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(54) **ASPIRATION SYSTEM FOR REMOVING LIQUID OTHER THAN URINE DISCHARGED BY THE HUMAN BODY**

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(57) **ABSTRACT**

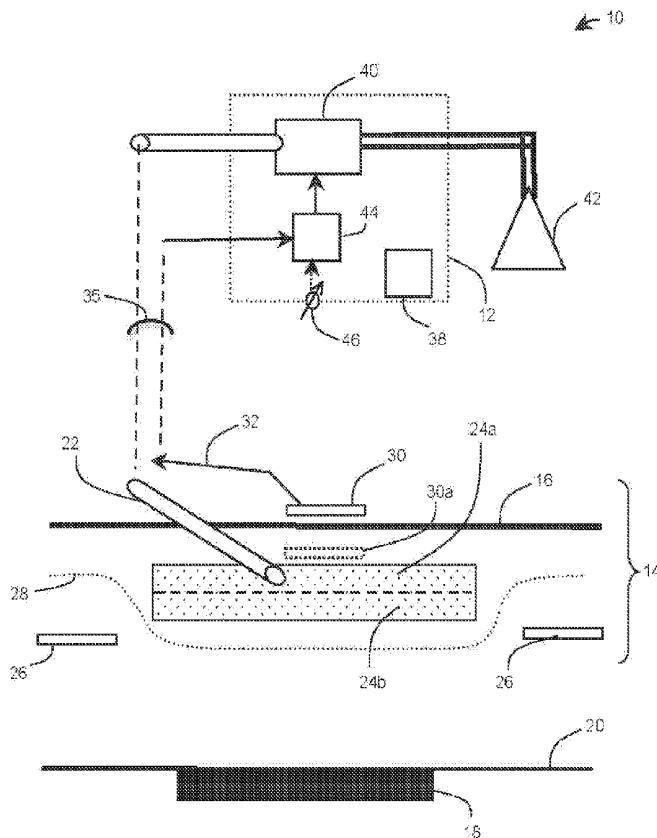
(21) Appl. No.: **12/738,332**

An aspiration system for removing liquid other than urine, which liquid is discharged from the human body, comprises a disposable body interface device having a liquid collection chamber. A liquid sensor detects the presence of liquid within the chamber, and controls application of aspiration suction to remove liquid from the liquid collection region. The body interface device may be a wound dressing, and the liquid wound exudate. The aspiration suction is controlled to remove only excess wound exudate.

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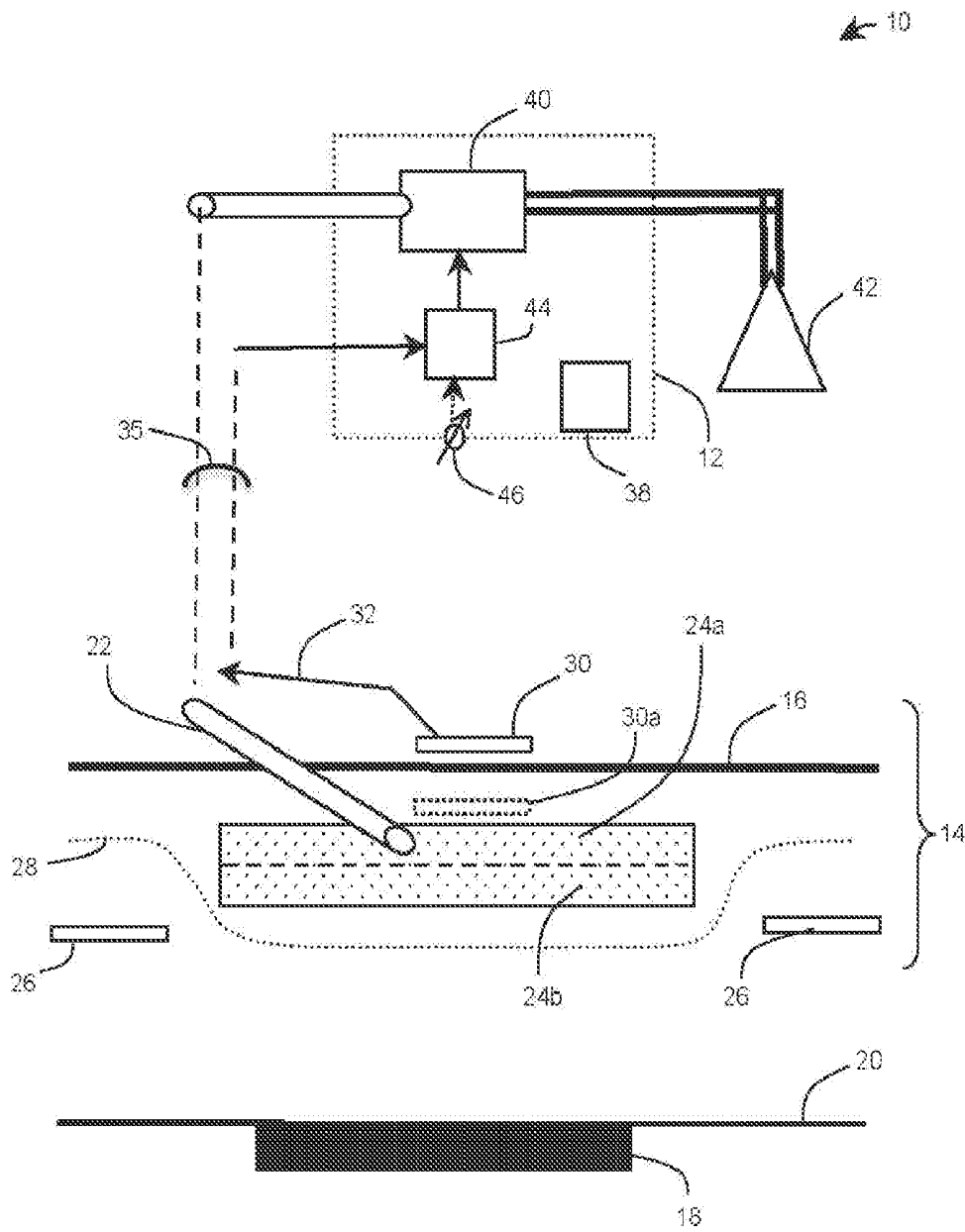


