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Shine et al.

(54) **ULTRASOUND GEL DISPENSING AND PROBE SANITIZING STATION**

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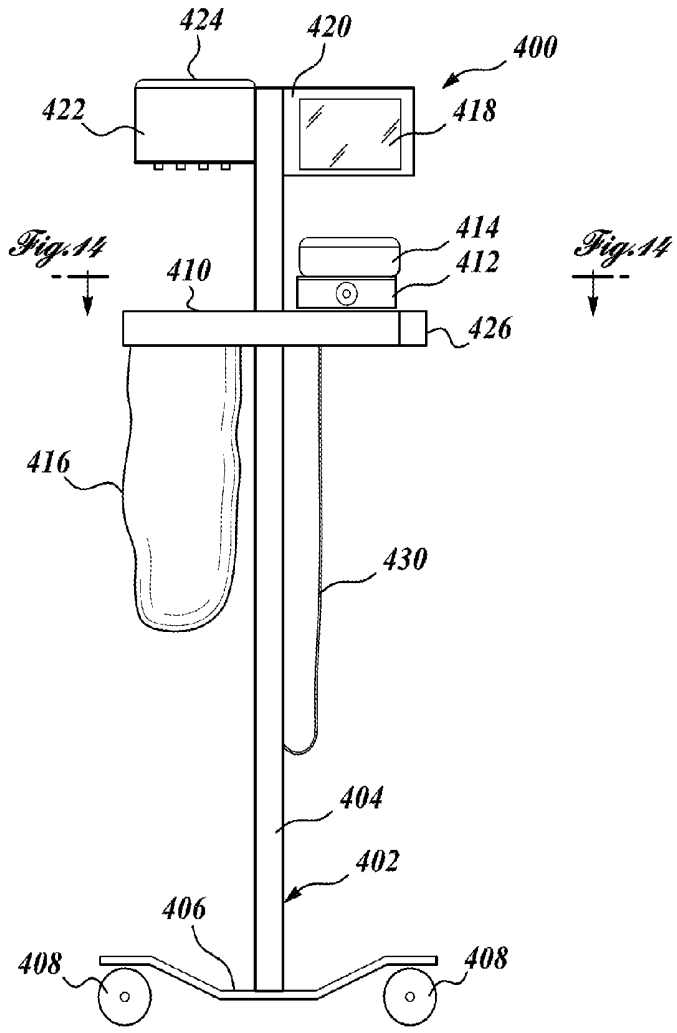
(57) **ABSTRACT**

A cart includes a power supply, a display unit, a holder having a primary coil positioned with respect to a compartment to be proximate a secondary coil of a handheld ultrasound probe when it is positioned in the compartment, a charging circuit that provides an alternating current to inductively couple the primary and the secondary coils, light sources operable to provide at least ultraviolet light, and a drive circuit electrically coupled to drive the light sources. The cart may include a dispenser with a container that can hold an ultrasound coupling medium, and a dispensing mechanism having a scoop with an elongated recess that is rotatably mounted with respect to the container to move between a first position in which the elongated recess is in fluid communication with the interior of the container and a second position in which the elongated recess is exposed to an exterior of the dispenser.



