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United States Patent	12383449
Kind Code	B2
Date of Patent	August 12, 2025
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Black light in remote device for patient support apparatus

Abstract

A handheld contamination detection device for a healthcare setting includes a body having a top surface, a bottom surface, and an end surface extending between the top surface and the bottom surface. A light source is coupled to the end surface. The light source emits ultraviolet light away from the body. A user-interface is coupled to the top surface of the body. The user-interface includes a touch screen. A controller is communicatively coupled with the light source and the user-interface. The controller receives a command input from the user-interface and activates the light source in response to the command input.

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Appl. No.: **17/036580**

Filed: **September 29, 2020**

Prior Publication Data

Document Identifier	Publication Date
US 20210093497 A1	Apr. 01, 2021

Related U.S. Application Data

us-provisional-application US 62908847 20191001

Publication Classification

Int. Cl.: **A61G7/05** (20060101); **A47C21/00** (20060101); **A61L2/08** (20060101); **A61L2/10** (20060101)

U.S. Cl.:

CPC **A61G7/05** (20130101); **A47C21/003** (20130101); **A61L2/084** (20130101); **A61L2/10** (20130101); A47C21/00 (20130101); A61G2203/12 (20130101); A61G2203/16 (20130101); A61G2203/20 (20130101); A61L2202/16 (20130101); A61L2202/20 (20130101)

Field of Classification Search

CPC: A61G (7/05); A61G (7/0524); A61G (2203/16); A61G (2203/20); A61L (2/084); A61L (2/10); A61L (2202/16); A61L (2202/20); A47C (21/003); A47C (21/00)

USPC: 5/600; 5/905; 5/658

References Cited

U.S. PATENT DOCUMENTS

Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
1574226	12/1925	Ackermann	5/101	A47D 9/02
5375276	12/1993	Nelson	5/503.1	A61G 1/06
6234642	12/2000	Bokamper	362/130	F21V 33/0072
7250615	12/2006	Soong	250/493.1	A61L 2/10
8105532	12/2011	Harmon	250/493.1	A61L 2/10
8226887	12/2011	Harmon	250/493.1	A61L 2/10
9095633	12/2014	Dayton	N/A	A61L 2/10
9588057	12/2016	Clark	N/A	N/A
9615983	12/2016	Stryker	N/A	A01N 59/20
9669121	12/2016	Liao et al.	N/A	N/A
10004654	12/2017	Zerhusen et al.	N/A	N/A
10086097	12/2017	Dayton	N/A	A61L 2/24
10183085	12/2018	Dobrinsky et al.	N/A	N/A
10293066	12/2018	Dayton	N/A	G08C 17/02
11224670	12/2021	Dayton	N/A	A61L 2/24
11395776	12/2021	Xu	N/A	A61G 1/013
11723817	12/2022	Xu	5/611	A61G 1/04
11857688	12/2023	Dayton	N/A	A61L 2/10
2004/0034933	12/2003	Smith	5/602	H05B 47/19
2006/0223731	12/2005	Carling	N/A	N/A
2010/0104471	12/2009	Harmon	422/186.3	A61L 2/10
2012/0093688	12/2011	Harmon	250/455.11	A61L 2/10
2012/0119110	12/2011	Hirsch et al.	N/A	N/A
2012/0196375	12/2011	Granja et al.	N/A	N/A
2013/0117936	12/2012	Stryker	422/24	A61L 2/235
2016/0093412	12/2015	Liao et al.	N/A	N/A
2016/0121007	12/2015	Dayton	250/492.1	A61L 2/10
2017/0112953	12/2016	Dayton	N/A	G08C 17/02
2017/0320083	12/2016	Hayward	N/A	N/A

2019/0022261	12/2018	Dayton	N/A	A61L 2/24
2021/0093497	12/2020	Limbach	N/A	G01N 21/29
2021/0113394	12/2020	Xu	N/A	A61G 1/013
2022/0088246	12/2021	Dayton	N/A	A61L 2/24
2022/0313507	12/2021	Xu	N/A	A61G 1/0275
2023/0190132	12/2022	Trepanier	600/532	A61B 5/746
2025/0073360	12/2024	Payne	N/A	A61L 2/24

FOREIGN PATENT DOCUMENTS

Patent No.	**Application Date**	**Country**	**CPC**
2006268288	12/2007	AU	A61B 5/6891
2006268288	12/2010	AU	A61B 5/6891
205626552	12/2015	CN	N/A
3799779	12/2020	EP	A61B 5/0059
3799779	12/2022	EP	A61B 5/0059
S63298140	12/1987	JP	N/A
2013070906	12/2012	WO	N/A
2018140072	12/2017	WO	N/A
WO-2025049496	12/2024	WO	A61L 2/08

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION (1) This application claims priority to and the benefit under 35 U.S.C. § 119(e) of U.S. Provisional Application No. 62/908,847, filed on Oct. 1, 2019, entitled “BLACK LIGHT IN REMOTE DEVICE FOR PATIENT SUPPORT APPARATUS,” the disclosure of which is hereby incorporated herein by reference in its entirety.

FIELD OF THE DISCLOSURE

(1) The present disclosure generally relates to a remote device configured to emit black light to illuminate contamination on a patient support apparatus.

SUMMARY OF THE DISCLOSURE

(2) According to one aspect of the present disclosure, a contamination identification system includes a patient support apparatus that includes a support frame disposed on a base. A first light source is coupled to the patient support apparatus. The first light source emits visible light toward a support surface of the support frame. A first controller is operably coupled to the patient support apparatus. The first controller activates the first light source to emit the visible light. A contamination detection device includes a body and a second light source coupled to the body and that emits ultraviolet light. A second controller is disposed in the body that activates the second light source to illuminate contamination on the patient support apparatus. A user-interface for receiving a command input relating to at least one of the first light source and the second light source is coupled to the body and communicatively coupled to the second controller.