FIG. 1

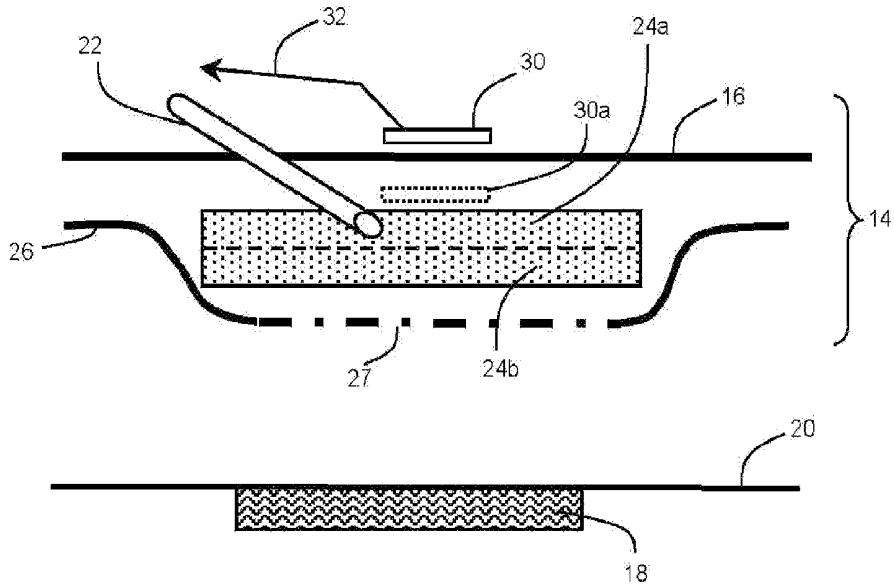


FIG. 2

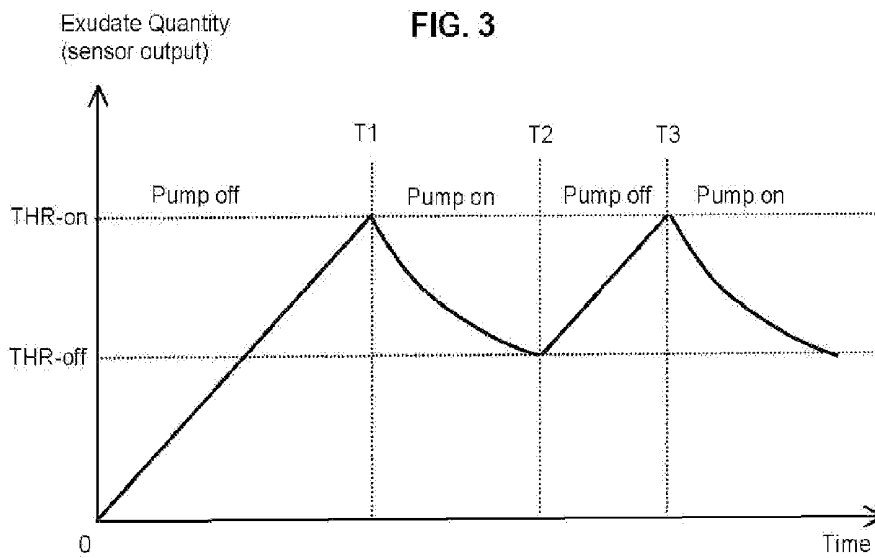


FIG. 3

**ASPIRATION SYSTEM FOR REMOVING  
LIQUID OTHER THAN URINE DISCHARGED  
BY THE HUMAN BODY**

FIELD OF THE INVENTION

**[0001]** The present invention relates to an aspiration system for use in removing liquids discharged by the human body. The invention may be used for removing body fluids and secretions other than urine. One aspect of the invention relates to removal of wound exudate.