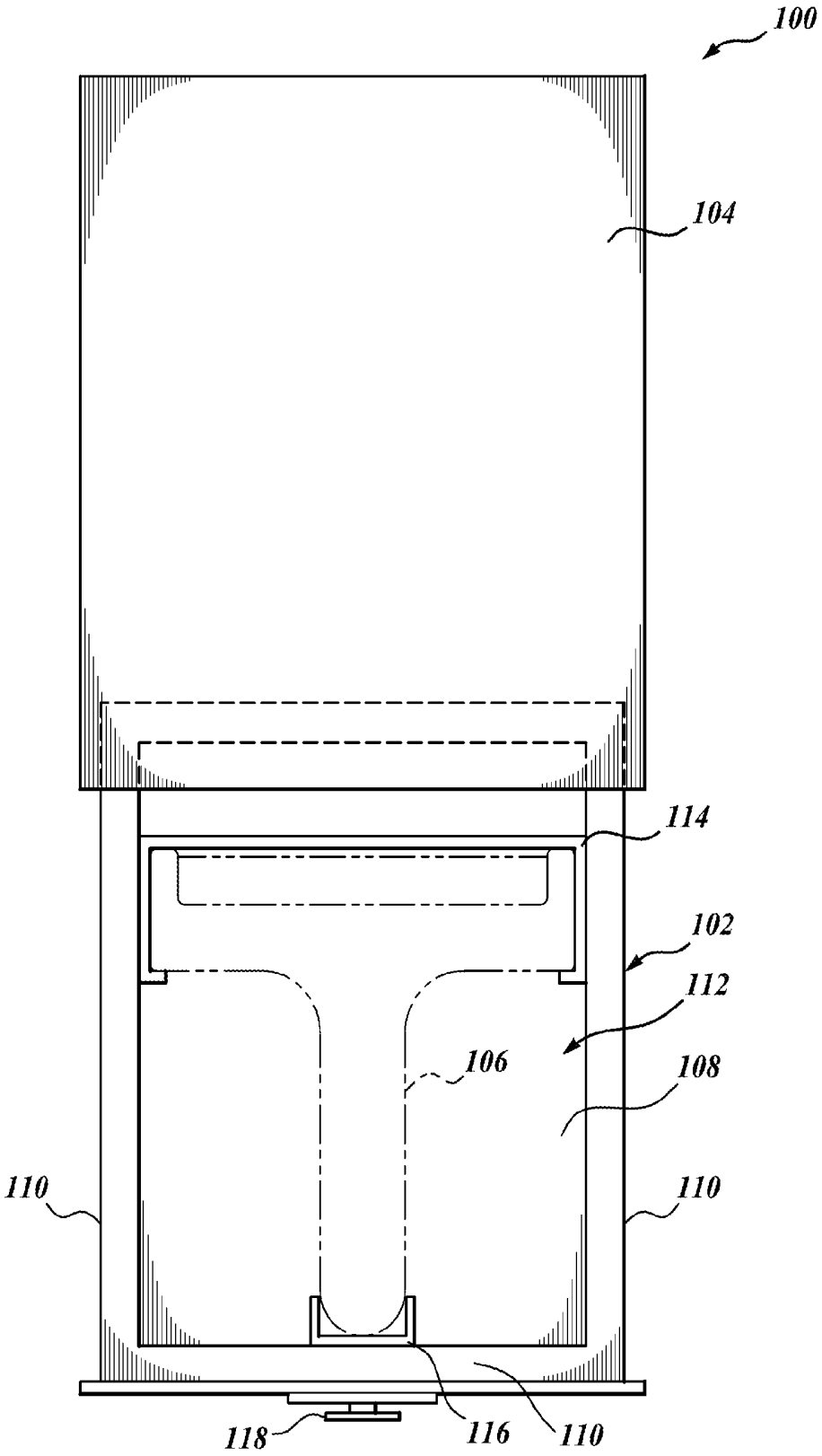


Fig. 1

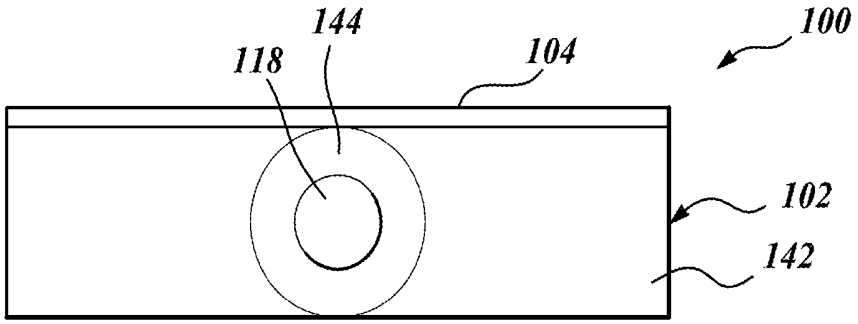

144
118
104
100
102
142

Fig.2

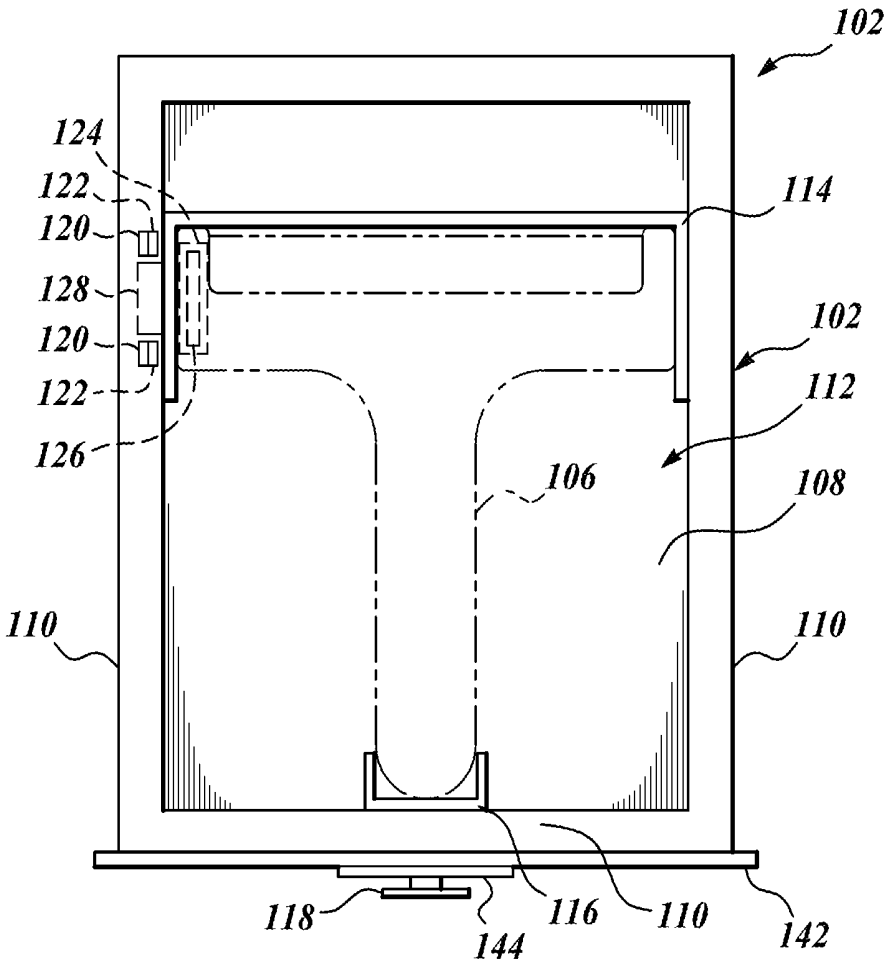

102
124
122
120
128
120
122
126
114
102
112
106
108
110
110
118
116
110
142
144

Fig.3

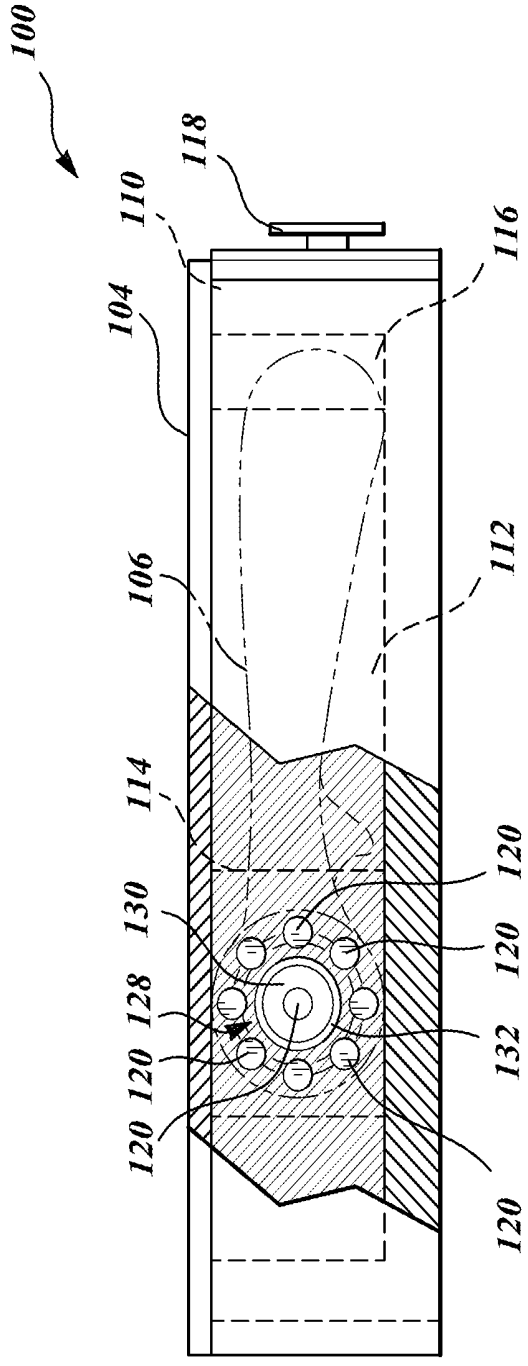


Fig. 4

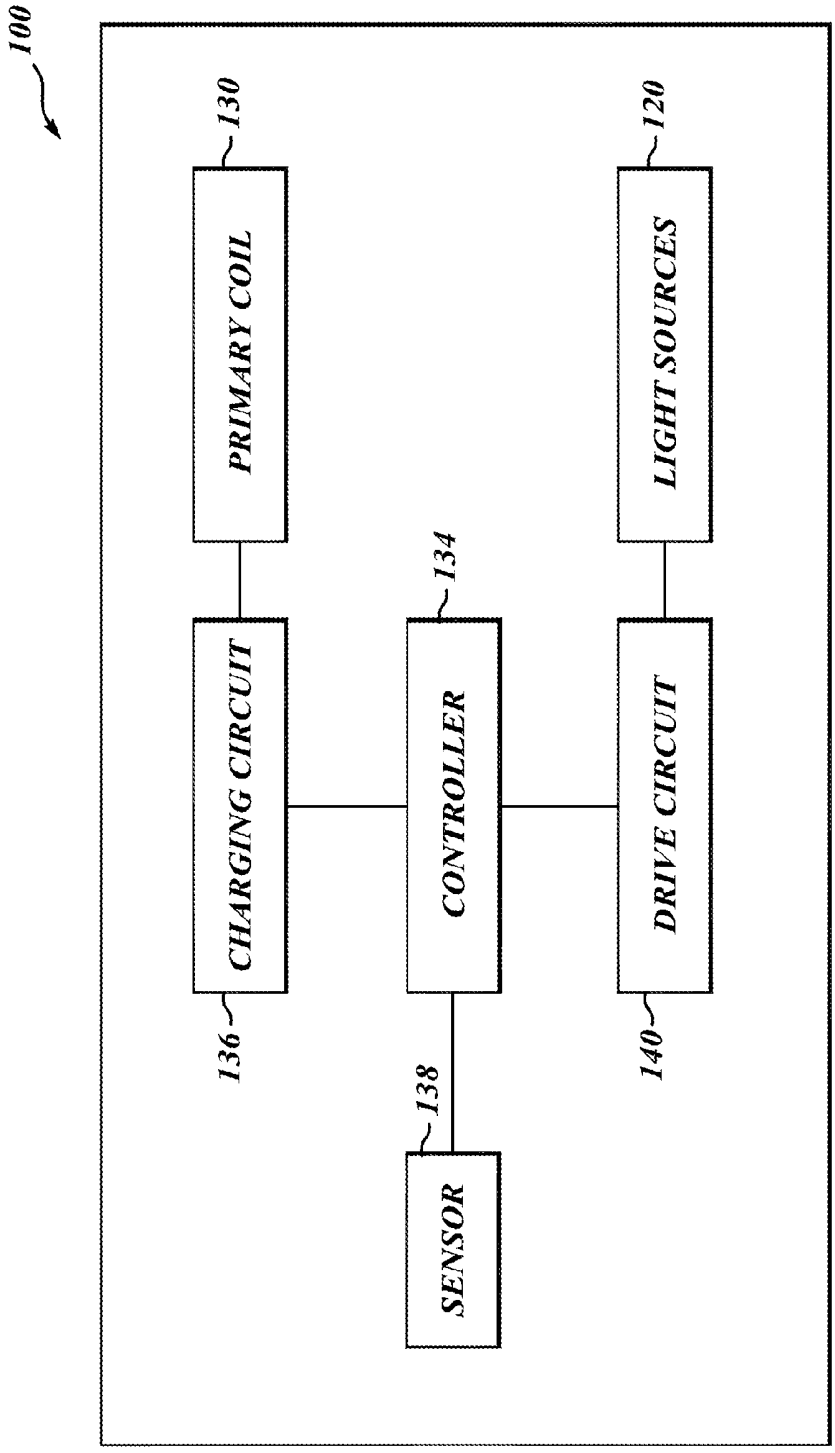

100
130
PRIMARY COIL
120
LIGHT SOURCES
134
CHARGING CIRCUIT
CONTROLLER
DRIVE CIRCUIT
136
138
140
SENSOR

Fig. 5

Fig.6

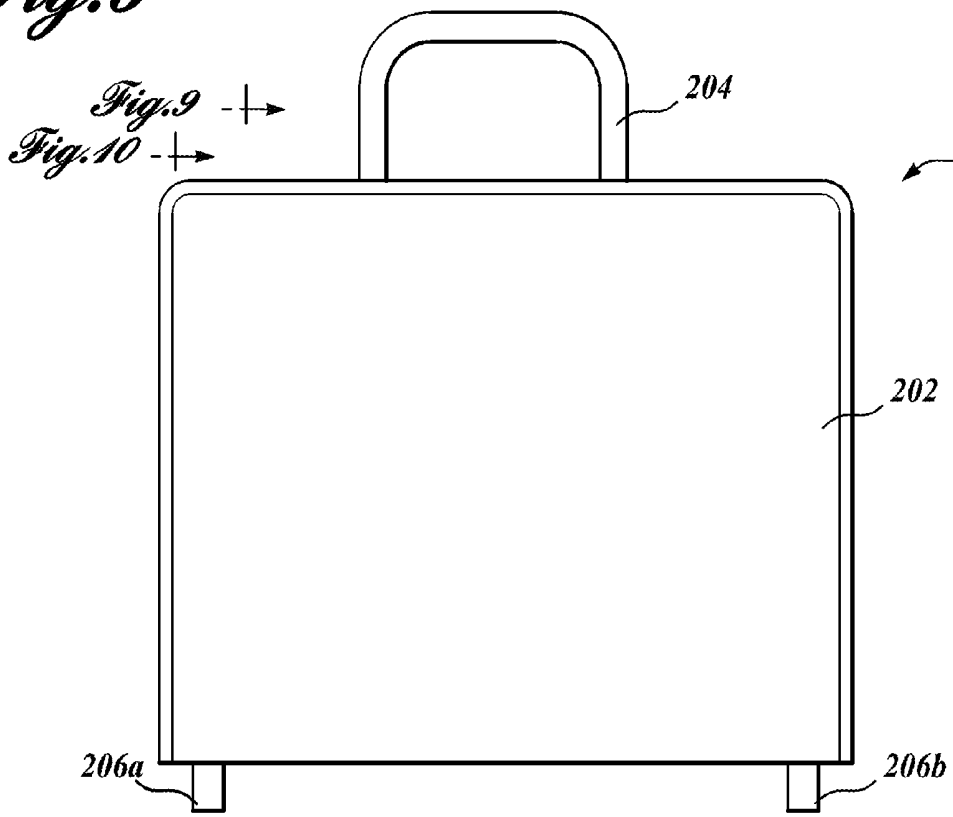
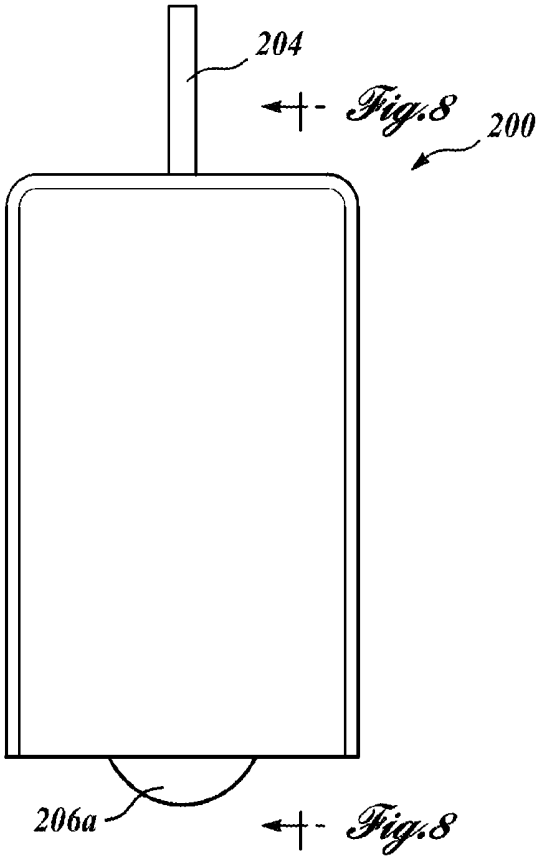