(3) According to another aspect of the present disclosure, a contamination identification system for a healthcare setting includes a contamination detection device including: a body, a first light source coupled to the body, and a controller operably coupled to the first light source. The controller activates the first light source to emit ultraviolet light to illuminate contamination within said healthcare setting. A second light source is communicatively coupled with the controller. The

controller activates the second light source to emit visible light to illuminate said healthcare setting. Healthcare equipment is disposed within said healthcare setting. The contamination detection device is freely movable relative to the healthcare equipment to illuminate the contamination on the healthcare equipment.

(4) According to yet another aspect of the present disclosure, a handheld contamination detection device for a healthcare setting includes a body having a top surface, a bottom surface, and an end surface extending between the top surface and the bottom surface. A light source is coupled to the end surface. The light source emits ultraviolet light away from the body. A user-interface is coupled to the top surface of the body. The user-interface includes a touch screen. A controller is communicatively coupled with the light source and the user-interface. The controller receives a command input from the user-interface and activates the light source in response to the command input.

(5) These and other features, advantages, and objects of the present disclosure will be further understood and appreciated by those skilled in the art by reference to the following specification, claims, and appended drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) In the drawings:

(2) FIG. **1** is a top side perspective view of a patient support apparatus, according to the present disclosure;

(3) FIG. **2** is a diagram of a communication interface between a first controller of a patient support apparatus and a second controller of a remote contamination detection device, according to the present disclosure;

(4) FIG. **3** is a side plan view of a remote contamination detection device of a contamination identification system, according to the present disclosure;

(5) FIG. **4** is a partial front perspective view of a contamination detection device, according to the present disclosure;

(6) FIG. **5** is a partial front perspective view of a contamination detection device, according to the present disclosure;

(7) FIG. **6**A is a top plan view of a remote contamination detection device with a user-interface that has a first display screen, according to the present disclosure;

(8) FIG. **6**B is a top plan view of a remote contamination detection device with a user-interface that has a second display screen, according to the present disclosure;

(9) FIG. **6**C is a top plan view of a remote contamination detection device with a user-interface that has a third display screen, according to the present disclosure; and

(10) FIG. **7** is a top side perspective view of a contamination identification system in a surgical suite during use, according to the present disclosure.

DETAILED DESCRIPTION

(11) The present illustrated embodiments reside primarily in combinations of method steps and apparatus components related to a black light in a remote device for a patient support apparatus. Accordingly, the apparatus components and method steps have been represented, where appropriate, by conventional symbols in the drawings, showing only those specific details that are pertinent to understanding the embodiments of the present disclosure so as not to obscure the disclosure with details that will be readily apparent to those of ordinary skill in the art having the benefit of the description herein. Further, like numerals in the description and drawings represent like elements.

(12) For purposes of description herein, the terms “upper,” “lower,” “right,” “left,” “rear,” “front,”

"vertical," "horizontal," and derivatives thereof, shall relate to the disclosure as oriented in FIG. **1**. Unless stated otherwise, the term "front" shall refer to a surface closest to an intended viewer, and the term "rear" shall refer to a surface furthest from the intended viewer. However, it is to be understood that the disclosure may assume various alternative orientations, except where expressly specified to the contrary. It is also to be understood that the specific structures and processes illustrated in the attached drawings, and described in the following specification are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

(13) The terms "including," "comprises," "comprising," or any other variation thereof, are intended to cover a non-exclusive inclusion, such that a process, method, article, or apparatus that comprises a list of elements does not include only those elements but may include other elements not expressly listed or inherent to such process, method, article, or apparatus. An element preceded by "comprises a . . . " does not, without more constraints, preclude the existence of additional identical elements in the process, method, article, or apparatus that comprises the element.

(14) Referring to FIGS. **1**-**7**, reference numeral **10** generally designates a contamination identification system that includes healthcare equipment **12**, such as a patient support apparatus **14** that has a support frame **18** and a base **22**. A first controller **26** is operably coupled to the patient support apparatus **14**. A first light source **30** is operably coupled to the patient support apparatus **14**. The first light source **30** emits visible light **34** toward the patient support apparatus **14**. A contamination detection device **38** includes a body **42** that has a top surface **46** and an end surface **50**. The contamination detection device **38** includes a second controller **54** and a second light source **58** that emits ultraviolet light **62** when activated by the second controller **54** to illuminate contamination on the patient support apparatus **14**.

(15) Referring to FIG. **1**, the patient support apparatus **14** is illustrated as a surgical table within a healthcare setting **66**, such as a surgical suite. The patient support apparatus **14** includes the support frame **18** for supporting the patient thereon. One or more pads **74** may be selectively disposed on a top support surface **78** of the support frame **18**. As illustrated in FIG. **1**, multiple pads **74** are arranged along the top support surface **78** of the support frame **18**. The pads **74** may be disposed in a spaced-apart arrangement along the top support surface **78**, or alternatively, may be directly coupled to one another. Alternatively, the support frame **18** may include a single pad **74** covering at least a portion of the top support surface **78**.

(16) The support frame **18** generally includes a plurality of segments **82** that are each pivotally coupled to one or two adjacent segments **82**. The segments **82** are independently movable relative to one another. In this way, a single segment **82** may be rotated to an incline, rotated to a decline, or otherwise moved relative to the remaining stationary segments **82**. The independently movable segments **82** may be advantageous for aligning the patient on the support frame **18** for one or more surgical procedures or other treatment of the patient.

(17) According to various aspects, the patient support apparatus **14** includes the base **22** coupled to a bottom surface **86** of the support frame **18**. The base **22** includes a support feature **90** and a central pedestal **94** extending between the support feature **90** and the support frame **18**. While the patient support apparatus **14** is illustrated with a single central pedestal **94**, it is contemplated that other configurations of the base **22** are contemplated without departing from the teachings herein (e.g., more than one pedestal **94** may extend between the support feature **90** and the support frame **18**, etc.). The support feature **90** includes rollers **98** that engage an underlying floor surface **100**. In this way, the patient support apparatus **14** is transportable about the surgical suite or otherwise within a hospital, medical facility, or other healthcare setting **66**.