BACKGROUND TO THE INVENTION

**[0002]** Wound exudate can be described as the liquid produced from chronic wounds, fistula, or acute wounds once haemostasis has been achieved. For centuries, the production of exudate was regarded as inevitable with certain types of wound, and inconsequential with respect to wound healing.

**[0003]** More recently, considerable attention has been given to the development of wound dressings that prevent the accumulation of large volumes of fluid within a wound, and also prevent the fluid from spreading over the surrounding healthy tissue. This is because excessive wound exudate can cause maceration of the peri-wound skin, which in turn can lead to infection. One technique known in the art is the application of suction to create negative pressure at the wound site, as taught in U.S. Pat. Nos. 4,969,880, 5,636,643, 5,645,081, 7,216,651, and U.S. Patent Publication No. 2001/0029956. Negative pressure means pressure below surrounding atmospheric pressure. Such a technique is referred to in the art as Topical Negative Pressure (TNP). This is believed by some researchers to aid drainage of wound exudate away from the wound bed, reduce infection rates, and increase localized blood flow.

**[0004]** The prior art arrangements are said to permit medical staff to manually adjust the duty cycle times of the application of suction. However, if too much suction is applied, complications occur diminishing the benefits of the wound dressing. In particular:

**[0005]** (i) The negative pressure tends to draw tissue growth into the pores of a foam piece inside the wound dressing. This can result in discomfort to the patient during use of the device, and both discomfort and potential new tissue damage upon removal or changing of the dressing.

**[0006]** (ii) The wound is vulnerable to drying out of wound exudate. This condition is undesirable because exudate is now believed to contain a complex mixture of bioactive molecules that have both positive and negative effects. While removal of excess exudate is desirable, removal of all exudate may hinder rather than aid wound healing. Proper use of the wound dressing may depend to a large extent on the expertise of medical staff in assessing the rate of production of wound exudate at the wound site, and adjusting the suction accordingly. If frequent removal of the dressing is required to assess the state of the wound and exudate, this merely exacerbates discomfort caused by drawback (i) above.

**[0007]** Some of the drawbacks may be partly mitigated by the use of hydro-fiber as described in U.S. Patent Publication No. 2006/0100594. However, this does not solve the root problem.

**[0008]** The present invention has been devised bearing such issues in mind.

SUMMARY OF THE INVENTION

**[0009]** Aspects of the invention are defined in the claims.

**[0010]** In a further broad aspect, an aspiration system and method are provided for removing liquid other than urine, which liquid is discharged from the human body. The system comprises a disposable body interface device having a liquid collection chamber. A liquid sensor detects the presence of liquid within the chamber. The application of aspiration suction to remove liquid from the liquid collection region is controlled responsive to the output of body fluids and secretions detected by the liquid sensor. The body interface device may be a wound dressing to allow controlled draining of the liquid wound exudate. The aspiration suction can be controlled to remove only excess wound exudate, according to the output of body fluids and secretions detected by the liquid sensor.

**[0011]** While certain features and ideas are emphasized above and in the appended claims, the Applicant may seek claim protection for any novel feature or idea described herein and/or illustrated in the drawings, whether or not emphasis has been placed thereon.

BRIEF DESCRIPTION OF THE DRAWINGS

**[0012]** FIG. 1 is a schematic block diagram of a first embodiment of aspiration system for collecting and removing liquid wound exudate discharged by a wound of the human body, the diagram including an exploded sectional view of the wound dressing components.

**[0013]** FIG. 2 is a schematic sectional view showing, in exploded form, a modification of the wound dressing from FIG. 1.

**[0014]** FIG. 3 is a schematic diagram showing operation of the aspiration system in graphical form.

DETAILED DESCRIPTION OF PREFERRED  
EMBODIMENTS

**[0015]** Preferred embodiments of the invention are now described with reference to the drawings. The same reference numerals are used to depict the same or equivalent features in each embodiment.

**[0016]** Referring to FIG. 1, an aspiration system 10 for removing body liquid (other than urine) discharged or secreted by the human body generally comprises: a body interface device 14; and an aspiration unit 12 for applying suction to the body interface device 14 to aspirate the body liquid. The present embodiment illustrates an aspiration system 10 specifically for removal of wound exudate from a wound site 18. The body interface device 14 is in the form of (and is hereafter referred to as) a wound dressing, configured for fitting to the body at, or around, the wound site 18. The field of wound dressings with exudate aspiration is quite unique, and very different from the field of, for example, urine removal. Urine is usually discharged as a gush of liquid, and a urine removal system should remove all urine to leave the skin dry in order to avoid irritation and infection. In contrast, wound exudate is not discharged in a gush, and it is not desirable to remove all of the wound exudate. The exudate contains a complex mixture of bioactive molecules that have both positive and negative effects. While removal of excess exudate is desirable, removal of all exudate may hinder rather

than aid wound healing. Instead, the present embodiment aims to manage the amount of wound exudate, and remove excess from the wound site.