Fig.9
Fig.10
204
200
202
206a
206b
Fig.10
Fig.9

Fig.7


204
Fig.8
200
206a
Fig.8

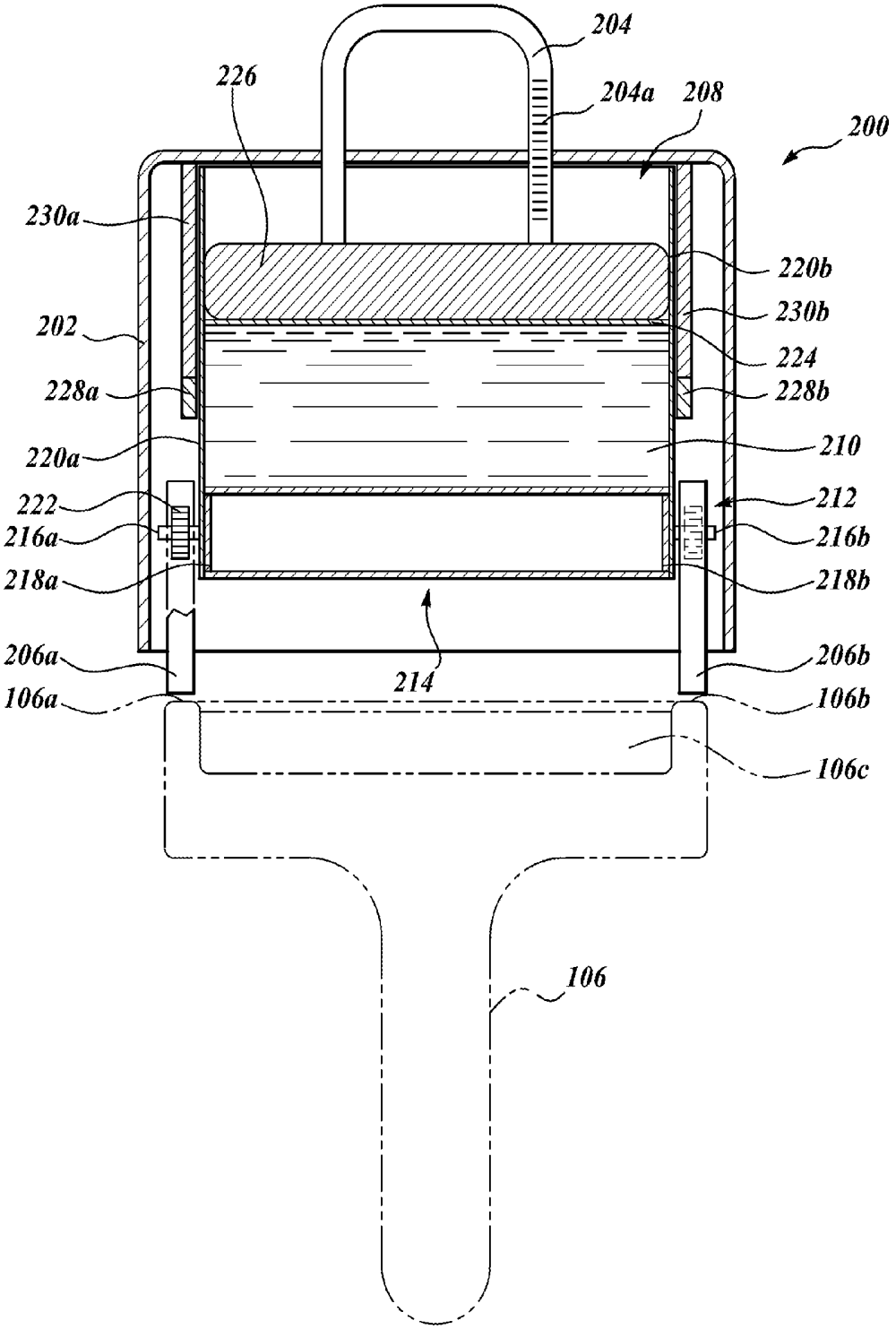

204
226
204a
208
200
230a
220b
230b
202
224
228a
228b
220a
210
222
212
216a
216b
218a
218b
206a
214
206b
106a
106b
106c
106