(18) The patient support apparatus **14** configured as the surgical table is generally used during one or more surgical procedures. During a surgical procedure, biological material or fluids may be deposited on the patient support apparatus **14**, on other healthcare equipment **12** (e.g., such as an

instrument table **102**, etc.), or otherwise deposited in the surgical suite. The fluids may include medicinal fluid, bodily fluid (e.g., mucus, blood, saliva, urine, etc.), or a combination thereof. Such material may be considered contamination deposited on the patient support apparatus **14** or elsewhere in the surgical suite. The contamination may be deposited as a result of one or more procedures or may be foreign contaminants shed by the patient or personnel in the surgical suite. As a result of the contamination, the surgical suite, the patient support apparatus **14**, and the other healthcare equipment **12** are cleaned following the surgical procedure. The floor surface **100** of the surgical suite may be relatively easy to clean, whereas the patient support apparatus **14** may be more difficult to clean due to different surface configurations of the support frame **18**, the base **22**, the roller **98**, etc. The different surfaces and/or shape of the components of the support frame **18** and the base **22** may increase the difficulty of visibility or accessibility of the contamination on the patient support apparatus **14**.

(19) Referring still to FIG. **1**, as well as FIG. **2**, the patient support apparatus **14** includes the first controller **26**. The first controller **26** includes a processor **104**, a memory **106**, and other control circuitry. The first controller **26** includes routines or instructions **110** stored within the memory **106** and executable by the processor **104**. In various examples, the first controller **26** includes light control circuitry for controlling the first light source **30**. In this way, the first controller **26** is configured to control the function of the first light source **30**, such as, for example, activation, deactivation, direction, intensity, etc.

(20) In the illustrated configuration, the first light source **30** is coupled to the base **22** of the patient support apparatus **14**. It is contemplated that the first light source **30** may be directly coupled to various locations of the patient support apparatus **14** without departing from the teachings herein, such as, for example, the base **22**, the support frame **18**, siderails, etc. In other examples, the first light source **30** is communicatively coupled with the first controller **26**, but may not have a direct mechanical connection to the patient support apparatus **14**. For example, the first light source **30** may be an overhead lighting assembly disposed within the surgical suite.

(21) Referring still to FIGS. **1** and **2**, the first light source **30** emits the visible light **34** toward the top support surface **78** of the patient support apparatus **14**. The first light source **30** may be movable or static relative to the patient support apparatus **14**. As illustrated, the first light source **30** includes an arm **112** and a light source housing **114**. The arm **112** is adjustable to adjust the light source housing **114** between various positions relative to the patient support apparatus **14** to provide different lighting effects during the surgical procedure, to illuminate the surgical suite, or a combination thereof. It may be advantageous for the first light source **30** to be movable relative to the patient support apparatus **14** to provide the visible light **34** at various locations on the support frame **18**. Further, it may be advantageous for the first light source **30** to be movable to reduce or prevent shadowing effects on the support frame **18** or the patient during surgical procedures that can be caused by the angled direction of the visible light **34**.

(22) In various examples, the visible light **34** is generally visible to the human eye and has a wavelength in a range from about 380 nm to 740 nm. The first light source **30** may include any form of light source. For example, fluorescent lighting, light-emitting diodes (LEDs), organic LEDs (OLEDs), polymer LEDs (PLEDs), laser diodes, quantum dot LEDs (OD-LEDs), solid-state lighting, a hybrid, or any other similar device. Any other form of lighting may be utilized within the patient support apparatus **14** or the first light source **30** without departing from the teachings herein. Further, various types of LEDs are suitable for use as the first light source **30**, including, but not limited to, top-emitting LEDs, side-emitting LEDs, and others. Moreover, according to various examples, multicolored light sources such as Red, Green, and Blue (RGB) LEDs that employ red, green, blue LED packaging may be used to generate various desired colors of light outputs from a single light source, according to known light color mixing techniques.

(23) The first light source **30** may be configured as a single light. In a non-limiting example, the first light source **30** may be a single LED. Alternatively, the first light source **30** may be configured

as multiple lights that may be disposed in various locations relative to the patient support apparatus **14**. In examples where the first light source **30** is configured as multiple lights, the first controller **26** may selectively control each light of the first light source **30**, such that one, all, or a portion of the lights can be activated at any given time. Additionally or alternatively, the patient support apparatus **14** can include one or more circuits or circuit boards coupled to the first light source **30**. The circuit boards may be printed circuit boards, which may be configured as flexible or rigid printed circuit boards.

(24) Referring still to FIGS. **1** and **2**, each of the first and second controllers **26**, **54** are configured for gathering input, processing the input, and generating an output response to the input. The first and second controllers **26**, **54** are communicatively coupled to one another. A communication interface **126** may be established between the contamination detection device **38** and the patient support apparatus **14** for bidirectional communication between the first and second controllers **26**, **54**. For example, the second controller **54** of the contamination detection device **38** may receive a command input. If the command input is related to the first light source **30**, the second controller **54** sends a signal to the first controller **26** regarding the command input for the first light source **30**. The first controller **26** then sends a corresponding signal to operate the first light source **30** in accordance with the command input.

(25) The first and second controllers **26**, **54** communicate by a network **130**. The network **130** may be one or more various wired or wireless communication mechanisms, including any combination of wired (e.g., cable and fiber) and/or wireless communications and any network topology or topologies. Exemplary communication networks **130** include wireless communication networks, such as, for example, a Bluetooth® transceiver, a ZigBee® transceiver, a Wi-Fi transceiver, an IrDA transceiver, an RFID transceiver, etc. It is also contemplated that each of the first and second controllers **26**, **58** may include separate transmitters and receivers without departing from the teachings herein. The first and second controllers **26**, **54** generally include circuitry configured for bidirectional wireless communication. Additional exemplary communication networks **130** include local area networks (LAN) and/or wide area networks (WAN), including the Internet and other data communication services. It is contemplated that the first and second controllers **26**, **54** may communicate by any suitable technology for exchanging data.