**[0017]** As explained in more detail later, such management is facilitated in accordance with the principles of the invention by provision of a liquid sensor **30** for detecting liquid exudate in the wound dressing **14**. The liquid sensor **30** generates a signal **32** indicative of sensed liquid. The sensor **30** may detect one or both of the following parameters: (i) proximity of liquid, and/or (ii) a quantity of liquid within sensing range. The aspiration unit **12** is responsive to the sensor signal **32** in order to control the application of aspiration suction. Such an arrangement provides the extremely significant advantage of being able to control the aspiration of wound exudate automatically, to remove excess exudate while preserving a desired residual quantity of exudate within the wound dressing without drying out the wound.

**[0018]** The constitution of the aspiration system **10** is now described in more detail. The wound dressing **14** is preferably attachable to the patient's skin **20** by means of an adhesive pad **26**. In the form illustrated in FIG. 1, the adhesive pad **26** has a closed loop shape that circumscribes the periphery of the wound site **18**. In the form illustrated in FIG. 2, the adhesive pad **26** extends over the wound site **18**, and has perforations or apertures **27** to permit passage of exudate from the wound site **18** into the wound dressing **14**. The adhesive pad **26** is made of a skin-friendly medical grade adhesive. Examples of suitable adhesives include pressure-sensitive adhesives that may be any of hydrocolloid, polyurethane, acrylic, thermoplastic elastomer (TPE), hydrogel, or silicone-based.

**[0019]** The wound dressing **14** may have any suitable construction for covering the wound site **18**, defining a liquid collection region and at least partly a local environment conducive to wound healing. For example, the wound dressing **14** may be the same as, or similar to, the dressings shown in any of the aforementioned U.S. Pat. Nos. 4,969,880, 5,636,643, 5,645,081, 7,216,651, and/or U.S. Publication Nos. 2001/0029956 and 2006/0100594. The wound dressing **14** typically comprises a cover **16** extending over the wound site **18**, and overlapping healthy peri-wound tissue. The wound dressing **14** may optionally contain or comprise a liquid handling material **24** (**24a**, **24b**). The liquid handling material **24** may, for example, be a material for absorbing exudate without gelling. Such a material may be non-woven and/or a foam. Such a non-woven material could be hydrophobic or hydrophilic, synthetic or natural. The liquid handling material **24** may alternatively be, or comprise, a fibrous blend or fibrous material (e.g., a non-woven) that forms a cohesive gel when wetted with wound exudate. Such a fibrous material can be provided, for example, by the wound contact layer of the Versiva® dressing (ConvaTec Inc., Skillman, N.J.) or by a fibrous mat of sodium carboxymethylcellulose. A fibrous mat of sodium carboxymethylcellulose is available as AQUACEL® dressing from ConvaTec Inc., as is a similar dressing further including silver. Other exemplary materials for the liquid handling material **24** include Medice™, Carboxflex™ (which provides an odor absorbent layer with fibrous material for wicking liquid away from the odor absorbent), Hyalofill™ (forming a hyaluronic acid-rich fibrous gel) or Kaltostat™ (containing alginate) dressings from ConvaTec Inc. While the liquid handling layer **24** has the ability to absorb the exudate quickly, it also allows exudate to be pumped away under suction.

**[0020]** In a further form, a combination of both a non-gelling liquid handling layer **24a** and a fibrous gelling layer **24b** may be used, for example, in distinct layers. The layers **24a** and **24b** may be bonded to each other, or they may be contained as separate layer components within the wound dressing **14**. FIG. 1 illustrates an optional perforated screen **28** that may be used, for example, to enclose such layers **24a** and **24b**. Furthermore, liquid handling layer **24b** may be perforated to allow excess exudate to be absorbed by liquid handling layer **24a**.

**[0021]** An aspiration source connector **22** (e.g. silicone tubing) extends into the wound dressing **14** for delivering aspiration suction from the aspiration unit **12**. In the form illustrated, the connector **22** extends through the cover **16**, although the connector **22** could enter the wound dressing **14** at any suitable point. Preferably, the point at which suction is applied is separated from the wound site **18** by at least a portion of the liquid handling material **24**. In the preferred form including both non-gelling and gelling layers **24a**, **24b**, respectively, the point at which suction is applied is spaced from the wound site **18** by at least the gelling layer **24b**, and preferably also by at least a portion of the non-gelling layer **24a**.

