US012438349B2

(12) **United States Patent**
Alvarez

(10) **Patent No.: US 12,438,349 B2**
(45) **Date of Patent: Oct. 7, 2025**

(54) **SMART IV POLE**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 262 days.

(21) Appl. No.: **18/132,099**

(22) Filed: **Apr. 7, 2023**

(65) **Prior Publication Data**

US 2023/0335978 A1 Oct. 19, 2023

Related U.S. Application Data

(60) Provisional application No. 63/330,347, filed on Apr. 13, 2022.

(51) **Int. Cl.**

H02G 3/08	(2006.01)
A61B 50/22	(2016.01)
A61B 50/26	(2016.01)
F16M 11/04	(2006.01)
F16M 11/42	(2006.01)
H02G 11/02	(2006.01)
H02J 9/06	(2006.01)

(52) **U.S. Cl.**

CPC ***H02G 3/08*** (2013.01); ***A61B 50/22*** (2016.02); ***A61B 50/26*** (2016.02); ***F16M 11/045*** (2013.01); ***F16M 11/046*** (2013.01); ***F16M 11/42*** (2013.01); ***H02G 11/02*** (2013.01); *H02J 9/06* (2013.01)

(58) **Field of Classification Search**

CPC H02G 3/08; H02G 11/02; A61B 50/22; A61B 50/26; F16M 11/045; F16M 11/046; F16M 11/42; H02J 9/06

USPC 361/622

See application file for complete search history.

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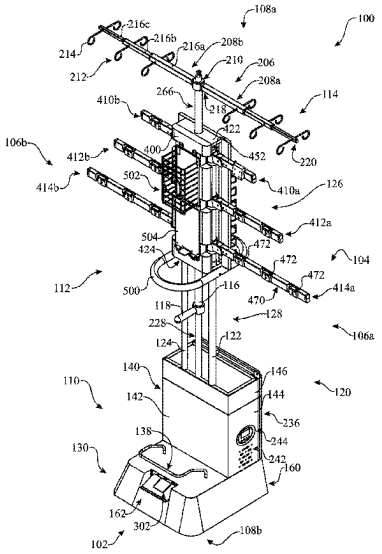
(57) **ABSTRACT**

A smart IV pole is provided for supporting a variety of equipment utilized by the anesthesiology care team and critical care staff. The smart IV pole includes a lower section, a middle section affixed to the lower section, and an adjustable upper section movably mounted to the middle section. The lower section includes a transport base, an uninterrupted power supply and cover mounted on the transport base, and a retractable cable reel in the base. The middle section includes a plurality of pivotable infusion pump arms. The adjustable upper section includes a plurality of hooks for suspending solution bags. The smart IV pole additionally includes a rail on the transport base, an auxiliary tray, and a blood reservoir.