(26) In examples where the first and second controllers **26**, **54** communicate via a Bluetooth® transceiver, the contamination detection device **38** and the patient support apparatus **14** may be linked or synchronized (e.g., synced). The contamination detection device **38** may be associated with multiple patient support apparatuses **14** by linking each individual patient support apparatus **14** to the contamination detection device **38** via Bluetooth®. In such examples, the contamination detection device **38** may be linked to a single patient support apparatus **14** at any given time, or alternatively, may be synced to multiple patient support apparatuses **14** at any given time.

(27) Referring still to FIG. **2**, as well as FIG. **3**, as previously stated, the contamination identification system **10** includes the contamination detection device **38**. The contamination detection device **38** includes the second light source **58**, which emits the ultraviolet light **62** when activated by the second controller **54**. The ultraviolet light **62** emitted by the second light source **58** may have a wavelength in a range from about 10 nm to about 400 nm. Accordingly, the ultraviolet light **62** may include UV-A light, UV-B light, UV-C light, or a combination thereof. In certain aspects, the ultraviolet light **62** may have a wavelength in a range of from about 320 nm to about 400 nm, such that the second light source **58** emits black light (e.g., UV-A light).

(28) The ultraviolet light **62** is generally not visible to a human eye, however, a portion of the ultraviolet light **62** may be visible. Typically, the human eye can respond to wavelengths in a range of from about 380 nm to about 740 nm (e.g., within the visible light spectrum). Accordingly, it may be difficult to determine where the ultraviolet light **62** is directed. In order to determine if the entire surface of the patient support apparatus **14** or other healthcare equipment **12** has been checked for contamination, the medical personnel may utilize a direction confirmation **116** provided by the

contamination detection device **38**. The direction confirmation **116** may be a visible indication on the surface of the patient support apparatus **14** or the other healthcare equipment **12**. For example, at least a portion of the ultraviolet light **62** emitted by the second light source **58** may be generally visible to a human eye. The ultraviolet light **62** that overlaps with the visible light spectrum (e.g., wavelengths in a range from about 380 nm to about 400 nm) may be at least partially visible to the human eye and may operate as the direction confirmation **116**.

(29) Additionally or alternatively, the contamination detection device **38** may also emit the visible light **34** simultaneously with the ultraviolet light **62** to provide the direction confirmation **116**. The visible light **34** may not substantially interfere with the illumination of the contamination provided by the ultraviolet light **62**. In certain aspects, the visible light **34** emitted by the second light source **58** may have a wavelength close to the wavelength of the ultraviolet light **62**. For example, the visible light **34** may include a violet light (having a wavelength in a range from about 380 nm to about 450 nm) or a blue light (having a wavelength in a range from about 380 nm to about 500 nm). The violet or blue light may allow the user of the contamination detection device **38** to see where the ultraviolet light **62** is being directed without substantially interfering with the illumination of the contamination. It is contemplated that the visible light **34** emitted by the second light source **58** may have any wavelength within the visible spectrum without departing from the teachings herein.

(30) Similar to the first light source **30**, the second light source **58** may include any form of light source. For example, fluorescent lighting, light-emitting diodes (LEDs), organic LEDs (OLEDs), polymer LEDs (PLEDs), laser diodes, quantum dot LEDs (OD-LEDs), solid-state lighting, a hybrid, or any other similar device. Any other form of lighting may be utilized within the patient support apparatus **14** without departing from the teachings herein. Further, various types of LEDs are suitable for use as the second light source **58**, including, but not limited to, top-emitting LEDs, side-emitting LEDs, and others. Moreover, according to various examples, multicolored light sources such as Red, Green, and Blue (RGB) LEDs that employ red, green, blue LED packaging may be used to generate various desired colors of light outputs from a single light source, according to known light color mixing techniques.

(31) Referring still to FIGS. **2** and **3**, the second light source **58** may be configured as a single light, such as a single LED. Alternatively, the second light source **58** may be configured as multiple lights. In examples where the second light source **58** is configured as multiple lights, the second controller **54** may selectively control each light of the second light source **58** such that one, all, or a portion of the lights can be activated at any given time. Additionally or alternatively, the contamination detection device **38** can include one or more circuits or circuit boards coupled to the second light source **58**. In circuit board examples, the circuit boards may be printed circuit boards, which may be configured as flexible or rigid printed circuit boards.

(32) According to various aspects, the contamination detection device **38** includes the second controller **54** communicatively coupled to the second light source **58** to control the second light source **58**. The second controller **54** may include a processor **118**, a memory **120**, and other control circuitry. The second controller **54** includes routines or instructions **122** stored within the memory **120** and executable by the processor **118**. The second controller **54** may execute software to automatically control the second light source **58**.

(33) The contamination detection device **38** includes a power source **138**, such as a battery. The battery is generally stored within the body **42**. It is contemplated that the power source **138** may be replaceable batteries or may be rechargeable batteries. In rechargeable battery examples, the contamination detection device **38** may define a port for receiving a charger to charge the rechargeable battery. Additionally or alternatively, the power source **138** may be outside of the body **42**. For example, the contamination detection device **38** may include a power receiving port to receive a cord, which can connect the contamination detection device **38** to the power source **138**.