Fig.8

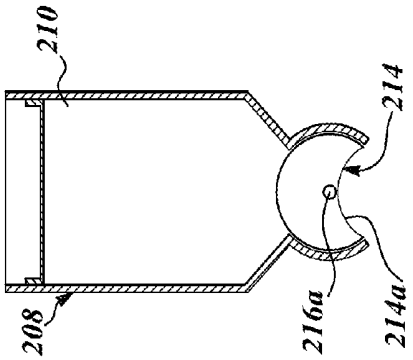


Fig. 9C

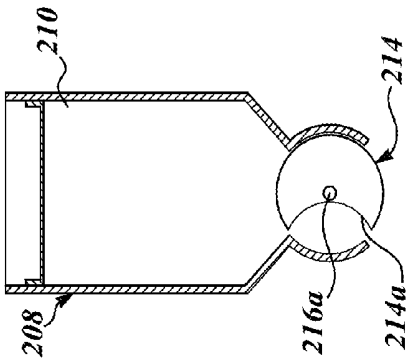


Fig. 9B

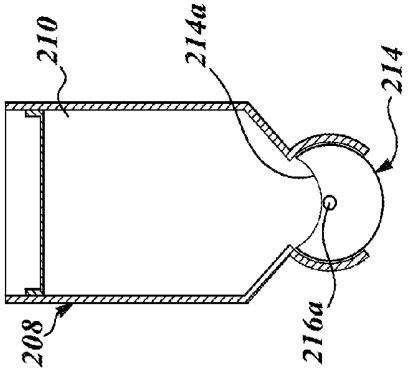


Fig. 9A

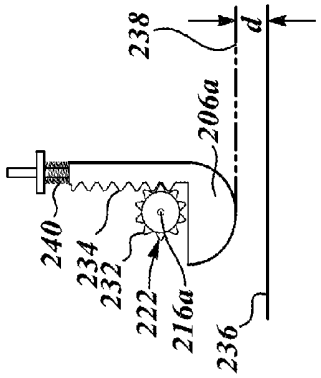


Fig. 10C

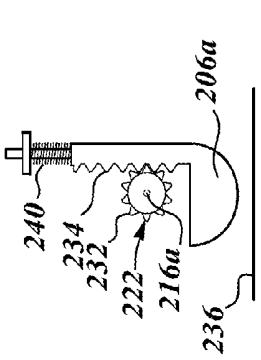


Fig. 10B

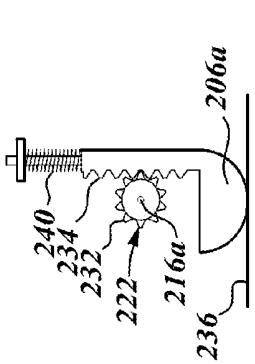


Fig. 10A

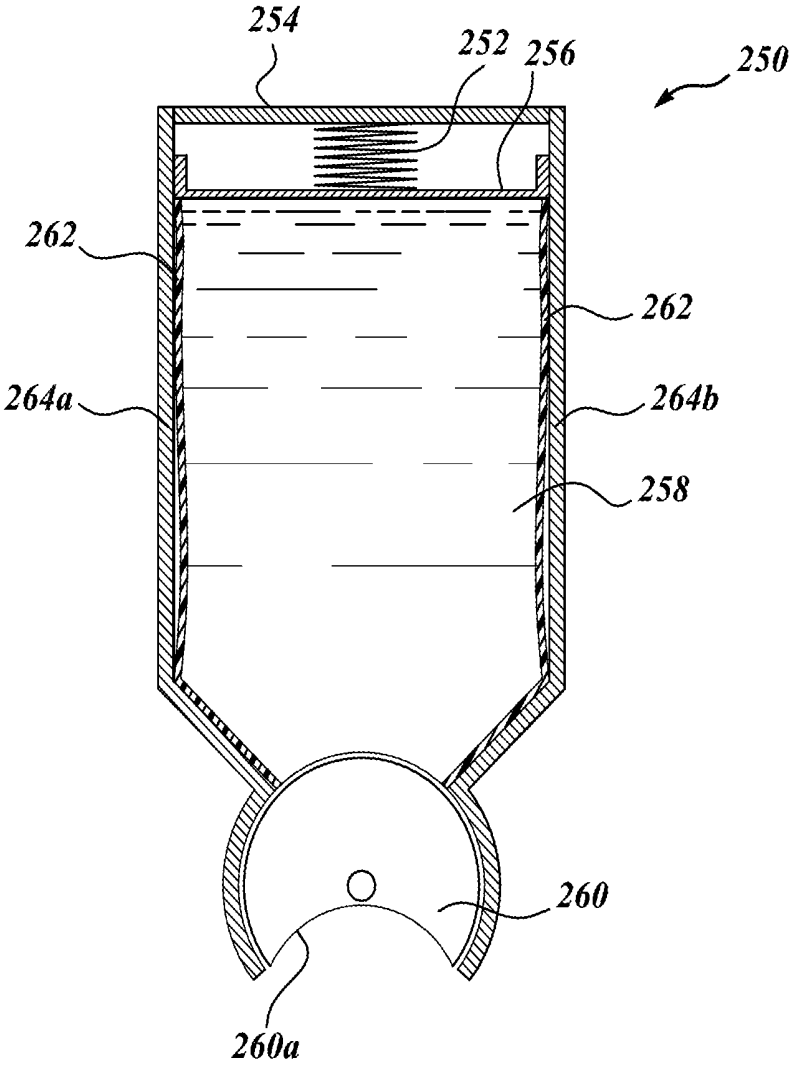


Fig. 11

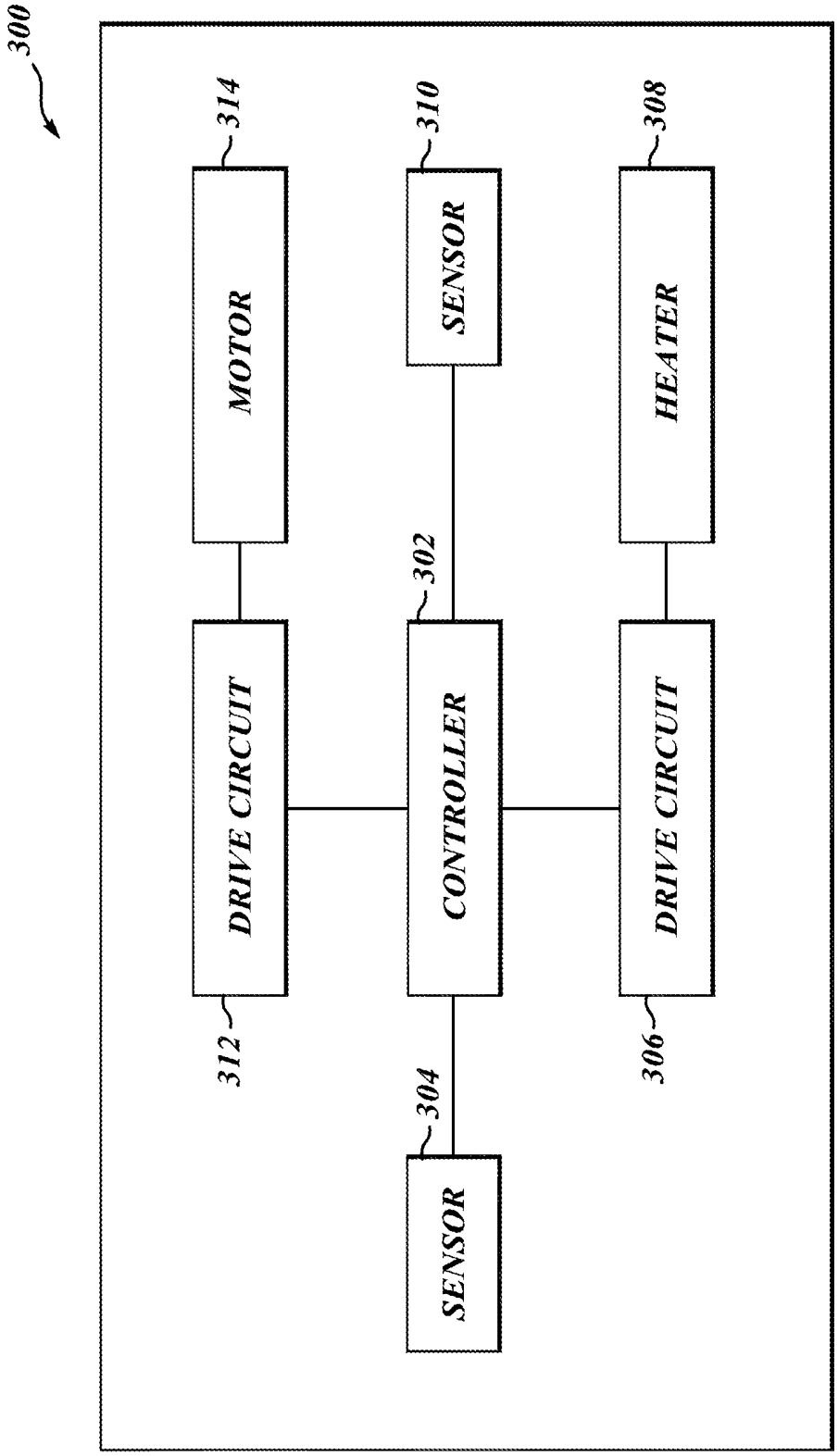

300
314
MOTOR
310
SENSOR
308
HEATER
302
DRIVE CIRCUIT
CONTROLLER
DRIVE CIRCUIT
312
304
306
SENSOR

Fig. 12

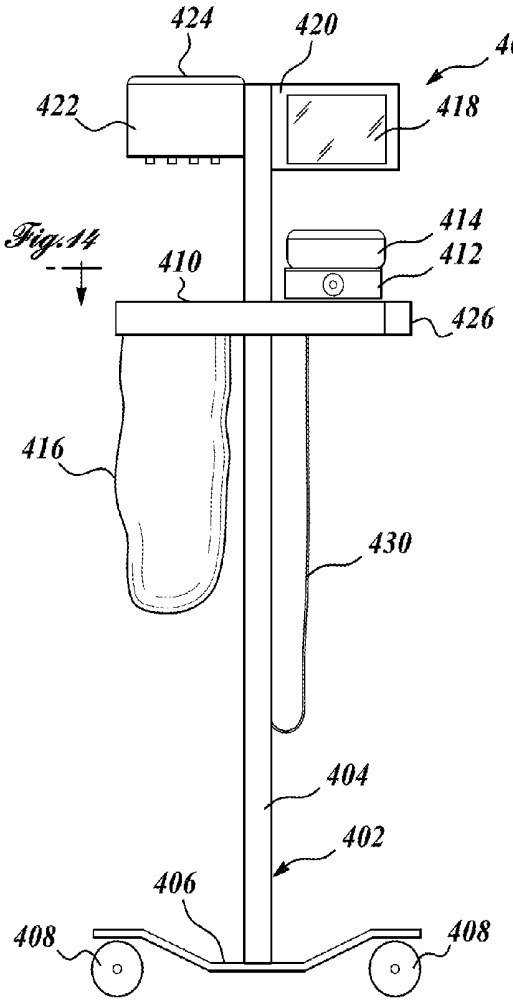

424
420
400
422
418
Fig.14
414
412
Fig.14
410
426
416
430
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Fig.13

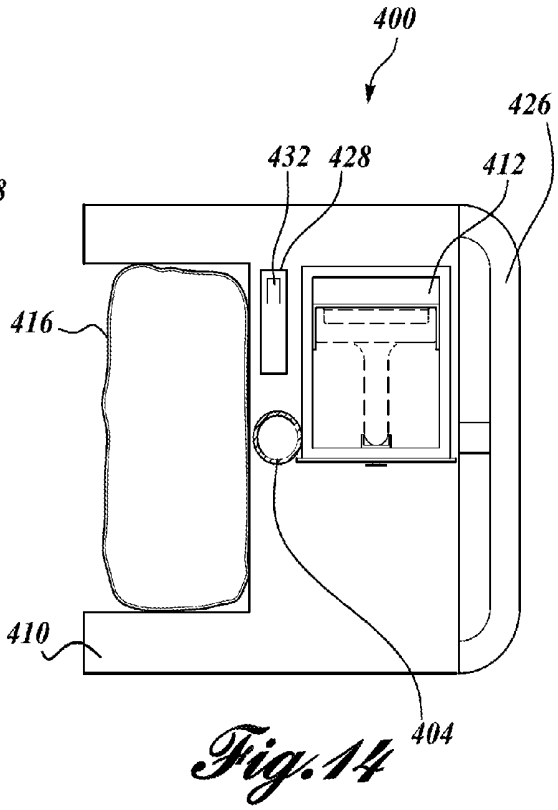
400
426
432
428
412
416
410
404

Fig.14

ULTRASOUND GEL DISPENSING AND PROBE SANITIZING STATION

BACKGROUND

[0001] 1. Technical Field

[0002] This disclosure generally relates to devices that may be used with ultrasound equipment, and more particularly to devices that may be used with handheld ultrasound probes.

[0003] 2. Description of the Related Art

[0004] Medical ultrasound requires the use of an ultrasound coupling medium to permit sonic energy to be efficiently transmitted into and received from the body of a patient. Typically, the coupling medium is in the form of a gel comprised primarily of water and having a consistency ranging from a tough gelatin to a runny paste. Generally, the more viscous the gel the better the ultrasound coupling properties; the vast majority of ultrasound exams are performed with a relatively viscous gel.

[0005] In a typical hospital setting, an ultrasound coupling medium is in the form of a water-based gel that is stored in a bottle formed from a pliable plastic material that an operator can squeeze to force the coupling medium out of a nozzle and onto the probe of an ultrasound device, the skin a patient, or both. Because the gel is generally stored at a room temperature that is over 25° F. cooler than the temperature of the patient's body, the patient may experience mild discomfort when the gel is initially applied. This is exacerbated by the very same properties that are useful for sonic coupling, because the water-based gel spreads out quickly and acts as a good thermal coupler. To provide a more comfortable experience to patients, ultrasound technicians may use conventional devices to electrically warm disposable bottles of ultrasound coupling media.

[0006] Because disposable bottles of gel for medical ultrasound contain only a limited amount of the gel, they tend to run out of the gel quickly. Additionally, such bottles become increasingly difficult to manipulate with use. For example, it may be difficult to squeeze out that last remaining amount of gel from such a bottle, which may result in an operator violently shaking the bottle in an upside-down position to attempt to move the remaining gel to an end of the bottle at which a dispensing nozzle is located. In addition, two-handed operation is typically required with such gel bottles regardless of whether the gel is applied to an ultrasound probe or to a patient's skin. For example, the operator may hold the ultrasound probe in one hand while manipulating a bottle containing a gel with the other hand to apply the gel to the ultrasound probe or the patient's skin.

[0007] Another issue associated with the use of medical ultrasound is cleaning, sanitizing, and sterilization of ultrasound probes. Ultrasound procedures typically require a liquid interface and skin contact, which may contaminate an ultrasound probe with pathogens from patients. To avoid cross contamination from one patient to another, a disposable plastic sheath or condom may be placed over the ultrasound probe. This takes extra time to deploy and provides an additional barrier that may obstruct and degrade the quality of ultrasound imaging. When a sheath is used, an ultrasound coupling gel typically must be used inside the sheath and on the outside of the sheath to provide adequate coupling, which is messy and increases the amount of gel that gets onto the ultrasound probe. In addition, the gel itself is typically not sterile and is dispensed from a multi-use bottle. Disposable sheaths are rarely used in practice because many operators consider them to be inconvenient. Moreover, because many operators do not use disposable gloves when performing ultrasound exams, the chances of contamination of the ultrasound probe increases.

BRIEF SUMMARY

[0008] This disclosure describes apparatuses, dispensers, and carts that overcome one or more of the problems identified above. For example, the present disclosure describes a portable station in the form of a cart with an apparatus that can sanitize an ultrasound probe while it is being charged and a gel dispenser that can be operated with one hand to improve an operator's experience and that can warm the gel to enhance a patient's experience.