16 Claims, 8 Drawing Sheets



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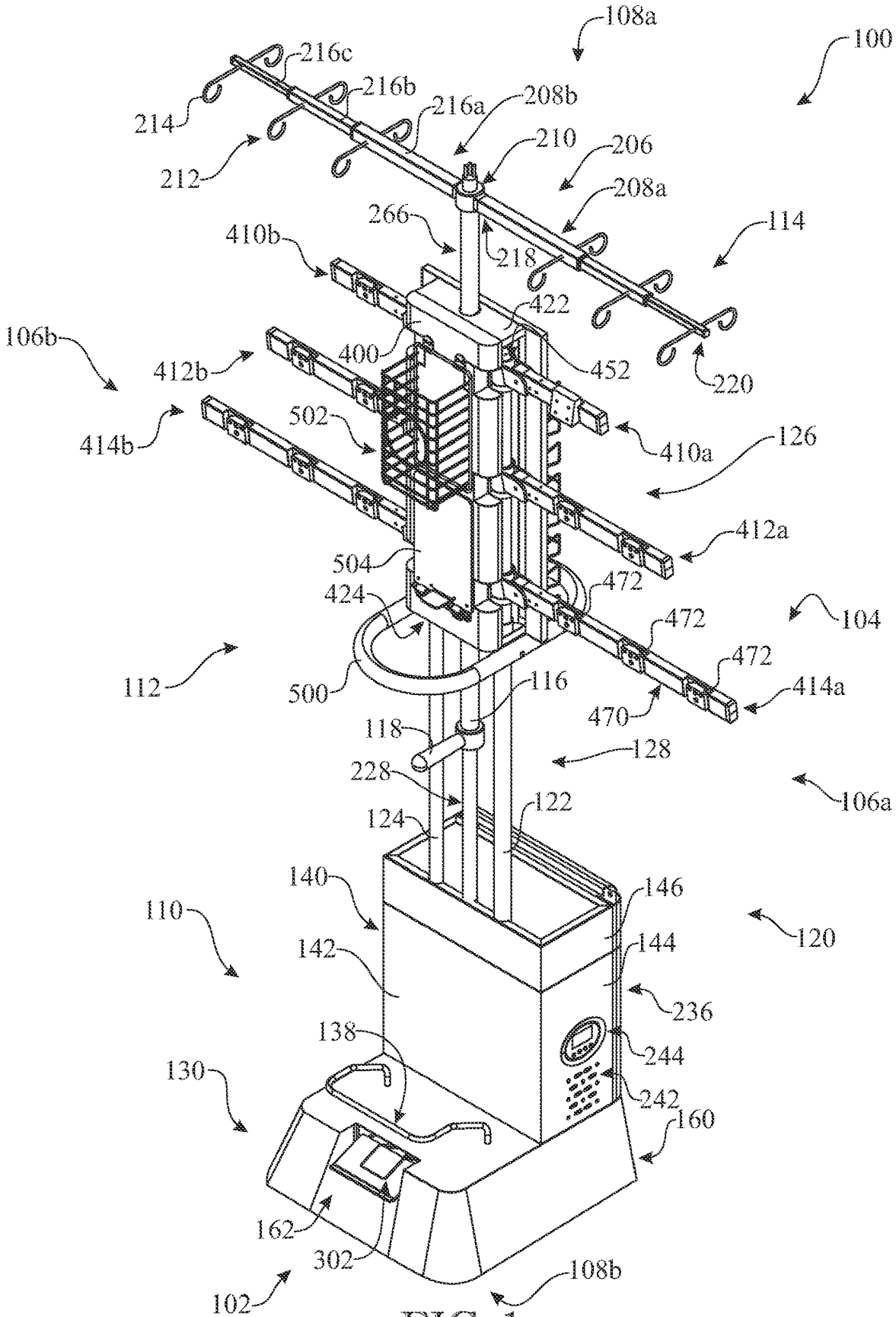
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412b
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414b
410a
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128
228
106a
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162
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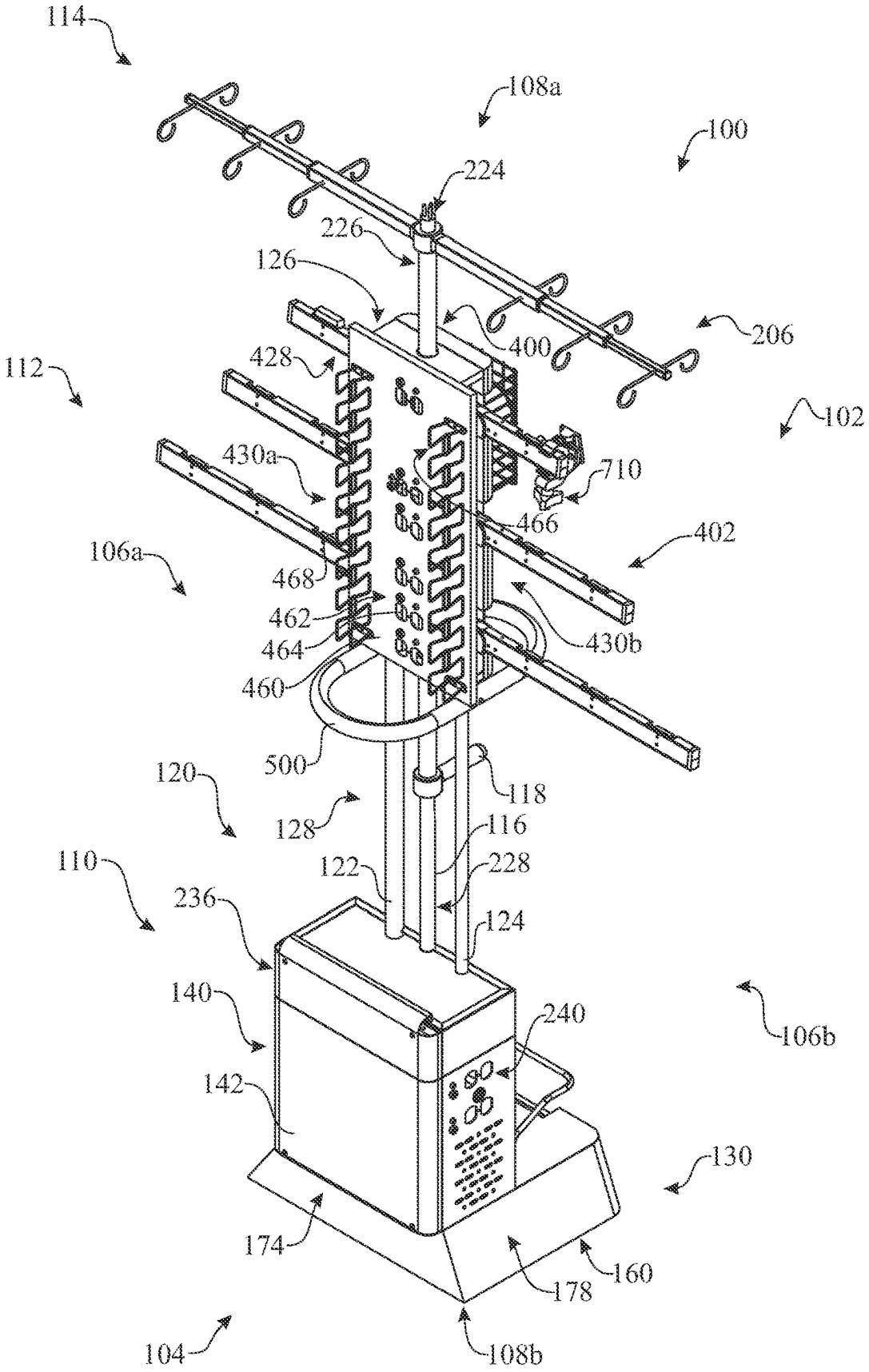
108b
102