(34) Referring still to FIGS. **2** and **3**, the contamination detection device **38** includes the body **42** having the top surface **46** and the end surface **50**. The second light source **58** is generally coupled to the end surface **50**. In various aspects, the second light source **58** is configured to direct the ultraviolet light **62** outwardly from the contamination detection device **38** and away from a user. The ultraviolet light **62** may be configured as a directed light beam, which may reduce or prevent the emission of scattered ultraviolet light **62**. For example, the second light source **58** may be configured as a laser to direct the ultraviolet light **62**. It is also contemplated that the contamination detection device **38** may include optics configured to direct or collimate the ultraviolet light **62**. The contamination detection device **38** may be configured such that the user may grasp the contamination detection device **38** and direct the ultraviolet light **62** away from the user. Accordingly, the end surface **50** where the second light source **58** is coupled is a distal end **158** of the contamination detection device **38** relative to the user.
(35) The body **42** of the contamination detection device **38** is generally configured to form a more ergonomic grasp for the user. In this way, the distal end **158** of the contamination detection device **38** has a greater thickness than a proximal end **162**. The thicker distal end **158** may be advantageous for housing the second controller **54**, the second light source **58**, the associated circuitry, the power source **138**, or a combination thereof. The proximal end **162** having a lesser thickness may be advantageous to improve the grasp of the user on the contamination detection device **38**.
(36) To form the ergonomic shape of the contamination detection device **38**, the top surface **46** is a substantially continuous, planar surface. A bottom surface **170** of the contamination detection device **38** has a first surface at the distal end **158** and a second surface at the proximal end **162**, which is offset from the first surface by a sloped surface. The bottom surface **170** may include a slope, a step, or other transition portion between the distal and proximal ends **158**, **162**. The bottom surface **170** may be generally planar, or alternatively, may be curved. In certain aspects, at least the bottom surface **170** adjacent to the proximal end **162** may be curved to provide a more ergonomic grasping location for the user. Additionally or alternatively, corners between the top surface **46** and side surfaces **178** as well as corners between the bottom surface **170** and the side surfaces **178** may be rounded to contribute to the ergonomic grasping location.
(37) Referring to FIGS. **4** and **5**, the second light source **58** may be coupled to the body **42** in different configurations. For example, as illustrated in FIG. **4**, the end surface **50** of the body **42** is planar and the second light source **58** extends outward from the end surface **50**. Accordingly, the second light source **58** may be a projection extending from the body **42**. Alternatively, as illustrated in FIG. **5**, the end surface **50** of the body **42** of the contamination detection device **38** may extend at least partially around the second light source **58**. Accordingly, the end surface **50** defines a channel or recessed portion **150**, and the second light source **58** is disposed within the recessed portion **150**. In such examples, the surface of the recessed portion **150** surrounding the second light source **58** may be configured as a light guide to direct the ultraviolet light **62** in the selected direction outwardly from the contamination detection device **38**. A window or lens **154** may extend over the recessed portion **150** to enclose the second light source **58**. The lens **154** generally does not substantially interfere with the emission of the ultraviolet light **62** of the visible light **34**. The lens **154** may be advantageous for preventing the contamination from entering a space defined by the recessed portion **150**. The lens **154** may also be advantageous for providing more convenient cleaning of the contamination detection device **38**. It is contemplated that the lens **154** may include the optics for directing the ultraviolet light **62**. It is also contemplated that a protective cover may be disposed around the contamination detection device **38** to provide more convenient cleaning and minimize or prevent contamination on the contamination detection device **38**.
(38) Referring to FIGS. **6**A-**6**C, the contamination detection device **38** includes a user-interface **200**. The user-interface **200** is generally coupled to or integrally formed with the top surface **46** of the contamination detection device **38**. The user-interface **200** is disposed on the distal end **158** of

the contamination detection device **38**, thereby allowing the user to grasp the proximal end **162** of the contamination detection device **38** without interfering with the user-interface **200**. Further, the user may grasp the contamination detection device **38** and the user-interface **200** may remain visible and accessible to the user.

(39) In various examples, the user-interface **200** may include a touch-sensitive display screen or a touch screen **204**. The touch screen **204** may utilize any practicable touch screen technology (e.g., resistive, capacitive, etc.). The user-interface **200** displays or presents a first display screen **208** having first user options **212**. As illustrated in FIG. **6**A, the first user options **212** include selectable features **216** that relate to the contamination identification system **10**, the surgical suite, settings, and user preferences. The first display screen **208** is generally a home screen or a default screen for the contamination detection device **38**. The first display screen **208** may be customizable by the user and may be personalized for each user.

(40) The user selects one of the selectable features **216**, which results in the first display screen **208** changing to a second display screen **220**. The second display screen **220** illustrated in FIG. **6**B appears when the user selects the selectable feature **216** relating to the contamination identification system **10**. The second display screen **220** includes second user options **224** corresponding or associated with the selectable feature **216** the user selected from the first display screen **208**. Accordingly, the second display screen **220** is a second level screen relative to the first display screen **208** (e.g., displayed after one user input). As illustrated in FIG. **6**B, the selectable features **216** on the second display screen **220** correspond to functions or settings of the patient support apparatus **14** and lighting.

(41) The user selects one of the selectable features **216** on the second display screen **220**, which results in the second display screen **220** changing to a third display screen **228**. The third display screen **228** includes third user options **232**. As illustrated in FIG. **6**C, the third user options **232** correspond with the lighting functions selected from the second display screen **220**. Accordingly, the selectable features **216** on the third display screen **228** correspond with the operation of first and second light sources **30**, **58**. The third display screen **228** operates as a third level display screen relative to the first display screen **208** (e.g., displayed after two user inputs). It is contemplated that the selectable features **216** relating to the first and second light sources **30**, **58** may change the third display screen **228** into another subsequent display screen.

(42) The levels of display screens may be advantageous for preventing inadvertent activation of a function of the contamination detection device **38** or the patient support apparatus **14**. In this way, the second user options **224** are displayed in response to a selection of one of the first user options **212**, and the third user options **232** are displayed in response to selection of one of the second user options **224**. Additionally or alternatively, the user-interface **200** may include a selectable lock feature that prevents the touch screen **204** from receiving and responding to a user input. This may be advantageous for preventing inadvertent selection of the selectable features **216** and may also operate as a power saving mode for the contamination detection device **38**.