[0009] An apparatus for use with a handheld ultrasound probe, the handheld ultrasound probe which includes a power storage device, may be summarized as including: a holder that forms a compartment, the compartment sized and dimensioned to receive at least a portion of the handheld ultrasound probe therein; a primary coil positioned with respect to the compartment to be proximate a secondary coil of the handheld ultrasound probe when the handheld ultrasound probe is positioned in the compartment; a charging circuit electrically coupled to the primary coil to selectively provide an alternating current therethrough of sufficient strength to inductively couple the primary and the secondary coils when the handheld ultrasound probe is positioned in the compartment; a plurality of light sources selectively operable to provide light at least from an ultraviolet band of an electromagnetic spectrum in at least part of the compartment to substantially illuminate the handheld ultrasound probe when the handheld ultrasound probe is positioned in the compartment; and a drive circuit electrically coupled to drive the light sources.

[0010] The apparatus may further include a cover, wherein at least one of the cover and the compartment is selectively movable between at least an open position in which the compartment is open to an exterior of the holder and a closed position in which the compartment is closed to the exterior of the holder. The drive circuit may drive the light sources to output ultraviolet light only when the cover or the compartment is in the closed position. At least a first portion of the holder may include at least one material that is transmissive of ultraviolet light. The first portion of the holder may be transmissive of visible light, and at least a second portion of the holder may be formed from one or more materials that is nontransmissive of ultraviolet light. The light sources may include at least one ultraviolet light emitting diode. The apparatus may further include at least one adhesive that is transmissive of ultraviolet light and that secures the light sources to the holder. At least one of the light sources may be positioned adjacent a center portion of the primary coil and one or more one of the light sources may be positioned adjacent an outer periphery of the primary coil. The primary coil may induce an electromagnetic field in the secondary coil of the ultrasound probe while the light sources output light.

[0011] A dispenser to dispense ultrasound coupling media may be summarized as including a container having an interior that in use holds a supply of an ultrasound coupling medium; and a dispensing mechanism having a scoop including at least an elongated recess, the elongated recess sized and dimensioned to hold a quantity of the ultrasound coupling medium, the scoop rotatably mounted with respect to the container to selectively move between at least a first position in which the elongated recess is in fluid communication with

the interior of the container and to at least a second position in which the elongated recess is exposed to an exterior of the dispenser to dispense the quantity of the ultrasound coupling medium.

[0012] The scoop may be an elongated cylindrical member with the elongated recess formed in a peripheral surface thereof. The scoop may be an elongated cylindrical member with the elongated recess having an arcuate profile. The dispensing mechanism may include a plunger disposed in the container, the plunger movable to urge at least some of the ultrasound coupling medium into the elongated recess, and the dispensing mechanism may also include means for biasing the plunger toward the scoop. The dispensing mechanism may include an actuator coupled to the scoop, wherein movement of the at least part of the actuator causes the scoop to rotate at least between the first and second positions. The actuator may include a first plurality of teeth, the scoop may be coupled to a second plurality of teeth that engage the first plurality of teeth, and movement of the first plurality of teeth may cause the scoop to rotate. The dispenser may further include a heater in thermal communication with the container or the interior of the container; and the container may include at least one thermal insulator at least partially enclosing the interior thereof. The dispenser may further include a hanger to detachably couple the dispenser to a pole. The ultrasound coupling media may be a gel contained in a bag that is removably received in the container.

[0013] A cart may be summarized as including: a frame; a plurality of wheels rotatably mounted to the frame; a power supply carried by the frame; a display unit carried by the frame, electrically coupled to the power supply; an ultrasound probe holder that forms a compartment, the compartment sized and dimensioned to receive at least a portion of the handheld ultrasound probe therein; a primary coil positioned with respect to the compartment to be proximate a secondary coil of the handheld ultrasound probe when the handheld ultrasound probe is positioned in the compartment; a charging circuit electrically coupled to the power supply and to the primary coil to selectively provide an alternating current therethrough of sufficient strength to inductively couple the primary and the secondary coils when the handheld ultrasound probe is positioned in the compartment; a plurality of light sources selectively operable to provide light at least from an ultraviolet band of an electromagnetic spectrum in at least part of the compartment to substantially illuminate the handheld ultrasound probe when the handheld ultrasound probe is positioned in the compartment; and a drive circuit electrically coupled to drive the light sources.

[0014] The display unit may display images based on data wirelessly received from the ultrasound probe. The ultrasound probe holder may be formed from at least one material that is transmissive of ultraviolet light. The primary coil may induce an electromagnetic field in the secondary coil of the ultrasound probe while the light sources output light. The cart may further include a cover, wherein at least one of the cover and the compartment is selectively movable between at least an open position in which the compartment is open to an exterior of the holder and a closed position in which the compartment is closed to the exterior of the holder. The drive circuit may drive the light sources to output ultraviolet light only when the cover or the compartment is in the closed position. At least a first portion of the holder may include at least one material that is transmissive of ultraviolet light. The power supply may include at least one battery. The cart may further include a dispenser including a container having an interior that in use holds a supply of an ultrasound coupling medium; and a dispensing mechanism having a scoop including at least an elongated recess, the elongated recess sized and dimensioned to hold a quantity of the ultrasound coupling medium, the scoop rotatably mounted with respect to the container to selectively move between at least a first position in which the elongated recess is in fluid communication with the interior of the container and to at least a second position in which the elongated recess is exposed to an exterior of the dispenser to dispense the quantity of the ultrasound coupling medium. The cart may further include a heater in thermal communication with the container or the interior of the container; and the container may include at least one thermal insulator at least partially enclosing the interior thereof. The cart may further include a hanger to detachably couple the dispenser to the frame.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0015] FIG. **1** is a top view of a charging and sanitizing apparatus, according to one illustrated embodiment.

[0016] FIG. **2** is a front view of the charging and sanitizing apparatus shown in FIG. **1**.

[0017] FIG. **3** is a top view of a portion of the charging and sanitizing apparatus shown in FIG. **1**.

[0018] FIG. **4** is a side view of the portion of the charging and sanitizing apparatus shown in FIG. **3** with a part of a side portion thereof cut away.

[0019] FIG. **5** is a block diagram of a charging and sanitizing apparatus, according to one illustrated embodiment.

[0020] FIG. **6** is a front view of a dispenser, according to one illustrated embodiment.

[0021] FIG. **7** is a side view of the dispenser shown in FIG. **6**.

[0022] FIG. **8** is a cross-sectional view of the dispenser shown in FIG. **7**.

[0023] FIGS. **9**A-**9**C are cross-sectional views of a first portion of the dispenser shown in FIG. **8**, at various stages of operation.

[0024] FIGS. **10**A-**100** are cross-sectional views of a second portion of the dispenser shown in FIG. **8**, at various stages of operation.

[0025] FIG. **11** is a cross-sectional view of a portion of a dispenser, according to one illustrated embodiment.

[0026] FIG. **12** is a block diagram of a dispenser, according to one illustrated embodiment.

[0027] FIG. **13** is a front view of a cart, according to one illustrated embodiment.

[0028] FIG. **14** is a cross-sectional view of the cart shown in FIG. **13**.

DETAILED DESCRIPTION

[0029] In the following description, certain specific details are set forth in order to provide a thorough understanding of various disclosed embodiments. However, one skilled in the relevant art will recognize that embodiments may be practiced without one or more of these specific details, or with other methods, components, materials, etc. In other instances, well-known structures associated with power supplies, inductive chargers, motors, electric heaters, light sources, and drive

circuits for same have not been shown or described in detail to avoid unnecessarily obscuring descriptions of the embodiments.

[0030] Unless the context requires otherwise, throughout the specification and claims which follow, the word "comprise" and variations thereof, such as, "comprises" and "comprising" are to be construed in an open, inclusive sense, that is as "including, but not limited to."

[0031] Reference throughout this specification to "one illustrated embodiment" or "an embodiment" means that a particular feature, structure or characteristic described in connection with the embodiment is included in at least one illustrated embodiment. Thus, the appearances of the phrases "in one illustrated embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

[0032] As used in this specification and the appended claims, the singular forms "a," "an," and "the" include plural referents unless the content clearly dictates otherwise. It should also be noted that the term "or" is generally employed in its sense including "and/or" unless the content clearly dictates otherwise.

[0033] The headings and Abstract of the Disclosure provided herein are for convenience only and do not interpret the scope or meaning of the embodiments.

[0034] FIGS. **1-4** show an ultrasound probe charging and sanitizing apparatus **100**, according to one illustrated embodiment. The apparatus **100** includes a holder **102** and a cover **104**. The holder **102** includes a base portion **108** and four side portions **110** disposed about a periphery of the base portion **108**. The base portion **108** and the side portions **110** of the holder **102** define a compartment **112** that is sized and dimensioned to receive at least a portion of a handheld ultrasound probe **106** therein. In one embodiment, the handheld ultrasound probe **106** is an automated bladder volume measurement device of a Benchmark Bladder System™ available from dBMEDx, Inc.

[0035] A first guide **114** and a second guide **116** are disposed in the compartment **112** of the holder **102**. As will be described in greater detail below, the first guide **114** and the second guide **116** enable the handheld ultrasound probe **106** to be precisely positioned within the compartment **112**. In one embodiment, the first guide **114** and the second guide **116** are formed from Corning® Gorilla® Glass, which is transmissive of ultraviolet (UV) light. In one embodiment, the first guide **114** and the second guide **116** are formed from a clear, UV transmissive, and scratch-resistant glass and/or plastic material.

[0036] The holder **102** may function like a drawer. For example, the holder **102** may be mounted to rails (not illustrated) that facilitate movement of the holder **102** with respect to the cover **104**. A knob **118** may be attached to one of the side portions **110**. An operator may pull on the knob **118** to move at least part of the holder **102** from under the cover **104** to at least partially expose the contents of the compartment **112** of the holder **102** to an exterior of the ultrasound probe charging and sanitizing apparatus **100**, as shown in FIG. **1**. In one embodiment, the cover **104** is pivotally attached to the holder **102** (e.g., using one or more hinges) such that an operator may lift the cover **104** to expose the contents of the compartment **112** of the holder **102** to an exterior of the ultrasound probe charging and sanitizing apparatus **100**.

[0037] As best illustrated in FIG. **3**, a plurality of light sources **120** is mounted with respect to the holder **102**. For illustrative simplicity, only two of the light sources **120** are shown in FIG. **3**. Additional light sources **120** (not shown) may be mounted to other portions of the first guide **114** and to portions of the second guide **116**. Also, additional light sources **120** (not shown) may be mounted above and below the holder **102** so that substantially all of the outer surfaces of the handheld ultrasound probe **106** are sufficiently irradiated with UV light to sanitize those surfaces.