FIG. 1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500
120
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108b

FIG. 2

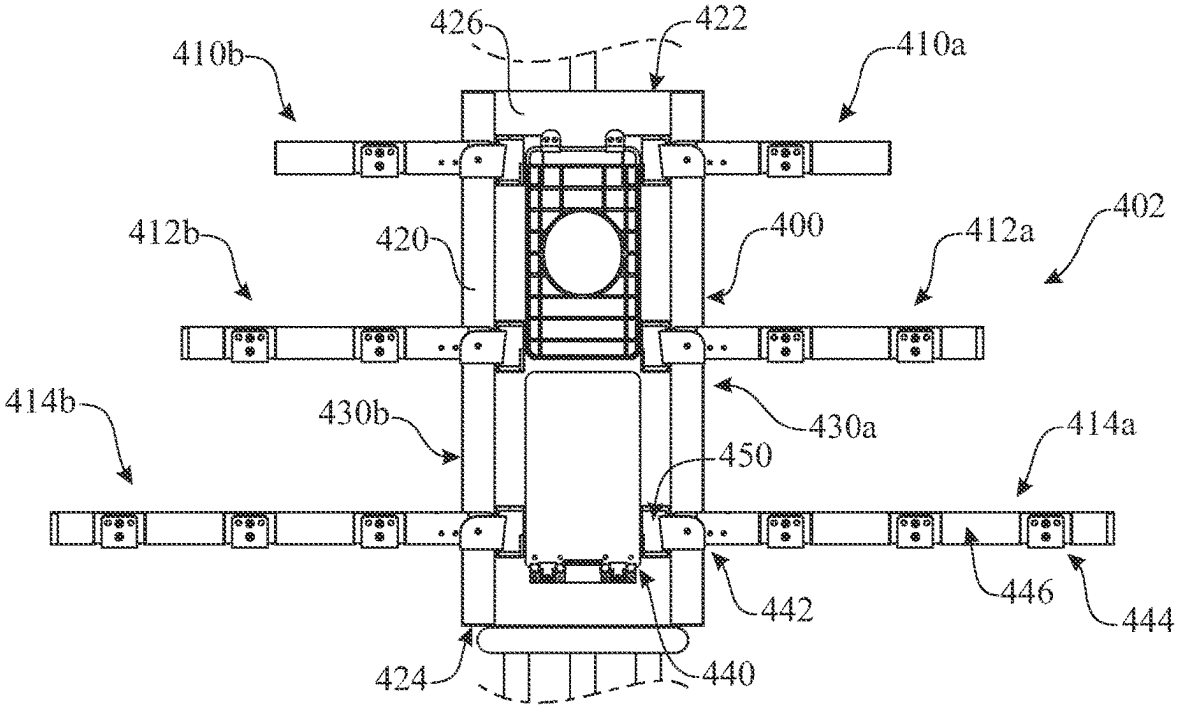
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FIG. 3A

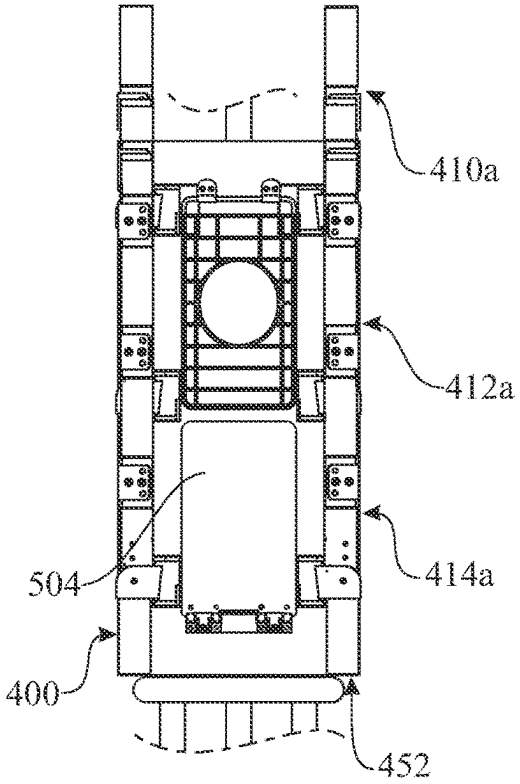
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FIG. 3B