(43) Referring still to FIGS. **6**A-**6**C, the touch screen **204** may include a variety of selectable features **216** configured as buttons, graphical icons, etc. Additional exemplary selectable features **216** may include a help feature, a battery status indicator, a network indicator, a sync indicator, etc. When a selection is made by the user, a subsequent display screen is displayed on the user-interface **200**. In this way, selecting the desired selectable feature **216** (e.g., button or icon) may provide access to the corresponding subsequent display screen in order to control various functions of the contamination identification system **10** or other features of the surgical suite. It is contemplated that additional or fewer selectable features **216** may be included in the user-interface **200** without departing from the teachings herein.

(44) According to various aspects, the user-interface **200** may return to a selected display screen (e.g., a home screen) after a predetermined amount of time has elapsed since user interaction with the user-interface **200**. Additionally or alternatively, the touch screen **204** may be an illuminated

screen. In such examples, the touch screen **204** may illuminate in response to user interaction with the user-interface **200**. The illumination may be deactivated or dimmed after a predetermined amount of time has elapsed since the user interaction with the user-interface **200**. While the user-interface **200** is illustrated as the touch screen **204**, it is contemplated that any suitable form of user input, such as soft key, buttons, switches, similar tactile features, touch features, or combinations thereof may be included on the contamination detection device **38**. Additionally or alternatively, the contamination detection device **38** may include a display that is not touch-sensitive, but the display may change between the first, second, and third display screens **208**, **220**, **228** in response to the user interacting with other features that receive the user input (e.g., soft keys, switches, etc.). The selectable features **216** illustrated in FIGS. **6**A-**6**C are merely exemplary and are not meant to be limiting.

(45) Referring to FIG. **7**, as well as to FIGS. **1**-**6**C, the second controller **54** operates to control the functions of the contamination detection device **38**. The second controller **54** is communicatively coupled to the user-interface **200** and controls the user-interface **200** to selectively display a specific display screen. The selectable feature **216** selected by the user is communicated to the second controller **54** as the command input.

(46) After receiving the information or command input from the user-interface **200**, the second controller **54** sends a corresponding signal in order to control the operation or function of the respective feature that corresponds with the selectable feature **216** chosen by the user. For example, if the user wants to activate the second light source **58**, the user can navigate through the respective levels of the user-interface **200** (e.g., the first, second, and third display screens **208**, **220**, **228**) to select the selectable feature **216** relating to the second light source **58**. The user-interface **200** communicates the command input to the second controller **54**, which then controls the second light source **58** accordingly. The operation may relate to activation, deactivation, intensity, color, combinations thereof, etc.

(47) In another non-limiting example, if the user wants to activate the first light source **30**, the user can navigate through the levels of the user-interface **200** to select the selectable feature **216** corresponding to the first light source **30**. The user-interface **200** communicates the command input selection to the second controller **54**, which then communicates the command input to the first controller **26** of the patient support apparatus **14**. Once the first controller **26** receives the command input from the second controller **54**, the first controller **26** operates the first light source **30** based on the command input. The operation may relate to activation, deactivation, intensity, color, combinations thereof, etc.

(48) The contamination detection device **38** is generally a handheld remote device, which is freely movable relative to the healthcare equipment **12**. The user may hold the contamination detection device **38** and move the contamination detection device **38** to direct the ultraviolet light **62** along the surface of the healthcare equipment **12** within the healthcare setting **66**.

(49) The healthcare setting **66** may be the illustrated surgical suite, however, the contamination detection device **38** may be utilized in other healthcare settings **66**. For example, the contamination detection device **38** may be used in hospitals, urgent care centers, doctor offices, rehabilitation centers, nursing homes, long-term care facilities, outpatient services or centers, in-home healthcare settings, etc. The contamination detection device **38** may be utilized in any healthcare setting **66** by the medical professional, the patient, or a combination thereof to optimize cleaning processes of any of the healthcare equipment **12**. Additionally or alternatively, the healthcare equipment **12** includes the patient support apparatus **14**, the instrument table **102**, instruments on the instrument table **102**, utility columns, surgical and exam lights, the first light source **30**, storage features, imaging devices, the pads **74** on the patient support apparatus **14**, etc. The contamination may be a result of the surgical procedures or shed by the patient or by the personnel. The contamination may also be transferred between healthcare equipment **12** by the medical personnel during treatment or surgical procedures. Accordingly, the contamination detection device **38** may be used to detect

contamination on any of the healthcare equipment **12**. The contamination detection device **38** may not be directly coupled (e.g., free of a mechanical connection) to the patient support apparatus **14** or any other healthcare equipment **12**, which is advantageous for increasing the mobility of the contamination detection device **38**.

(50) For the illustrated patient support apparatus **14**, during surgical procedures or operations, the contamination may be deposited on the patient support apparatus **14**. The contamination is at least partially deposited on the support frame **18** or the base **22**, including the support frame **18** and the central pedestal **94**. For example, the support frame **18** includes the movable segments **82**. Contamination may be deposited on or between the segments **82**. The base **22** generally includes an adjustment system **248** within a protective shroud **252**. The adjustment system **248** adjusts the support frame **18** relative to the base **22** (e.g., height, angles, etc.). Accordingly, the protective shroud **252** is flexible and may have grooves or folds based on the position of the support frame **18**. Contamination may be deposited within the grooves and folds of the protective shroud **252**.

(51) The contamination may also be deposited on the floor surface **100** and on or within the rollers **98**. If the patient support apparatus **14** is moved, the rollers **98** may be adjusted on or over fluids on the floor surface **100**. The contamination in various locations on the patient support apparatus **14** may be difficult for the user to see when cleaning the patient support apparatus **14** after the procedure as a result of the different surfaces or shapes of the various features on the patient support apparatus **14**. The ultraviolet light **62** from the contamination detection device **38** can illuminate contamination (e.g., fluids) on the patient support apparatus **14**, allowing the user to see the contamination remaining on the patient support apparatus **14** that should be cleaned further.

