0094] Negative pressure applied through the tissue interface **120** can create a negative pressure

differential across the fluid restrictions **220** in the fluid management layer **205**, which can open or expand the fluid restrictions **220** from their resting state. For example, in some embodiments in which the fluid restrictions **220** may comprise substantially closed fenestrations through the fluid management layer **205**, a pressure gradient across the fenestrations or deformation of the fluid management layer **205** can strain the adjacent material of the fluid management layer **205** and increase the dimensions of the fenestrations to allow liquid movement through them, similar to the operation of a duckbill valve. Opening the fluid restrictions **220** can allow exudate and other liquid movement through the fluid restrictions **220** into the manifold layer **210** and the container **115**. The fluid management layer **205** can also substantially reduce or prevent exposure of tissue to the manifold layer **210**, which can inhibit growth of tissue into the manifold layer **210**. If the negative-pressure source **105** is removed or turned-off, the pressure differential across the fluid restrictions **220** can dissipate, allowing the fluid restrictions **220** to move to their resting state and prevent or reduce the rate at which exudate or other liquid from returning to the tissue site through the fluid management layer **205**.

[0095] Additionally or alternatively, instillation solution or other fluid may be distributed to the dressing **110**, which can increase the pressure in the tissue interface **120**. The increased pressure in the tissue interface **120** can create a positive pressure differential across the fluid restrictions **220** in the fluid management layer **205**, which can open or expand the fluid restrictions **220** from their resting state to allow the instillation solution or other fluid to be distributed to the tissue site **1404**.

[0096] While shown in a few illustrative embodiments, a person having ordinary skill in the art will recognize that the systems, apparatuses, and methods described herein are susceptible to various changes and modifications that fall within the scope of the appended claims. Moreover, descriptions of various alternatives using terms such as “or” do not require mutual exclusivity unless clearly required by the context, and the indefinite articles “a” or “an” do not limit the subject to a single instance unless clearly required by the context.

[0097] Features, elements, and aspects described in the context of some embodiments may also be omitted, combined, or replaced by alternative features serving the same, equivalent, or similar purpose without departing from the scope of the invention defined by the appended claims. For example, one or more of the features of some layers may be combined with features of other layers to provide an equivalent function.

[0098] Components may be also be combined or eliminated in various configurations for purposes of sale, manufacture, assembly, or use. For example, in some configurations the container **115** may be eliminated or separated from other components for manufacture or sale. In other example configurations, the controller **130** may also be manufactured, configured, assembled, or sold independently of other components.

[0099] The appended claims set forth novel and inventive aspects of the subject matter described above, but the claims may also encompass additional subject matter not specifically recited in detail. Certain features, elements, or aspects may be omitted from the claims if not necessary to distinguish the novel and inventive features from what is already known to a person having ordinary skill in the art.

Claims

1. A manifold layer for use with dressing for treating a tissue site with negative pressure, comprising: a first surface configured to face the tissue site, a second surface opposite the first surface, and a thickness extending between the first surface and the second surface; a tissue portion; and a bridge portion comprising a distal end configured to be extended away from the tissue portion by separation of one or more lines of detachment at an edge between the bridge portion and the tissue portion, wherein the tissue portion and the bridge portion each include a width perpendicular to the edge between the tissue portion and the bridge portion, wherein the

width of the tissue portion is greater than the width of the bridge portion, and wherein the lines of detachment do not extend beyond the edge into the tissue portion.

2. The manifold layer of claim 1, wherein the lines of detachment are configured to allow the bridge portion to be displaced from a first position relative to the tissue portion to a second position relative to the tissue portion.

3. The manifold layer of claim 1, wherein the one or more lines of detachment comprise at least one slit or at least one perforated line or a combination thereof.

4. The manifold layer of claim 1, wherein the bridge portion is configured to be rotated relative to the tissue portion about an axis substantially perpendicular to the first surface and the second surface, and wherein the bridge portion is configured to be rotated relative to the tissue portion about an axis substantially parallel to the first surface and the second surface, or combinations thereof.

5. The manifold layer of claim 1, wherein, in a first position the bridge portion is disposed adjacent to the edge of the tissue portion, and wherein, in a second position, the bridge portion is further away from the tissue portion than in the first position.

6. The manifold layer of claim 5, wherein the bridge portion is configured to be rotated about an axis substantially perpendicular to the first surface and the second surface to the second position in which a distal end of the bridge portion is further away from the tissue portion than in the first position.

7. The manifold layer of claim 5, wherein the bridge portion is configured to be rotated about an axis substantially parallel to the first surface and the second surface to the second position in which a distal end of the bridge portion is further away from the tissue portion than in the first position.

8. The manifold layer of claim 1, wherein, in a first position the bridge portion at least partially circumscribes the tissue portion.

9. The manifold layer of claim 8, wherein the bridge portion is configured to be rotated relative to the first surface and the second surface to a second position in which the distal end of the bridge portion is further away from the tissue portion than in the first position.

10. The manifold layer of claim 1, wherein in a first position the bridge portion is disposed adjacent to the edge of the tissue portion and comprises a serpentine pattern.

11. The manifold layer of claim 10, wherein the bridge portion is configured to be rotated about a plurality of axes substantially perpendicular and substantially parallel to the first surface and the second surface to a second position in which the distal end of the bridge portion is further away from the tissue portion than in the first position.

12. The manifold layer of claim 1, further comprising a first polymeric layer disposed adjacent to the first surface of the manifold layer and comprising a first plurality of fenestrations extending through the first polymeric layer.

13. The manifold layer of claim 12, further comprising a second polymeric layer disposed adjacent to the second surface, wherein the second polymeric layer comprises a negative-pressure aperture, and wherein the negative-pressure aperture is disposed in the second polymeric layer adjacent to the bridge portion.

14. The manifold layer of claim 13, wherein the second polymeric layer comprises a second plurality of fenestrations extending through the second polymeric layer.

15. The manifold layer of claim 13, wherein the first polymeric layer is coupled to the second polymeric layer about a periphery of the manifold layer.

16. The manifold layer of claim 1, wherein the manifold layer comprises an open-cell foam.

17. A dressing for treating a tissue site with negative pressure, comprising; the manifold layer of claim 1; and a flexible drape configured to form a sealed space including the manifold layer at the tissue site.

18. A system for treating a tissue site, comprising: the manifold layer of claim 1; a drape configured to form a sealed space including the manifold layer at the tissue site; and a negative-pressure source

fluidly coupled to the manifold layer through the drape.

19. A method for treating a tissue site with negative pressure, comprising: extending the bridge portion of the manifold layer of claim 1 away from the tissue portion; positioning the manifold layer relative to the tissue site such that the tissue portion is adjacent to the tissue site and the bridge portion extends away from the tissue site; sealing the manifold layer to epidermis adjacent to the tissue site; fluidly coupling the tissue portion to a negative-pressure source via the bridge portion; and applying negative pressure to the tissue portion through the bridge portion using the negative-pressure source.