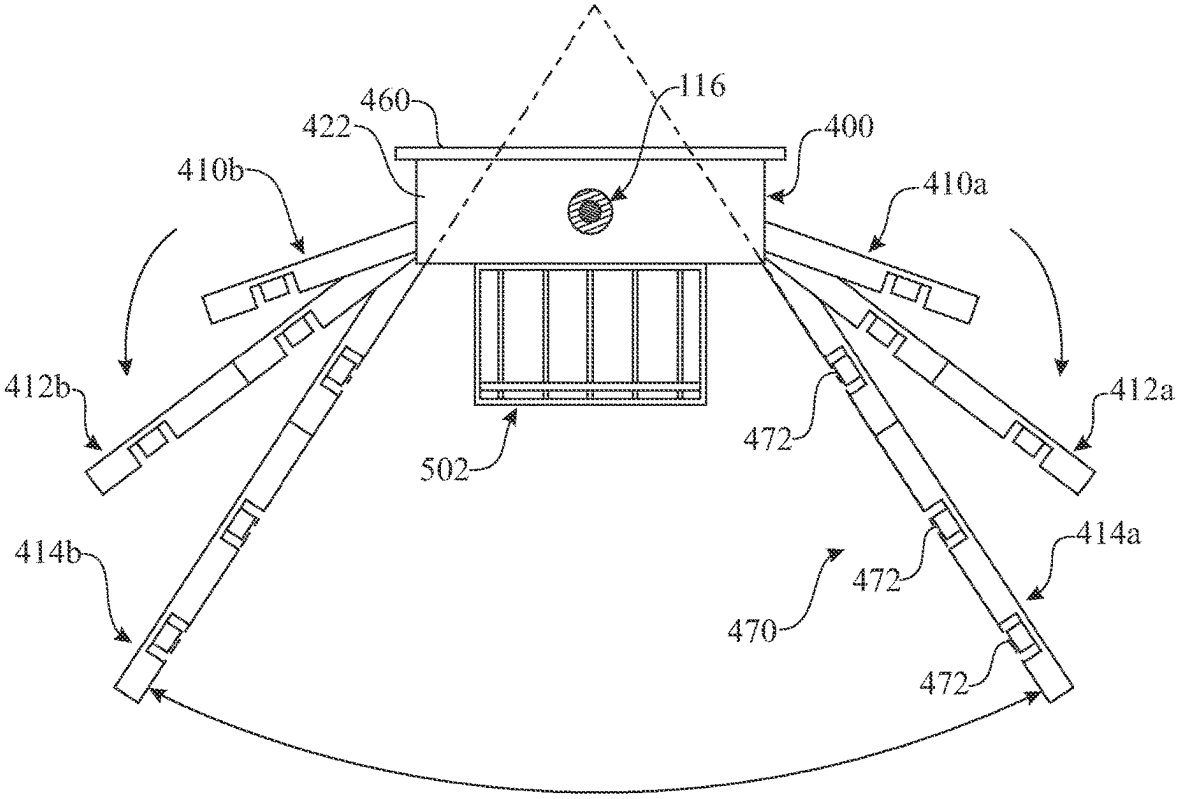
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FIG. 4

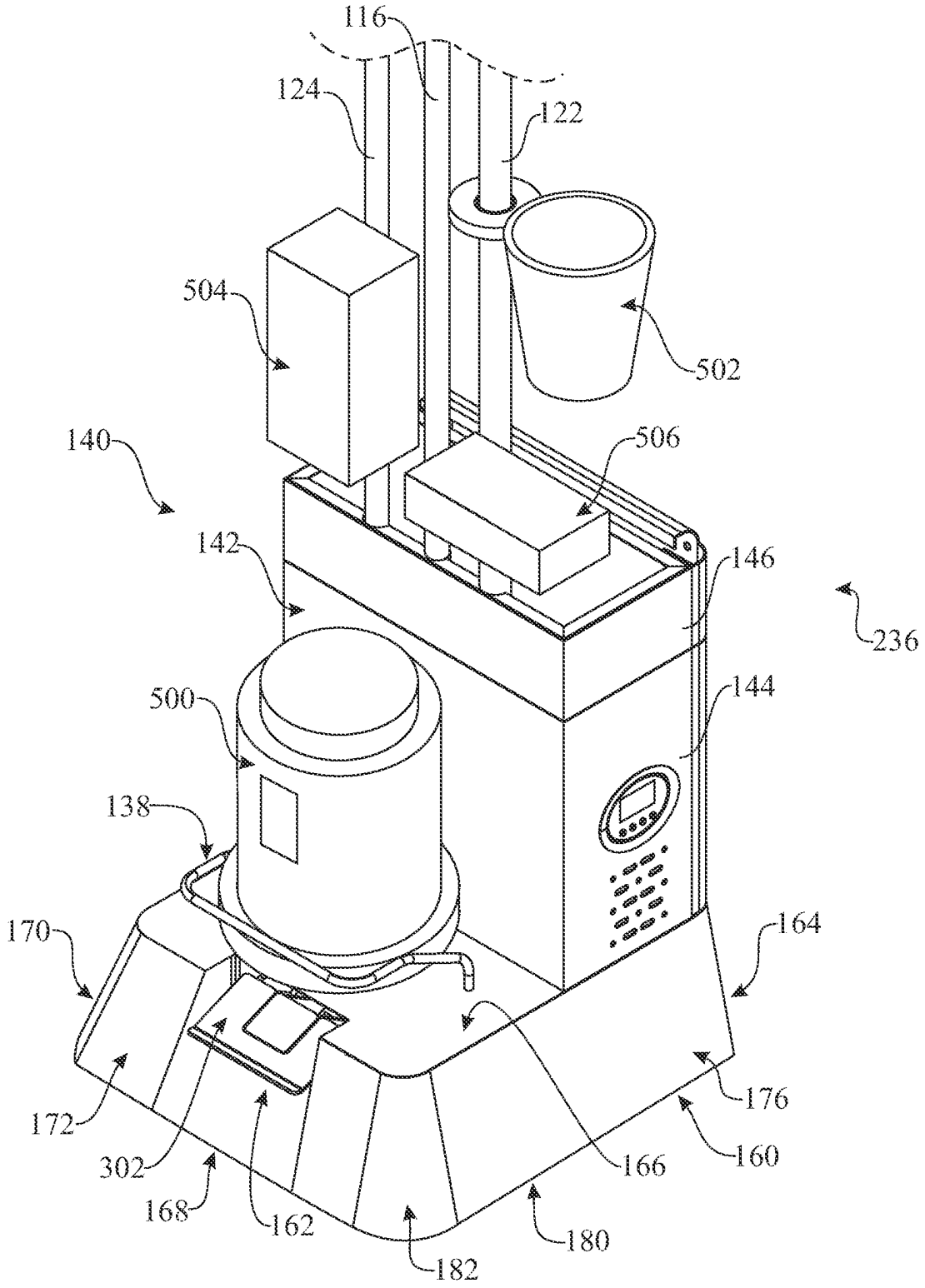
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FIG. 5