[0038] The light sources **120** are selectively operable to provide light at least from an ultraviolet band of an electromagnetic spectrum in at least part of the compartment **112** to substantially illuminate the handheld ultrasound probe **106** when the handheld ultrasound probe **106** is positioned in the compartment **112**. The light sources **120** shown in FIG. **3** are mounted to the first guide **114** using an adhesive **122** that is transmissive of ultraviolet light. In one embodiment, at least some of the light sources **120** are UV light emitting diodes (LEDs) that have wide dispersing UV lens. In one embodiment, the light sources **120** are UV LEDs that produce wavelengths of UV light in a range from about 380 nanometers (nm) to about 395 nm.

[0039] In one embodiment, the base portion **108**, the side portions **110**, and a front portion **142** of the holder **102** are made from a material that is transmissive of visible light, but is not transmissive of UV light. A plate **144** that is not transmissive of visible and UV light is disposed between the knob **118** and the front portion **142**. The plate **144** prevents light sources **120** (not shown) that are adhered to the front of the second guide **116** and corresponding wires from being visible, for example, when the holder **102** is viewed from the front as shown in FIG. **2**.

[0040] As best illustrated in FIG. **4**, the coil unit **128** includes a primary coil **130** that is surrounded by a ferrous annular ring **132**. The primary coil **130** may include a plurality of loops or coils of a copper wire. In the illustrated embodiment, one of the light sources **120** is positioned adjacent a center portion of the primary coil **130** and several of the light sources **120** are positioned adjacent an outer periphery of the primary coil **130**.

[0041] Referring now to FIGS. **3** and **4**, the handheld ultrasound probe **106** includes a power storage device **124** that is electrically coupled to a secondary coil **126**. The primary coil **130** is positioned with respect to the compartment **112** to be proximate the secondary coil **126** of the handheld ultrasound probe **106** when the handheld ultrasound probe **106** is positioned in the compartment **112**.

[0042] FIG. **5** schematically illustrates the charging and sanitizing apparatus **100** of FIGS. **1-4**. The charging and sanitizing apparatus **100** includes a controller **134** that is electrically coupled to a charging circuit **136**. The charging circuit **136** is electrically coupled to a power supply (not shown in FIG. **5**) and to the primary coil **130** to selectively provide an alternating current therethrough of sufficient strength to inductively couple the primary coil **130** of the charging and sanitizing apparatus **100** and the secondary coil **126** of the handheld ultrasound probe **106**. When the alternating current is inductively coupled to the primary coil **130** and the secondary coil **126**, a current may flow from the secondary coil **130** to the power storage device **124**, which charges the power storage device **124**.

[0043] The controller **134** also is electrically coupled to a switch or sensor **138** and a drive circuit **140**, which drives the

light sources **120**. In one embodiment, the sensor **138** provides a signal to the controller **134** when the compartment **112** is not exposed to an exterior of the holder **102**, and does not provide the signal to the controller **134** when the compartment **112** is exposed to the exterior of the holder **102**. For example, the compartment **112** is not exposed to the exterior of the holder **102** when the entire compartment **112** is in a closed position beneath the cover **104**. So long as the sensor **138** provides the signal to the controller **134**, the controller **134** provides a signal to the drive circuit **140**, which enables the drive circuit **140** to drive the light sources **120**. Accordingly, the drive circuit **140** may drive the light sources **120** to output UV light only when the compartment **112** (or the cover **104**) is in a closed position.

[0044] In that connection, the cover **104** and the base portion **108** and the side portions **110** of the holder **102** are formed from at least one material that is not transmissive of the UV light output from the light sources **120**. Because it can be useful to know whether the handheld ultrasound probe **106** is in the holder **102**, in one embodiment, the cover **104** and the side portions **110** and the front portion **142** of the holder **102** are formed from one or more materials that are transmissive of visible light and that are not transmissive of UV light. For example, the cover **104** and the side portions **110** and the front portion **142** of the holder **102** may be formed from the Optivex™ UV Filter from the GrayGlass Company, which blocks 99% of light having wavelengths below 400 nm. Alternatively, the cover **104** and the side portions **110** and the front portion **142** of the holder **102** may be formed from a transparent glass or plastic on which a coating has been formed, wherein the coating blocks 99% of light having wavelengths below 400 nm.

[0045] FIGS. **6-8** show a dispenser **200**, according to one illustrated embodiment. The dispenser **200** includes a housing **202**. As shown in FIG. **6**, a portion of a remaining quantity indicator **204** extends from an upper portion of the housing **202** and portions of a first activation button **206***a* and a second activation button **206***b* extend from a lower portion of the housing **202**.

[0046] As shown in FIG. **8**, the dispenser **200** includes a container **208** having an interior that may contain a supply of an ultrasound coupling medium **210**. A dispensing mechanism **212** dispenses the ultrasound coupling medium **210** from the container **208**. The dispensing mechanism **212** includes a scoop **214** that is rotatably coupled to the container **208**.

[0047] More particularly, the scoop **214** includes a first axle **216***a* that extends outwardly from a first end portion **218***a* of the scoop **214** through an aperture formed in a first side portion **220***a* of the container **208**. The scoop **214** also includes a second axle **216***b* that extends outwardly from a second end portion **218***b* of the scoop **214** through an aperture formed in an opposing second side portion **220***b* of the container **208**. A pair of gears **222** is coupled to the first axle **216***a* and the second axle **216***b;* however, only one of the gears **222** is shown in FIG. **8**. In that connection, only a portion of the first activation button **206***a* is shown in FIG. **8** so that the gear **222** coupled to the first axle **216***a* can be seen in FIG. **8**. The structure of the first activation button **206***a* is substantially the same as that of the second activation button **206***b*. When the gears **222** are rotated, the scoop **214** rotates about the first axle **216***a* and the second axle **216***b*.

[0048] The dispenser **200** also includes a plunger **224** that can move from the top of the container **208** toward the scoop **214**. A weight **226** is disposed on the plunger **224**. Gravity pulls the weight **226**, and thus the plunger **224**, toward the scoop **214**. The weight **226** is coupled to the remaining quantity indicator **204**. The weight **226** and the remaining quantity indicator **204** move downwardly as the dispensing mechanism **212** dispenses the ultrasound coupling medium **210** from the dispenser **200**.

[0049] The remaining quantity indicator **204** includes a plurality of markings **204***a,* which may be printed on or embossed into the remaining quantity indicator **204**, for example. The markings **204***a* are positioned on the remaining quantity indicator **204** to indicate the quantity of the ultrasound coupling medium **210** remaining in the container **208**. For example, if 50% of the ultrasound coupling medium **210** that was originally contained in the container **208** has been dispensed from the dispenser **200**, a marking **204***a* labeled "50%" may be visible just above the upper surface of the housing **202**.

[0050] The dispenser **200** also may include a first heater **228***a* adjacent the first side portion **220***a* of the container **208** and a second heater **228***b* adjacent the second side portion **220***b* of the container **208**. The first heater **228***a* and the second heater **228***b* are in thermal communication with the interior of the container **208**. In one embodiment, the first heater **228***a* and the second heater **228***b* are resistance heaters. Additionally, the dispenser **200** may include a first thermal insulator portion **230***a* and a second thermal insulator portion **230***b* that at least partially enclose the interior of the container **208**. The first thermal insulator portion **230***a* and the second thermal insulator portion **230***b* may keep the interior of the container **208** and thus the ultrasound coupling medium **210** warm after the first heater **228***a* and the second heater **228***b* have stopped producing heat.

[0051] FIGS. **9**A-**9**C show a first portion of the dispenser **200** showing the container **208** and the scoop **214** at various stages of operation. FIGS. **10**A-**10**C show a second portion of the dispenser **200** showing the gear **222** and the first activation button **206***a* at the same stages of operation as in FIGS. **9**A-**9**C, respectively.

[0052] Operation of the dispenser **200** will now be described with reference to FIGS. **8**, **9**A-**9**C, and **10**A-**100**. FIGS. **9**A and **10**A correspond to default positions of the scoop **214** and the first activation button **206***a,* respectively. For example, FIGS. **9**A and **10**A correspond to a situation in which an operator holds the handheld ultrasound probe **106** such that a first portion **106***a* of the handheld ultrasound probe **106** is vertically aligned with the first activation button **206***a* and a second portion **106***b* of the handheld ultrasound probe **106** is vertically aligned with the second activation button **206***b,* as shown in FIG. **8**.

[0053] As shown in FIGS. **8** and **9**A-**9**C, the scoop **214** is an elongated cylindrical member with an elongated recess **214***a* having an arcuate profile. When the scoop **214** is in the default position shown in FIG. **9**A, the elongated recess **214***a* is in fluid communication with the interior of the container **208**. A reference marker **236** is shown in FIGS. **10**A-**10**C to indicate the position of the bottom of the first activation button **206***a* when the first activation button **206***a* is in the default position.

[0054] FIGS. **9**B and **10**B correspond to intermediate positions of the scoop **214** and the first activation button **206***a,* respectively. For example, FIGS. **9**B and **10**B correspond to a situation in which the operator moves the handheld ultrasound probe **106** upwardly from the position shown in FIG. **8** such that the first portion **106***a* and the second portion **106***b* of

the handheld ultrasound probe **106** contact the first activation button **206***a* and the second activation button **206***b*, respectively, causing the first activation button **206***a* and the second activation button **206***b* to move upwardly a short distance.

[0055] The gear **222** includes a plurality of teeth **232** that engage a plurality of teeth **234** formed on the first activation button **206***a*. Accordingly, when the first activation button **206***a* is moved upwardly, the gear **222** rotates counterclockwise, which cause the scoop **214** to rotate counterclockwise. When the first activation button **206***a* is moved upwardly, an upper portion of the first activation button **206***a* compresses a spring **240**.

[0056] FIGS. **9**C and **100** correspond to end positions of the scoop **214** and the first activation button **206***a*, respectively. FIGS. **9**C and **100** correspond to a situation in which the operator moves the handheld ultrasound probe **106** upwardly from the position shown in FIG. **8** a predetermined distance such that the first activation button **206***a* and the second activation button **206***b* sufficiently actuate the gears **222** to cause the scoop **214** to rotate counterclockwise **180**° so that the elongated recess **214***a* is exposed to an exterior of the container **208**.

[0057] As shown in FIG. **8**, a portion **106***c* of the handheld ultrasound probe **106** may be positioned directly below the scoop **214**. For example, the portion **106***c* of the handheld ultrasound probe **106** contains ultrasound transducers. In one embodiment, the first activation button **206***a* and the second activation button **206***b* are disposed between a plurality of guides (not shown) that extend from the lower portion of the housing **202** to ensure that the handheld ultrasound probe **106** is in a predetermined position with respect to the scoop **214** (e.g., the position of the handheld ultrasound probe **106** shown in FIG. **8**) when the handheld ultrasound probe **106** contacts the first activation button **206***a* and the second activation button **206***b*.