(52) Generally, the patient support apparatus **14** is cleaned and reprocessed after each use. Cleaning is time consuming and, depending on the grade or amount of contamination, can take up to about thirty minutes to clean a single patient support apparatus **14**. The entire patient support apparatus **14** and related accessories (e.g., the pads **74**) are cleaned before the patient support apparatus **14** is used for another patient. The contamination detection device **38** illuminates blood or other fluids (e.g., the contamination), even in places that may be more difficult to reach for cleaning. It may be advantageous to deactivate the first light source **30** to more easily see the illuminated contamination. However, it is contemplated that the contamination detection device **38** may illuminate the contamination with the ultraviolet light **64** with the first light source **30** illuminating the healthcare setting **66**. The contamination detection device **38** may be utilized to confirm that the patient support apparatus **14**, the floor surface **100**, and other healthcare equipment **12** are sufficiently cleaned. The contamination detection device **38** may increase efficiency of the cleaning processes, as well as provide a confirmation of the level of cleanliness of the equipment or environment.

(53) Use of the present device may provide a variety of advantages. For example, the contamination detection device **38** may be movable relative to the patient support apparatus **14**, such that the ultraviolet light **62** may be directed to a variety of locations on the patient support apparatus **14**. Additionally, the cleaning process for the patient support apparatus **14** or the surgical suite can be time-consuming, and the ultraviolet light **62** may increase the efficiency of the cleaning process by illuminating the contamination remaining on the patient support apparatus **14**. Further, the ultraviolet light **62** illuminates the contamination in hard-to-reach spaces on the patient support apparatus **14**. The hard-to-reach spaces may be more difficult to clean, such that contamination may remain after an initial cleaning of the patient support apparatus **14**. In this way, the ultraviolet light **62** of the contamination detection device **38** may illuminate the remaining contamination for cleaning. Moreover, the cleaning process generally includes cleaning the pads **74** and the support frame **18**, as well as, the support feature **90**, the central pedestal **94**, and the rollers **98** of the base **22**. The contamination detection device **38** may be moved by the user to illuminate contamination that may remain on each of the components of the patient support apparatus **14**, and thereby increase efficiency and effectiveness of the cleaning process. Also, the contamination

detection device **38** may be utilized to detect contamination on a variety of healthcare equipment **12** in various healthcare settings **66**. Further, the contamination detection device **38** may be utilized to control the first light source **30** operably coupled with the patient support apparatus **14**. Additional benefits or advantages of using this device may also be realized and/or achieved.

(54) A contamination identification system includes a patient support apparatus that includes a support frame disposed on a base. A first light source is coupled to the patient support apparatus. The first light source emits visible light toward a support surface of the support frame. A first controller is operably coupled to the patient support apparatus. The first controller activates the first light source to emit the visible light. A contamination detection device includes a body and a second light source coupled to the body and that emits ultraviolet light. A second controller is disposed in the body that activates the second light source to illuminate contamination on the patient support apparatus. A user-interface for receiving a command input relating to at least one of the first light source and the second light source is coupled to the body and communicatively coupled to the second controller.

(55) According to another aspect, the contamination detection device is a remote device free of a direct mechanical connection to the patient support apparatus.

(56) According to another aspect, the contamination detection device communicates with the patient support apparatus via a wireless communication interface.

(57) According to another aspect, the first light source is activated through the command input received by the user-interface when the first controller is communicatively coupled with the second controller.

(58) According to another aspect, the user-interface includes a touch screen coupled to a top surface of the body.

(59) According to another aspect, the touch screen displays a first display screen with first user options and a second display screen with second user options. The second display screen is displayed after a selection of one of the first user options.

(60) According to another aspect, the visible light has a wavelength in a range of 380 nm to 740 nm and the ultraviolet light has a wavelength in a range from 320 nm to 400 nm.

(61) According to another aspect of the present disclosure, a contamination identification system for a healthcare setting includes a contamination detection device including: a body, a first light source coupled to the body, and a controller operably coupled to the first light source. The controller activates the first light source to emit ultraviolet light to illuminate contamination within said healthcare setting. A second light source is communicatively coupled with the controller. The controller activates the second light source to emit visible light to illuminate said healthcare setting. Healthcare equipment is disposed within said healthcare setting. The contamination detection device is freely movable relative to the healthcare equipment to illuminate the contamination on the healthcare equipment.

(62) According to another aspect, the healthcare equipment includes a patient support apparatus.

(63) According to another aspect, the second light source is coupled to the patient support apparatus.

(64) According to another aspect, the patient support apparatus includes a controller communicatively coupled to the controller of the contamination detection device for activating the second light source.

(65) According to another aspect, the contamination detection device includes a user-interface coupled to the body for receiving a command input relating to at least one of the first light source and the second light source.

(66) According to another aspect, the user-interface displays a first display screen with first user options and a second display screen with second user options. The first user options and the second user options are different.

(67) According to another aspect, the second user options relate to controlling the first light source.