**[0022]** A flexible conduit **35** couples the wound dressing **14** to the aspiration unit **12**. A releasable connector or an easy release coupling may be provided at one end, or both ends, of the conduit **35**. The flexible conduit **35** may be regarded as part of the aspiration unit **12** and/or part of the body interface device **14**. The flexible conduit **35** links the connector **22** to a suction source **40** within the aspiration unit **12**. The aspiration unit **12** comprises a power supply **38**, an electronic control unit **44**, and the suction source **40**. The power supply **38** is selected as one or more of: a replaceable battery, a rechargeable battery, radiation collection panels, and a mains power supply. Preferably, the power supply **38** includes a combination of a rechargeable battery and a mains power supply; such a combination allows portable operation when the aspiration system **10** is not connected to a mains power supply, as well as automatic recharging of the battery when the aspiration system **10** is coupled to a mains power supply. Additionally or alternatively, the power supply **38** includes radiation collection panels, such as photovoltaic panels or cells for generating electricity from ambient light, which can improve autonomy of operation or for charging the rechargeable battery. The power supply **38** may provide power for any one or more of: the electronic control unit **44**, the liquid sensor **30** (if needed) and any power needed by the suction source **40**. In the present embodiment, the suction source **40** is an electric pump that operates under control of the electronic control unit **44**. The pump **40** could be a suction device based on diaphragm, peristaltic, volume displacement, spring, gravity, siphon, heat-recoverable metal drive, or an in-line pump. The flexible conduit **35** is coupled through the pump **40** to a liquid collection chamber **42** for collecting exudate removed from the wound dressing **14**. The liquid collection chamber **42** may either be separate from the aspiration unit **12** (as illustrated) and coupled thereto with a suitable connector, or the liquid collection chamber **42** may be integral with and/or housed in the aspiration unit **12** (arrangement not shown). In an alternative form, instead of a pump **40** directly applying suction to the flexible conduit **35**, the suction source **40** may comprise a vacuum chamber charged with a low pressure vacuum, and an electronically controlled valve for controlling application of

suction from the vacuum chamber to the flexible conduit **35**. A pump may be provided for charging the vacuum chamber with the vacuum.

**[0023]** The liquid sensor **30** may be separate or separable from the wound dressing **14**, enabling replacement of the wound dressing **14** without having to use a new sensor **30**. In such a case, a means is preferably provided for releasably attaching the sensor **30** to the wound dressing **14**. Alternatively, the liquid sensor **30** may be permanently attached to the wound dressing **14** to form an integral unit. With permanent attachment, the liquid sensor **30** is intended to be disposed of with the wound dressing **14**.

**[0024]** The sensor signal **32** is typically an electrical or electronic signal. However, other signal forms may be used as desired, for example, optical.

**[0025]** The sensor **30** may generate output signal **32** that varies in accordance with the sensed parameter(s). For example, the output signal **32** may be a varying analog signal (e.g., variable current or voltage), or the output signal **32** may be a digital signal (e.g., a quantized representation, or a variable pulsed representation). Alternatively, the output signal **32** may be a logical (e.g., binary, or on/off) signal indicating whether or not the sensed parameter exceeds or is below one or more thresholds.

**[0026]** The liquid sensor **30** is preferably a non-contact sensor that is able to detect the presence or proximity of liquid without contact with the liquid. The liquid sensor **30** generates an electrical output signal responsive to proximity of detected liquid. The electrical signal is communicated to the aspiration unit **12** either via the conduit **35**, or via a separate wire or wireless connector. A wired electrical connector may also supply power from the aspiration unit **12** to power the liquid sensor **30**.

**[0027]** The feature of the liquid sensor **30** being a non-contact sensor provides significant advantages because: (i) the non-contact approach automatically avoids any concerns about passing an electrical current through liquid in contact with the skin **20** and wound site **18**. Instead, there is no direct contact between the liquid sensor **30** and the liquid; (ii) the non-contact approach means that the liquid sensor **30** is not contaminated by touching the liquid exudate. This allows the liquid sensor **30** easily to be reused with a different wound dressing **14**; and (iii) the non-contact approach means that the liquid sensor **30** does not itself have to be in a sterile condition before use, thus avoiding the difficulty of, or risk of damage when, sterilizing the aspiration system **10** that does interface intimately with the body. The feature of the liquid sensor **30** being coupled to the aspiration unit **12** by an electrical connector avoids the expense and fragility associated with using an optical fiber connection.

**[0028]** An optional feature of the invention is that the liquid sensor **30** is separate from, or at least separable from, the wound dressing **14**. The wound dressing **14** may be a disposable item that may be manufactured inexpensively, and disposed of after a single use, or a limited number of uses. The liquid sensor **30** may be more expensive, but may be intended to be used plural times, preferably, with a sequence of different wound dressings **14** used during wound treatment. This enables the aspiration system **10** to be produced and used very cost efficiently, since the disposable components are generally low cost. The higher cost components may be used multiple times, and may require infrequent replacement. In one

form, the liquid sensor **30** is a universal device that may be used with any of a plurality of different types of wound dressings **14**

**[0029]** Alternatively, the non-contact sensor may be permanently attached to the wound dressing **14**, and not be a reusable item.