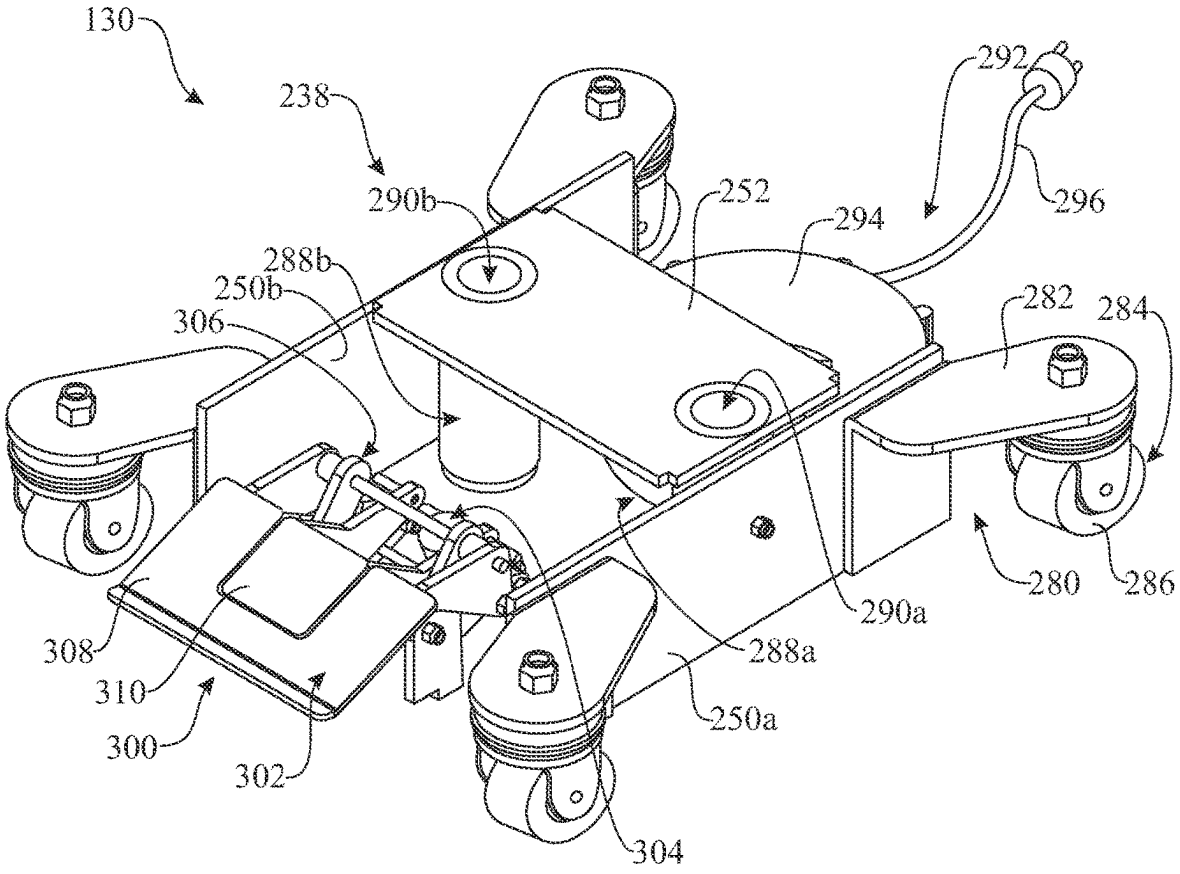
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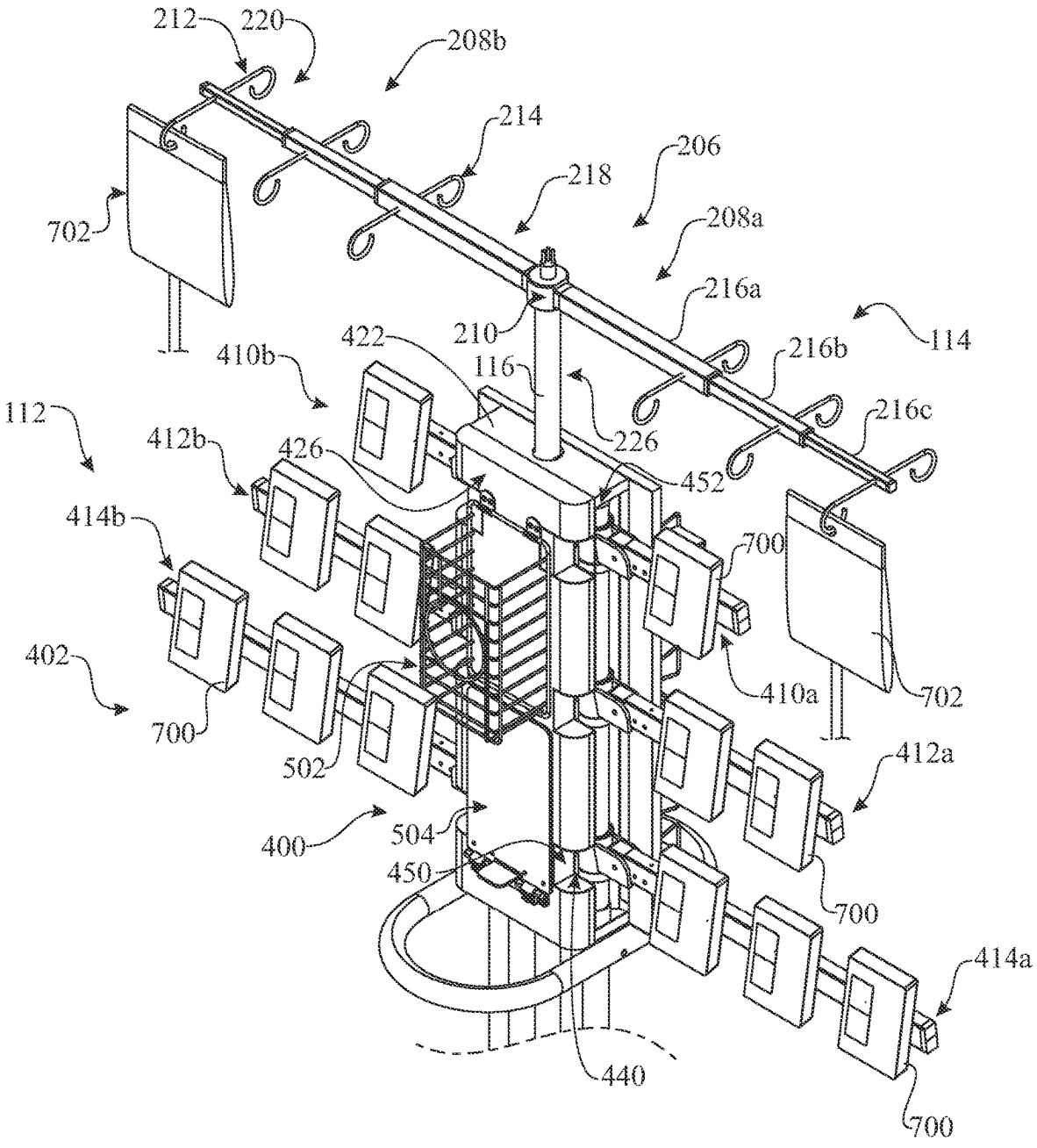
FIG. 6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412a
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700
414a
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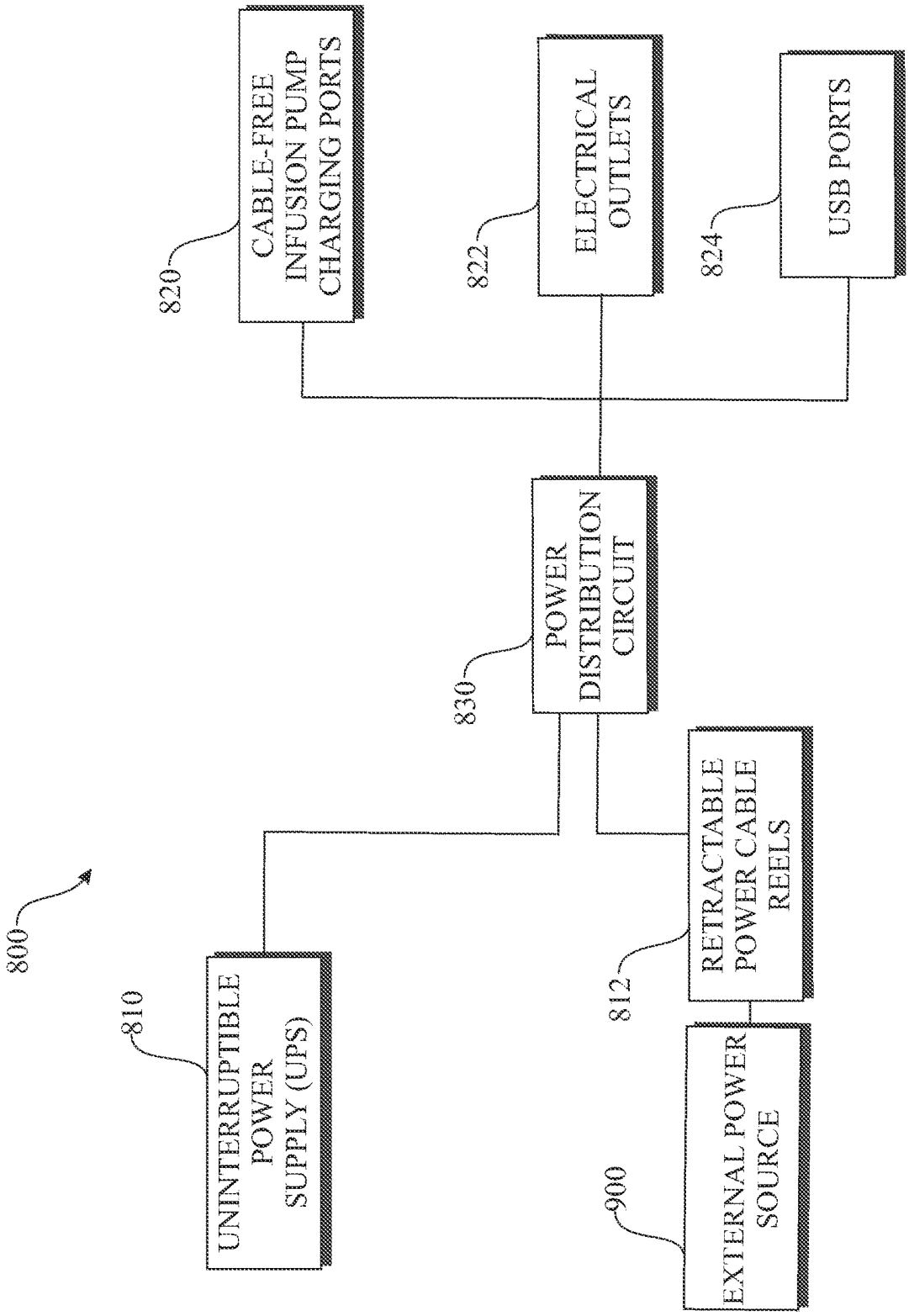
FIG. 7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810
UNINTERRUPTIBLE POWER SUPPLY (UPS)
812
RETRACTABLE POWER CABLE REELS
900
EXTERNAL POWER SOURCE
830
POWER DISTRIBUTION CIRCUIT
820
CABLE-FREE INFUSION PUMP CHARGING PORTS
822
ELECTRICAL OUTLETS
824
USB PORTS