(68) According to another aspect of the present disclosure, a handheld contamination detection device for a healthcare setting includes a body having a top surface, a bottom surface, and an end surface extending between the top surface and the bottom surface. A light source is coupled to the end surface. The light source emits ultraviolet light away from the body. A user-interface is coupled to the top surface of the body. The user-interface includes a touch screen. A controller is communicatively coupled with the light source and the user-interface. The controller receives a command input from the user-interface and activates the light source in response to the command input.
(69) According to another aspect, the light source emits visible light simultaneously with the ultraviolet light as a direction confirmation.
(70) According to another aspect, the user-interface includes a first display screen having first user options and a second display screen having second user options. The second user options are displayed in response to a selection of one of the first user options.
(71) According to another aspect, the second user options include selectable features for activating or deactivating the light source.
(72) According to another aspect, a first end of the body has a greater thickness than a second end to provide a grasping location.
(73) According to another aspect, the ultraviolet light has a wavelength in a range from 320 nm to 400 nm.
(74) It will be understood by one having ordinary skill in the art that construction of the described disclosure and other components is not limited to any specific material. Other exemplary embodiments of the disclosure disclosed herein may be formed from a wide variety of materials unless described otherwise herein.
(75) For purposes of this disclosure, the term “coupled” (in all of its forms, couple, coupling, coupled, etc.) generally means the joining of two components (electrical or mechanical) directly or indirectly to one another. Such joining may be stationary in nature or movable in nature. Such joining may be achieved with the two components (electrical or mechanical) and any additional intermediate members being integrally formed as a single unitary body with one another or with the two components. Such joining may be permanent in nature or may be removable or releasable in nature unless otherwise stated.
(76) It is also important to note that the construction and arrangement of the elements of the disclosure, as shown in the exemplary embodiments, are illustrative only. Although only a few embodiments of the present innovations have been described in detail in this disclosure, those skilled in the art who review this disclosure will readily appreciate that many modifications are possible (e.g., variations in sizes, dimensions, structures, shapes, and proportions of the various elements, values of parameters, mounting arrangements, use of materials, colors, orientations, etc.) without materially departing from the novel teachings and advantages of the subject matter recited. For example, elements shown as integrally formed may be constructed of multiple parts or elements shown as multiple parts may be integrally formed, the operation of the interfaces may be reversed or otherwise varied, the length or width of the structures and/or members or connector or other elements of the system may be varied, the nature or number of adjustment positions provided between the elements may be varied. It should be noted that the elements and/or assemblies of the system may be constructed from any of a wide variety of materials that provide sufficient strength or durability, in any of a wide variety of colors, textures, and combinations. Accordingly, all such modifications are intended to be included within the scope of the present innovations. Other substitutions, modifications, changes, and omissions may be made in the design, operating conditions, and arrangement of the desired and other exemplary embodiments without departing from the spirit of the present innovations.
(77) It will be understood that any described processes or steps within described processes may be combined with other disclosed processes or steps to form structures within the scope of the present

disclosure. The exemplary structures and processes disclosed herein are for illustrative purposes and are not to be construed as limiting.

Claims

1. A contamination identification system, comprising: a patient support apparatus including a support frame disposed on a base; a first light source directly coupled to the patient support apparatus, wherein the first light source emits visible light toward a support surface of the support frame; a first controller operably coupled to the patient support apparatus, wherein the first controller activates the first light source to emit the visible light; and a contamination detection device freely movable relative to the patient support apparatus, the contamination detection device including: a body; a second light source coupled to the body and that emits ultraviolet light; a second controller disposed in the body and that activates the second light source to illuminate contamination on the patient support apparatus, wherein the second controller is communicatively coupled to the first controller for activating the second light source; and a user-interface for receiving a command input relating to at least one of the first light source and the second light source, wherein the user-interface is coupled to the body and communicatively coupled to the second controller, and wherein the user-interface includes a touch screen coupled to a top surface of the body.
2. The contamination identification system of claim 1, wherein the contamination detection device is a remote device free of a direct mechanical connection to the patient support apparatus.
3. The contamination identification system of claim 2, wherein the contamination detection device communicates with the patient support apparatus via a wireless communication interface.
4. The contamination identification system of claim 1, wherein the first light source is activated through the command input received by the user-interface.
5. The contamination identification system of claim 1, wherein the touch screen displays a first display screen with first user options and a second display screen with second user options, wherein the second display screen is displayed after a selection of one of the first user options.
6. The contamination identification system of claim 1, wherein the visible light has a wavelength in a range of 380 nm to 740 nm and the ultraviolet light has a wavelength in a range from 320 nm to 400 nm.
7. The contamination identification system of claim 1, wherein the second light source emits the visible light simultaneously with the ultraviolet light as a direction confirmation.
8. The contamination identification system of claim 1, wherein the first light source is directly coupled to the base of the patient support apparatus.
9. A contamination identification system for a healthcare setting, comprising: a contamination detection device including: a body; a first light source coupled to the body; and a controller operably coupled to the first light source, wherein the controller activates the first light source to emit ultraviolet light to illuminate contamination within said healthcare setting; a second light source communicatively coupled with the controller, wherein the controller activates the second light source to emit visible light to illuminate said healthcare setting; and healthcare equipment including a patient support apparatus disposed within said healthcare setting, wherein the second light source is directly coupled to a base of the patient support apparatus, and wherein the contamination detection device is freely movable relative to the healthcare equipment to illuminate the contamination on the healthcare equipment, and wherein the patient support apparatus includes a controller communicatively coupled to the controller of the contamination detection device for activating the second light source.
10. The contamination identification system of claim 9, wherein the contamination detection device includes a user-interface coupled to the body for receiving a command input relating to at least one of the first light source and the second light source.

11. The contamination identification system of claim 10, wherein the user-interface displays a first display screen with first user options and a second display screen with second user options, wherein the first user options and the second user options are different.
12. The contamination identification system of claim 11, wherein the second user options relate to controlling the first light source.
13. A handheld contamination detection device for a healthcare setting, comprising: a body having a top surface, a bottom surface, and an end surface extending between the top surface and the bottom surface; a light source coupled to the end surface, wherein the light source emits ultraviolet light away from the body; a user-interface coupled to the top surface of the body, wherein the user-interface includes a touch screen; and a controller communicatively coupled with the light source, the user-interface, and at least one piece of healthcare equipment in said healthcare setting, wherein the controller receives a command input from the user-interface and activates the light source in response to the command input, and wherein the controller receives an additional command input from the user-interface and activates a light attached to the at least one piece of healthcare equipment in response to the additional command input.
14. The handheld contamination detection device of claim 13, wherein the light source emits visible light simultaneously with the ultraviolet light as a direction confirmation.
15. The handheld contamination detection device of claim 13, wherein the user-interface includes a first display screen having first user options and a second display screen having second user options, and wherein the second user options are displayed in response to a selection of one of the first user options.
16. The handheld contamination detection device of claim 15, wherein the second user options include selectable features for activating or deactivating the light source.
17. The handheld contamination detection device of claim 13, wherein a first end of the body has a greater thickness than a second end to provide a grasping location.
18. The handheld contamination detection device of claim 13, wherein the ultraviolet light has a wavelength in a range from 320 nm to 400 nm.