**[0030]** The liquid sensor **30** can take a variety of different forms.

**[0031]** The liquid sensor **30** is selected from: a capacitance sensor; an ultrasonic sensor; and a piezo-electric (or piezo-resonant) sensor. A capacitance sensor detects proximity of liquid according to changes in the dielectric effect of liquid proximity, compared to air proximity. The dielectric effect affects the electric field in the active zone around the sensor, and thus, the effective capacitance in the sensor. The capacitance is monitored by any suitable capacitance sensing circuit (not shown), such as an RC oscillator whose oscillation frequency and/or whether oscillation occurs, is dependent on the value of a resistor in combination with the effective capacitance of the sensor. The oscillation in turn triggers an output stage, coupled to an output amplifier, to generate an output signal indicative of liquid presence. The capacitance sensing circuit is preferably disposed near or at the liquid sensor **18** (e.g., as part of the liquid sensor **18** itself), or the capacitance sensing circuit can be disposed at the aspiration unit **12**, or at a point along electrical connector **35**. A suitable capacitance sensor and capacitance sensing circuit are described in U.S. Pat. No. 5,576,619, the contents of which are hereby incorporated by reference.

**[0032]** The ability to detect liquid has been tested using a capacitance "smart" sensor from SIE Sensors. The sensor **30** of dimension 35 mm (length)×22 mm (width)×10 mm (height) was affixed to the external wall of a body interface device **14**. The sensor **30** detected the presence of two test liquids, water and saline solution, as soon as the liquid was introduced, and provided an activation signal to the aspiration unit **12** within milliseconds. The electric field from the sensor **30** is able to penetrate a wide variety of plastic components (e.g., polyethylene (PE), polypropylene (PP) and acrylics), either transparent or opaque, with great sensitivity.

**[0033]** An ultrasonic sensor works using the principle of sonar at the ultrasonic frequency range. A transducer is resonated at a set frequency to convert electric energy into ultrasonic frequency range acoustic energy. The ultrasonic acoustic waves are emitted towards a liquid collection region. Energy is reflected either from the walls if the region is empty of liquid, or from liquid if present in the region. By measuring the time delay for reflected waves to arrive, and comparing this to one or more pre-calibrated time delays taken when the liquid collection region is empty, the presence of liquid can be reliably and quickly detected. An example of ultrasonic liquid sensor is described in U.S. Pat. No. 3,960,007, the content of which is incorporated herein by reference. A commercially available ultrasonic sensor is made available by ZEVEX Inc.

**[0034]** A piezo-electric or piezo-resonant sensor also uses high frequency, e.g., ultrasonic energy or acoustic signal, in a similar way to the ultrasonic sensor described above. The ultrasonic or acoustic signal could penetrate either transparent or opaque plastic walls. An example of piezo-electric sensor is described in U.S. Pat. No. 3,948,098, the content of which is incorporated herein by reference.

**[0035]** The ability to detect liquid has been tested with a piezo-resonant sensor obtained from GEMS Sensors. The

sensor 30 of diameter 40 mm was attached to the external wall of the body interface device 14, and detected the presence of liquid as soon as introduced.

[0036] With the arrangement illustrated in FIGS. 1 and 2, the liquid sensor 30 is disposed outside the wound dressing 14, or at least outside a liquid collection region of the wound dressing 14. The cover 16 is typically made of material through which the sensing electric field can pass in the case of a capacitance sensor, or through which an ultrasonic vibration can pass in the case of an ultrasonic and/or piezo-electric sensor. The cover 16 may be made suitably thin to provide the sensor 30 with the desired sensitivity to liquid within the body interface device 14. Alternatively, the cover 16 may include a window portion made of material through which the electric field or ultrasonic vibration can pass easily if the entire cover 16 is not made of such a material. In an alternative embodiment, the housing of the wound dressing 14 can be shaped into a pocket with or without membrane, for receiving and retaining a capacitive, ultrasonic or piezo-electric non-contact liquid sensor 30. Such a design also increases the interface area between the sensor 30 and the liquid collection region of the wound dressing 14.