FIG. 8

SMART IV POLE

CROSS-REFERENCE TO RELATED APPLICATIONS

This patent application claims the benefit of U.S. Provisional Patent Application Ser. No. 63/330,347 filed Apr. 13, 2022, which is incorporated herein by reference thereto.

FIELD OF THE INVENTION

The present invention generally relates to medical intravenous infusion IV poles, and, more particularly, to a smart IV pole as a structure to provide an uninterrupted electrical power supply and a centralized location to support and organize various equipment utilized in the care of critically ill patients.

BACKGROUND OF THE INVENTION

Anesthesiologist and critical care staff often require a large amount of equipment readily on hand to perform their duties attending to critically ill patients. Such equipment may include multiple drug infusion pumps, fluid warming devices, massive transfusion sets, hot air blower devices, solution bags for blood or other intravenous solutions and the like.

A common way of securing the various equipment is on a single intravenous or IV pole. These are typically vertical telescoping poles mounted at the bottom center of multiple long branched legs radiating outward with exposed wheels. These spoke-like legs may be independent or interlinked, forming a large base with wide gaps. These bases take up a substantial amount of room circumferentially with a fixed broad footprint in all environments the IV poles are used, conflicting with other standing equipment within a limited space. In the operating room theater, the IV pole legs collide with the anesthesia machine, blood cell saver processing machine, and ultrasound machine, among others. The problem is compounded when several IV poles are required to mount additional equipment for the care of complex surgery like open heart surgery, organ transplant or life-saving equipment for trauma patients. During transport of the critical ill patient from the operating room to the Intensive Care Unit, the long radiating legs bang against the ICU bed wheels and other equipment routinely stationed on the narrow hallways of all hospitals. Lastly, the ICU room may have limited floor space due to an increase use of newer continuous monitoring equipment that requires an independent standing support tower.