[0058] When the scoop **214** is in the position shown in FIG. **9**C, the elongated recess **214***a* is exposed to an exterior of the dispenser **200** and substantially all of the ultrasound coupling medium **210** disposed in the elongated recess **214***a*, if any, falls onto the portion **106***c* of the handheld ultrasound probe **106**. Because the elongated recess **214***a* has a predetermined volume, when the elongated recess **214***a* is filled with the ultrasound coupling medium **210**, a predetermined quantity of the ultrasound coupling medium **210** falls onto the portion **106***c* of the handheld ultrasound probe **106** when the handheld ultrasound probe **106** moves the first activation button **206***a* to the position shown in FIG. **100**.

[0059] A reference marker **238** is shown in FIG. **100** to indicate the position of the bottom of the first activation button **206***a* when the first activation button **206***a* is in the end position. As shown in FIG. **100**, the reference marker **236** and the reference marker **238** are a distance d apart from one another. Accordingly, when the operator moves the handheld ultrasound probe **106** upwardly from the position shown in FIG. **8** into contact with the first activation button **206***a* and the second activation button **206***b* and then causes the first activation button **206***a* and the second activation button **206***b* to move upwardly by the distance d, the scoop **214** moves from the default position shown in FIG. **9**A to the end position shown in FIG. **9**C. In one implementation, the distance d is $9/64^{th}$ of an inch.

[0060] When the operator moves the handheld ultrasound probe **106** away from the first activation button **206***a* and the second activation button **206***b*, the spring **240** decompresses and exerts a force on the first activation button **206***a* causing the first activation button **206***a* to move downwardly to the default position shown in FIG. **10**A. As the first activation button **206***a* moves downwardly, the teeth **234** cause the gear **222** to rotate clockwise, which causes the scoop **214** to rotate clockwise until the scoop **214** returns to the default position shown in FIG. **9**A.

[0061] FIG. **11** shows a portion of a container **250** according to one illustrated embodiment. The container **250** is similar in many relevant respects to the container **208**. One difference is that the container **250** includes a spring **252** disposed between an upper portion **254** of the container **250** and a plunger **256**. When the container **250** is initially filled with an ultrasound coupling medium **258**, the spring **252** is compressed. Accordingly, the spring **252** exerts a force on the upper portion **254** and the plunger **256**. The force exerted by the spring **252** causes the plunger **256** to be biased toward an elongated recess **260***a* of a scoop **260**. Accordingly, the spring **252** may cause the plunger **256** to urge at least some of the ultrasound coupling medium **258** into the elongated recess **260***a*.

[0062] In one embodiment, the upper portion **254** is a removable lid. For example, side portions **264***a* and **264***b* of the container **250** may include recesses (not shown) into which opposing ends of the upper portion **254** may be inserted and removed to fasten the upper portion **254** to the container **250** and unfasten the upper portion **254** from the container **250**, respectively. In one embodiment, the ultrasound coupling medium **258** is a gel contained in a bag **262** that is removably received in the container **250**.

[0063] FIG. **12** shows a dispenser **300**, according to one illustrated embodiment. The dispenser **300** includes a controller **302** electrically coupled to a temperature sensor **304** and a drive circuit **306**, which is electrically coupled to a heater **308**. The temperature sensor **304** is thermally coupled to the interior of a container (e.g., container **208**) that may contain an ultrasound coupling medium.

[0064] The temperature sensor **304** provides a signal to the controller **302** indicating the temperature of the interior of the container.

[0065] The controller **302** stores a value corresponding to a desired temperature. The value corresponding to the desired temperature may be predetermined or may be set by an operator via an operator interface (not shown). For example, the operator interface may include an alphanumeric keypad that an operator can use to enter the value corresponding to the desired temperature.

[0066] When the signal provided by the temperature sensor **304** indicates that the temperature of the interior of a container (e.g., container **208**) is a predetermined amount below the desired temperature, the controller **302** provides a signal to the drive circuit **306**. In response, the drive circuit **306** causes a current to flow through the heater **308**, which causes the heater **308** to produce heat. When the signal provided by the temperature sensor **304** indicates that the temperature of the interior of the container is the desired temperature, the controller **302** stops providing the signal to the drive circuit **306**. In response, the drive circuit **306** stops causing the current to flow through the heater **308**, which causes the heater **308** to stop actively producing heat.

[0067] In one implementation, the controller **302** is electrically coupled to a switch or sensor **310** and a drive circuit **312**, which is electrically coupled to a motor **314**. For example, the first activation button **206***a* and/or the second activation but-

ton **206***b* may be replaced with first and/or second proximity sensors that provide signals to the controller **302** when the handheld ultrasound probe **106** is in the position shown in FIG. **8**. Alternatively, the first activation button **206***a* and the second activation button **206***b* may be replaced with first and second buttons each of which includes a switch or sensor **310** that provide a signal to the controller **302** when the buttons are depressed (e.g., by the first portion **106***a* and the second portion **106***b* of the handheld ultrasound probe **106**, respectively).

[0068] When the switch or sensor **310** provides a signal to the controller **302**, the controller **302** provides a signal to the drive circuit **312**. In response, the drive circuit **312** outputs a signal that causes the motor **314** to rotate by a predetermined amount. For example, the motor **314** may be a stepper motor having a rotor coupled to a gear having threads that are dimensioned and positioned to engage the teeth **232** of the gear **222**. When the switch or sensor **310** provides the signal to the controller **302**, the controller **302** may provide a signal to the drive circuit **312** that causes the drive circuit **312** to control rotation of the rotor such that the scoop **214** rotates from the position shown in FIG. **9**A to the position shown in FIG. **9**C, and then rotate back to the position shown in FIG. **9**A.

[0069] FIGS. **13** and **14** show a cart **400**, according to one illustrated embodiment. The cart **400** includes a frame **402** comprised of a pole **404** that is coupled to a base **406**. For example, an aperture having threads therein may be formed in a center portion of the base **406** and a bottom portion of the pole **404** may have complimentary threads formed thereon for attaching the pole **404** to the base **406** when the pole **404** is rotated clockwise.

[0070] A plurality of wheels **408** (e.g., 4) is rotatably mounted to the base **406** of the frame **402**. For example, the wheels **408** may be of the swivel caster type, wherein each wheel **408** is rotatably mounted about a horizontal axle to which a fork is coupled. Each fork may be coupled to a swivel joint that rotates about a vertical axle that is inserted into an aperture formed in the base **406**. Accordingly, the wheels **408** may enable an operator to move the cart **400** in any desired direction with very little effort.

[0071] A shelf **410** is coupled to the pole **404**. For example, the pole **404** is inserted through an aperture formed in the shelf **410** and an L-shaped bracket is secured to the pole **404** and the shelf **410** using a plurality of bolts and nuts. In one embodiment, the shelf **410** is coupled to the pole **404** such that the height of the shelf **410** is adjustable.

[0072] A charging and sanitizing apparatus **412** (e.g., charging and sanitizing apparatus **100**) is disposed on or in the shelf **410**. In one embodiment, the charging and sanitizing apparatus **412** is coupled to the shelf **410** using at least one bolt and at least one nut to ensure that the charging and sanitizing apparatus **412** does not fall off the shelf **410**, for example, while an operator is moving the cart **400**.

[0073] A container **414** may be disposed on the shelf **410** or the charging and sanitizing apparatus **412**. The container **414** may be sized and dimensioned to hold a supply of disposable alcohol or bleach wipes that can be used to sanitize parts of the cart **400**, for example. A waste basket or bag **416** may be coupled to the shelf **410**. For example, a plurality of clips (not shown) that can be removably secured to a plurality of portions of the bag **416** may be coupled to the shelf **410**. The cart **400** may include one or more additional containers (not shown) that may be used to store one or more containers (e.g., containers **208**) of an ultrasound coupling medium.

[0074] A display unit **418** is coupled to the pole **404**. In one embodiment, the display unit **418** is of a type included in the console of the Benchmark Bladder System™ available from dBMEDx, Inc. The display unit **418** displays images based on data wirelessly received from an ultrasound probe (e.g., handheld ultrasound probe **106**). For example, the display unit **418** may display a value indicating a measured volume of a bladder. In one embodiment, the display unit **418** includes a controller that is electrically coupled to a wireless receiver and a plurality of LEDs.

[0075] A mounting bracket **420** may be coupled to the display unit **418** and to the pole **404**. In one embodiment, the mounting bracket **420** is coupled to the display unit **418** and the pole **404** using a plurality of bolts and nuts. In one embodiment, the mounting bracket **420** is coupled to the pole **404** such that the height of the display unit **418** is adjustable.

[0076] A dispenser **422** (e.g., dispenser **200**) may be coupled to the pole **404** using a hanger **424**. In one embodiment, the hanger **424** is coupled to the pole **404** and to the dispenser **422** using a plurality of bolts and nuts. In one embodiment, the hanger **424** is coupled to the pole **404** such that the height of the dispenser **422** is adjustable.

[0077] In one implementation, the dispenser **422** is detachably coupled to the pole **404**. For example, the hanger **424** may be coupled to the pole **404** and may include a track into which an operator can insert a portion of the dispenser **422** to couple the dispenser **422** to the pole **404**; the operator can remove the portion of the dispenser **422** to detach the dispenser **422** from the pole **404**. An operator may remove the dispenser **422** from the hanger **424** so that the dispenser **422** can be placed on a patient to dispense an ultrasound coupling medium directly onto the skin of the patient, for example, onto the patient's abdominal region. In one implementation, at least part of the waste basket or bag **416** is positioned directly beneath at least part of the dispenser **422** such that, if the dispenser **422** is inadvertently activated, for example, any ultrasound compiling medium dispensed from the dispenser **422** falls into the waste basket or bag **416**.

[0078] As shown in FIG. **14**, a handle **426** is coupled to the shelf **410**, for example, using a plurality of bolts and nuts. In one implementation, the handle **426** is integrally formed with the shelf **410**. A towel (not shown) may be placed over the handle **426** such that a portion of the towel hangs between the shelf **410** and the handle **426**, so that an operator can quickly access the towel during an ultrasound procedure, for example.