[0037] In an alternative embodiment, the sensor 30 is an electro-optical sensor. The cover 16 comprises a window region (not shown) made of material that is transparent to the optical radiation used by the electro-optical sensor. For example, the optical radiation may be in the infra-red range, and/or the visible range, and/or ultra-violet range. The term "optical" as used herein means that the radiation lies in a frequency range that obeys substantially the laws of optics. The electro-optical sensor comprises an electro-optical emitter, an electro-optical receiver, and sensing circuitry for detecting the presence of liquid according to the electrical output of the electro-optical receiver. The sensing circuitry is preferably disposed at the liquid sensor 30 (e.g., as part of the liquid sensor 30), or the sensing circuitry is disposed at the aspiration unit 12, or at a point along electrical connector 35. An example electro-optical liquid sensor is described in U.S. Pat. No. 4,354,180, the content of which is incorporated herein by reference.

[0038] If preferred, the liquid sensor may be disposed at a position 30a in contact with exudate inside the wound dressing 14, even if the sensor 30 does not rely on direct contact to detect the liquid. Such a possibility also enables the use of a contact-based sensor 30 instead of a non-contact sensor 30. An example of a contact-based sensor 30 is an electrical resistance sensor that detects liquid by conductance between electrodes in contact with the liquid.

[0039] In the case that the liquid sensor 30 is separate from, or at least separable from, the wound dressing 14, the liquid sensor 30 may be held in an operative position with respect to the wound dressing 14 by a detachable attachment device (not shown) for releasably attaching the liquid sensor 30 to the wound dressing 14. For example, the detachable attachment device could comprise a peelable adhesive, or a peelable mechanical fastener, such as Velcro, or a mechanical coupling based on interference fitting, or other mechanical means.

[0040] As mentioned previously, a goal of this embodiment is to manage wound exudate, so that excess exudate is removed efficiently while leaving a residual amount of exudate in the wound dressing 14. Referring to FIG. 3, when the wound dressing 14 is first fitted, the amount of wound exudate in the dressing 14 will rise progressively from zero as exudate is accumulated (for example, in the material(s) 24). The sen-

sor 30 and the control unit 44 co-operate to control the suction source 40 to keep the amount of exudate at a desired level. While the level could be indicated by a single threshold, preferably two thresholds THR-on and THR-off are used to introduce hysteresis to avoid the pump 40 being switched frequently. The upper threshold THR-on defines a threshold at which the pump 40 is switched to an aspiration mode (e.g., turned-on), and the lower threshold THR-off defines a threshold at which the aspiration is reduced or deactivated (e.g., pump 40 turned off), to stop further substantial remove of exudate. The amount of wound exudate will therefore fluctuate between the two thresholds, with the pump 40 being switched at successive time points T1, T2 and T3, for example.

[0041] The thresholds THR-on and THR-off may optionally be adjusted manually by means of a manual control 46 of the aspiration unit 12. This may allow medical practitioners to control variably the "wetness" of the wound site 18, and allow different healing environments to be established as desired by a medical practitioner. The control 46 may enable both thresholds to be adjusted. Alternatively, one of the thresholds may be fixed at a predetermined level. Alternatively, the difference between the thresholds may be variable, or may be fixed at a predetermined level.

[0042] The control unit 44 may function to apply the thresholds to the sensor signal 32. Alternatively, the sensor 30 itself may apply the thresholds, such that the output signal 32 is already thresholded. The sensitivity of the liquid sensor 30 may also be controlled by suitable positioning of the liquid sensor 30 with respect to the liquid handling material(s) 24 of the wound dressing 14 and/or by the thickness of the cover 16 in reducing the sensing field of the sensor 30. In one form, it might not be necessary to apply the lower threshold THR-off electronically. Instead, the sensor 30 may be sufficiently insensitive to liquid amounts below the threshold THR-off. Such an arrangement may be especially suitable when water-gelling material is used as the liquid handling material 24.

[0043] It will be appreciated that the aspiration system 10 as described herein provides significant advantages compared to the prior art, and can address or mitigate many of the drawbacks of the prior art, especially in terms of efficient aspiration of wound exudate, without drying out the wound site 18, and without requiring frequent changes of the wound dressing 14 to inspect the degree of wetness of the wound site 18.

[0044] It will be appreciated that many modifications, improvements and equivalents may be made within the claimed scope of the invention.

1. An aspiration system for removing liquids other than urine, which liquids are discharged by the human body, the aspiration system comprising:

- a. a body interface device having a liquid collection region for collecting said liquid other than urine discharged by the human body; and
- b. a liquid sensor disposed or disposable adjacent to the liquid collection region, for detecting the presence of discharged liquid in the liquid collection region.

2. The aspiration system according to claim 1, wherein the liquid sensor is configured to detect liquid without contact with the liquid.

3. The aspiration system according to claim 1, wherein the liquid sensor generates an electronic signal indicative of sensed liquid.

4. The aspiration system according to claim 1, wherein the body interface device is a disposable device.

5. The aspiration system according to claim 1, wherein the liquid sensor is separate or separable from the body interface device.

6. The aspiration system according to claim 1, wherein the liquid sensor is permanently attached to the body interface device.

7. The aspiration system according to claim 5, wherein the liquid sensor is configured to be used a plurality of times with different body interface devices.

8. The aspiration system according to claim 5, further comprising an attachment part for detachably attaching the liquid sensor to the body interface device.

9. The aspiration system according to claim 1, further comprising a garment wearable over the body interface device, the garment being configured to hold the liquid sensor captive in an operative sensing position adjacent to the body interface device.

10. The aspiration system according to claim 1, wherein the body interface device comprises a wound dressing for a wound site.

11. The aspiration system according to claim 1, wherein the liquid sensor is selected from: a capacitance sensor; an ultrasonic sensor; a piezo-electric sensor; an electro-optic sensor; and a temperature sensor.

12. The aspiration system according to claim 1, wherein the body interface device comprises a pocket or recess for receiving the liquid sensor adjacent to the liquid collection region.

13. The aspiration system according to claim 11, wherein the liquid sensor is a capacitance sensor, and wherein the body interface device comprises a wall or wall portion made of material through which the capacitance sensor can project an electric field.

14. The aspiration system according to claim 11, wherein the liquid sensor is an ultrasonic sensor, and wherein the body interface device comprises a wall or wall portion made of material through which an ultrasonic wave can be passed.

15. The aspiration system according to claim 11, wherein the liquid sensor is an electro-optic sensor, and wherein the body interface device comprises a wall or wall portion made of material through which optical radiation can be passed.

16. The aspiration system according to claim 1, further comprising a skin adhesive for releasably attaching the body interface device to the body.

17. The aspiration system according to claim 1, further comprising a liquid handling material within the liquid collection region, the liquid handling material comprising at least one selected from: a non-gelling liquid absorbing material; and a gelling liquid absorbing material.

18. The aspiration system according to claim 17 comprising a first region of gelling liquid handling material facing an opening of the body interface device, and a second region of non-gelling liquid handling material disposed on the opposite side.

19. An aspiration system for removing liquid other than urine, which liquid is discharged by the human body, the system comprising:

a liquid sensor configured to detect said liquid other than urine discharged from the body in the proximity of the sensor without contact with the liquid, the sensor generating an electrical output indicative of detected liquid, and the sensor being selected from: a capacitance sensor; an ultrasonic sensor; a piezo-electric sensor; an optical sensor.

20. The aspiration system according to claim 19, further comprising a body interface device having a liquid collection region for receiving the liquid other than urine, and wherein the liquid sensor is disposed outside the liquid collection region and configured to detect urine within the liquid collection region.

21. The aspiration system according to claim 20 wherein the body interface device comprises a wound dressing, and the liquid other than urine is wound exudate.

22. The aspiration system according to claim 21, further comprising an aspiration unit responsive to the output from the liquid sensor, and configured to generate suction to aspirate liquid from the body interface device when liquid is detected by the liquid sensor.

23. A wound dressing comprising a liquid sensor is configured to detect liquid discharged from the body in the proximity of the sensor without contact with the liquid, the sensor being selected from: a capacitance sensor; an ultrasonic sensor; a piezo-electric sensor; and an optical sensor.

24. The wound dressing of claim 23, wherein the liquid sensor is disposed adjacent to but outside a liquid collection region of the wound dressing for collecting exudate discharged from a wound, and is configured to detect the presence of exudate in the liquid collection region.

25. A method of preparing an aspiration system for removing liquid other than urine, which liquid is discharged by the human body, the method comprising:

- a. providing a body interface device having a liquid collection region for receiving said liquid other than urine discharged by the human body;
- b. providing a liquid sensor for detecting the presence of discharged liquid in the liquid collection region;
- c. providing an aspiration unit couplable to the body interface device and to the liquid sensor, the aspiration unit being operable to generate suction to aspirate liquid from the body interface device in response to the liquid sensor.

26. The method of claim 25, wherein the liquid sensor is separate or separable from the body interface device.

27. The method of claim 25, wherein the liquid sensor is permanently attached to the body interface device.

28. The method of claim 25, wherein the liquid sensor is a non-contact sensor for detecting the liquid without contact with the liquid.

29. The method of any of claims 25, wherein the body interface device is a wound dressing, and the liquid other than urine is wound exudate.

30. The method of any of claims 25, wherein the liquid sensor is selected from: a capacitance sensor; an ultrasonic sensor; a piezo-electric sensor; an electro-optic sensor; and a temperature sensor.

\* \* \* \* \*

专利名称(译)	用于除去人体排出的尿液以外的液体的抽吸系统		
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摘要(译)

一种用于除去尿液以外的液体的抽吸系统，该液体从人体排出，包括具有液体收集室的一次性体接口装置。液体传感器检测腔室内液体的存在，并控制抽吸抽吸的施加以从液体收集区域移除液体。身体界面装置可以是伤口敷料，并且液体伤口渗出物。控制抽吸抽吸以仅去除多余的伤口渗出液。