[0079] A power supply **428** is disposed in or on the shelf **410**. In one embodiment, the power supply **428** is a model AHM85PS switching AC adapter available from Kowa Electronic Industries that can be provided with AC voltages ranging from about **80** V_{AC} to about **264** V_{AC}. In one implementation, the power supply **428** is coupled to the shelf **410** using at least one bolt and at least one nut to ensure that the power supply **428** does not fall off the shelf **410** while an operator is moving the cart **400**, for example. The power supply **428** is electrically coupled to a power cord **430** (shown in FIG. **13**), which may be electrically coupled to AC mains, for example. The power supply **428** also may be electrically coupled to the charging and sanitizing apparatus **412**, the display unit **418**, and the dispenser **422**, for example, using a plurality of wires.

[0080] The power supply **428** may include a battery **432**. For example, the power cord **430** may be plugged into an AC electrical outlet for a period of time sufficient to allow the

battery **432** to become fully charged, to allow the charging and sanitizing apparatus **412** to fully charge the power storage device **124** of the handheld ultrasound probe **106**, and to allow an ultrasound coupling medium contained in the dispenser **422** to be warmed to a desired temperature. After the power cord **430** is unplugged from the electrical outlet, the battery **432** may provide electrical power to the charging and sanitizing apparatus **412**, the display unit **418**, and/or the dispenser **422**. Accordingly, the battery **432** of the power supply **428** may enable the charging and sanitizing apparatus **412**, the display unit **418**, and the dispenser **422** to be fully operational while the power supply **428** is not plugged into an electrical outlet.

[0081] The various embodiments described above can be combined to provide further embodiments. All of the U.S. patents, U.S. patent application publications, U.S. patent applications, International (PCT) patent applications referred to in this specification and/or listed in the Application Data Sheet, including but not limited to U.S. application Ser. No. 12/948,622, filed Nov. 17, 2010, International Application No. PCT/US11/26923, filed Mar. 2, 2011, U.S. Provisional Application No. 61/573,493, filed Sep. 6, 2011, U.S. Provisional Application No. 61/621,877, filed Apr. 9, 2012, U.S. Provisional Application No. 61/638,925, filed Apr. 26, 2012, U.S. Provisional Application No. 61/638,833, filed Apr. 26, 2012, U.S. Provisional Application No. 61/725,893, Nov. 13, 2012, U.S. application Ser. No. 13/800,993, Mar. 13, 2013, U.S. application Ser. No. 13/871,842, filed Apr. 26, 2013, U.S. application Ser. No. 13/871,835, filed Apr. 26, 2013, International Application No. PCT/US13/38505, filed Apr. 26, 2013, International Application No. PCT/US13/38479, filed Apr. 26, 2013, U.S. Provisional Application No. 61/876,018, filed Sep. 10, 2013, and International Application No. PCT/US13/68979, filed Nov. 7, 2013, are incorporated herein by reference, in their entirety. Aspects of the embodiments can be modified, if necessary to employ concepts of the various patents, applications and publications to provide yet further embodiments.

[0082] These and other changes can be made to the embodiments in light of the above-detailed description. In general, in the following claims, the terms used should not be construed to limit the claims to the specific embodiments disclosed in the specification and the claims, but should be construed to include all possible embodiments along with the full scope of equivalents to which such claims are entitled. Accordingly, the claims are not limited by the disclosure.

1. An apparatus for use with a handheld ultrasound probe, the handheld ultrasound probe which includes a power storage device, the apparatus comprising:

a holder that forms a compartment, the compartment sized and dimensioned to receive at least a portion of the handheld ultrasound probe therein;

a primary coil positioned with respect to the compartment to be proximate a secondary coil of the handheld ultrasound probe when the handheld ultrasound probe is positioned in the compartment;

a charging circuit electrically coupled to the primary coil to selectively provide an alternating current therethrough of sufficient strength to inductively couple the primary and the secondary coils when the handheld ultrasound probe is positioned in the compartment;

a plurality of light sources selectively operable to provide light at least from an ultraviolet band of an electromagnetic spectrum in at least part of the compartment to substantially illuminate the handheld ultrasound probe when the handheld ultrasound probe is positioned in the compartment; and

a drive circuit electrically coupled to drive the light sources.

2. The apparatus of claim **1**, further comprising:

a cover, wherein at least one of the cover and the compartment is selectively movable between at least an open position in which the compartment is open to an exterior of the holder and a closed position in which the compartment is closed to the exterior of the holder.

3. The apparatus of claim **2** wherein the drive circuit drives the light sources to output ultraviolet light only when the cover or the compartment is in the closed position.

4. The apparatus of claim **1** wherein at least a first portion of the holder comprises at least one material that is transmissive of ultraviolet light.

5. The apparatus of claim **4** wherein the first portion of the holder is transmissive of visible light, and at least a second portion of the holder is formed from one or more materials that is nontransmissive of ultraviolet light.

6. The apparatus of claim **1** wherein the light sources include at least one ultraviolet light emitting diode.

7. The apparatus of claim **1**, further comprising:

at least one adhesive that is transmissive of ultraviolet light and that secures the light sources to the holder.

8. The apparatus of claim **1** wherein at least one of the light sources is positioned adjacent a center portion of the primary coil and one or more one of the light sources is positioned adjacent an outer periphery of the primary coil.

9. The apparatus of claim **1** wherein the primary coil induces an electromagnetic field in the secondary coil of the ultrasound probe while the light sources output light.

10. A dispenser to dispense ultrasound coupling media, comprising:

a container having an interior that in use holds a supply of an ultrasound coupling medium; and

a dispensing mechanism having a scoop including at least an elongated recess, the elongated recess sized and dimensioned to hold a quantity of the ultrasound coupling medium, the scoop rotatably mounted with respect to the container to selectively move between at least a first position in which the elongated recess is in fluid communication with the interior of the container and to at least a second position in which the elongated recess is exposed to an exterior of the dispenser to dispense the quantity of the ultrasound coupling medium.

11. The dispenser of claim **10** wherein the scoop is an elongated cylindrical member with the elongated recess formed in a peripheral surface thereof.

12. The dispenser of claim **10** wherein the scoop is an elongated cylindrical member with the elongated recess having an arcuate profile.

13. The dispenser of claim **10** wherein the dispensing mechanism includes a plunger disposed in the container, the plunger movable to urge at least some of the ultrasound coupling medium into the elongated recess, and the dispensing mechanism also includes means for biasing the plunger toward the scoop.

14. The dispenser of claim **10** wherein the dispensing mechanism includes an actuator coupled to the scoop, wherein movement of the at least part of the actuator causes the scoop to rotate at least between the first and second positions.

15. The dispenser of claim **14** wherein
the actuator includes a first plurality of teeth,
the scoop is coupled to a second plurality of teeth that engage the first plurality of teeth, and
movement of the first plurality of teeth causes the scoop to rotate.

16. The dispenser of claim **10**, further comprising:
a heater in thermal communication with the container or the interior of the container; and wherein the container includes at least one thermal insulator at least partially enclosing the interior thereof.

17. The dispenser of claim **10**, further comprising:
a hanger to detachably couple the dispenser to a pole.

18. The dispenser of claim **10** wherein the ultrasound coupling media is a gel contained in a bag that is removably received in the container.

19. A cart, comprising:
a frame;
a plurality of wheels rotatably mounted to the frame;
a power supply carried by the frame;
a display unit carried by the frame, electrically coupled to the power supply;
an ultrasound probe holder that forms a compartment, the compartment sized and dimensioned to receive at least a portion of the handheld ultrasound probe therein;
a primary coil positioned with respect to the compartment to be proximate a secondary coil of the handheld ultrasound probe when the handheld ultrasound probe is positioned in the compartment;
a charging circuit electrically coupled to the power supply and to the primary coil to selectively provide an alternating current therethrough of sufficient strength to inductively couple the primary and the secondary coils when the handheld ultrasound probe is positioned in the compartment;
a plurality of light sources selectively operable to provide light at least from an ultraviolet band of an electromagnetic spectrum in at least part of the compartment to substantially illuminate the handheld ultrasound probe when the handheld ultrasound probe is positioned in the compartment; and
a drive circuit electrically coupled to drive the light sources.

20. The cart of claim **19** wherein the display unit displays images based on data wirelessly received from the ultrasound probe.

21. The cart of claim **19** wherein the ultrasound probe holder is formed from at least one material that is transmissive of ultraviolet light.

22. The cart of claim **19** wherein the primary coil induces an electromagnetic field in the secondary coil of the ultrasound probe while the light sources output light.

23. The cart of claim **19**, further comprising:
a cover, wherein at least one of the cover and the compartment is selectively movable between at least an open position in which the compartment is open to an exterior of the holder and a closed position in which the compartment is closed to the exterior of the holder.

24. The cart of claim **23** wherein the drive circuit drives the light sources to output ultraviolet light only when the cover or the compartment is in the closed position.

25. The cart of claim **19** wherein at least a first portion of the holder comprises at least one material that is transmissive of ultraviolet light.

26. The cart of claim **19** wherein the power supply includes at least one battery.

27. The cart of claim **19**, further comprising:
a dispenser including a container having an interior that in use holds a supply of an ultrasound coupling medium; and a dispensing mechanism having a scoop including at least an elongated recess, the elongated recess sized and dimensioned to hold a quantity of the ultrasound coupling medium, the scoop rotatably mounted with respect to the container to selectively move between at least a first position in which the elongated recess is in fluid communication with the interior of the container and to at least a second position in which the elongated recess is exposed to an exterior of the dispenser to dispense the quantity of the ultrasound coupling medium.

28. The cart of claim **27**, further comprising:
a heater in thermal communication with the container or the interior of the container; and wherein the container includes at least one thermal insulator at least partially enclosing the interior thereof.

29. The cart of claim **27**, further comprising:
a hanger to detachably couple the dispenser to the frame.

* * * * *

专利名称(译)	超声波凝胶分配和探针消毒站		
公开(公告)号	US20150245810A1	公开(公告)日	2015-09-03
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申请(专利权)人(译)	DBMEDX INC.		
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摘要(译)

推车包括电源，显示单元，具有相对于隔室定位的初级线圈的支架，当手持式超声探头位于隔室中时，所述初级线圈靠近手持式超声探头的次级线圈，提供交流电的充电电路电感耦合初级和次级线圈，可操作以提供至少紫外光的光源，以及电耦合以驱动光源的驱动电路。推车可包括具有容器的分配器，该容器可容纳超声耦合介质，以及分配机构，其具有带有细长凹槽的勺，该细长凹槽相对于容器可旋转地安装，以在第一位置之间移动，在该第一位置，细长凹槽位于第一位置与容器内部的流体连通和第二位置，其中细长凹槽暴露于分配器的外部。