All the medical devices that may be attached to the lower section of the IV pole or as a stand-alone equipment in the operating room theater have an electrical power cords of 5 to 10 feet long. These are medically graded cords that despite conscious care by the personnel, they keep uncoiled, detached, tangled, kink or crushed by the heavy equipment including the IV pole when is fully loaded. The expose wheels of each of the legs are inoperative when surrounded by entangled cables on the floor, impeding any translational movement of the IV pole for an alternative position. Depending on the number of drug infusion pumps attached to the IV pole, there may be insufficient electrical outlets near available having the need to run power cords "floating" through the air to the next medically graded electrical wall outlet creating a safety hazard for the personnel.

The majority of IV poles are a single two part telescoping vertical tubes often too small in diameter and fragile to hold, secure or support multiple heavy medical devices at once. Others sturdiest IV poles have a "fork" type structure or "Y" shape with 90-degree angles holding vertical fixed poles increasing the space to secure more medical devices including multiple drug infusion pumps. Nevertheless, when more drug infusion pumps are needed than the capacity of these two vertical poles, additional horizontal plates have to the added as extension accessories which causes conflict between them and weight-balance problems especially at transportation.

Additionally, the continuous operation of the medical equipment in the operating room and intensive care unit is often critical to the clinical state and safety of the patient. These not only include the drug infusion pumps but the anesthesia machine, computers supporting ancillary function and vital respirators. Any disruption of power, even for just several seconds while the Hospital generator is activated, causes the various medical equipment to rebut compromising patient safety, with exponential risk when having extended power plant failures that have been reported.

Lastly, there is no consistency in inventory control, location, and positioning of the medical equipment needed for the care of the critically ill patient in the perioperative period, meaning from the pre-surgical suite, the operating room theater, and the recovery room or intensive care unit. Some of the essential medical equipment is attached to IV poles, and others are as a standalone in any of these rooms, which causes delays in patient management if they are not centralized.

Accordingly, there is a need for a solution to at least one of the aforementioned problems. For instance, there is an established need for an IV pole that can reliably provide an uninterrupted power supply to a large variety of medical equipment mounted in a centralized structure.

SUMMARY OF THE INVENTION

The present invention is directed to a smart IV pole for supporting a variety of equipment utilized by the anesthesiology care team and critical care staff. The smart IV pole includes a lower section, a middle section coupled to the lower section, and an adjustable upper section. The lower section includes a transport base with a mounted cover, an uninterrupted power supply, and a retractable cable reel housed in the base to provide a bottom-exiting electrical plug. The middle section includes a plurality of pivotable infusion pump arms carried by a carrier subassembly. The pivotable arms can be equipped with charging ports to enable cable-free installation and operation of the infusion pumps. An exemplary frame structure includes a pair of vertical supporting poles to support the middle section relative to the lower section. The adjustable upper section includes a length-adjustable vertical portion and a length-adjustable horizontal portion disposed at the upper end of the vertical portion. The horizontal portion includes a plurality of hooks to suspend solution bags. The plug of a retractable electrical cord is threaded through the vertical portion and emerges as a top-exiting component available for plug-in to a ceiling outlet. The smart IV pole additionally includes a retention rail at the base to secure and protect equipment. The smart IV pole includes sensors for medical device location system for the equipment installed.

In an exemplary implementation of the invention, a stand assembly comprises:

- a base subassembly;
- a carrier subassembly disposed above the base subassembly; and

an arm subassembly mounted to the carrier subassembly and including one or more arms pivotably connected to the carrier subassembly.

In a second aspect, at least one arm of the arm subassembly is configured to selectably adopt a deployed configuration and a retracted configuration.

In another aspect, at least one arm of the arm subassembly is configured in a first mode to pivot about a generally horizontal axis enabling the arm to traverse through a generally vertical plane, and configured in a second mode to pivot about a generally vertical axis enabling the arm to traverse through a generally horizontal plane.

In another aspect, the first mode facilitates retraction of the arm into a generally vertical orientation and facilitates extension of the arm into a generally horizontal orientation.

In another aspect, the assembly further includes a container-supporting rack subassembly. The rack subassembly includes, in combination, a proximal end coupled to the base subassembly, a distal end, a length-adjustable generally vertical first portion extending between the proximal end and the distal end, and a length-adjustable generally horizontal second portion disposed at the distal end.

In another aspect, the rack subassembly further includes, in combination, an adjustable first telescoping device defining at least part of the first portion of the rack subassembly; a pair of independently adjustable second telescoping devices defining at least part of the second portion of the rack subassembly and extending in opposite directions; and at least one hook disposed on the second portion of the rack subassembly.

In another aspect, the base subassembly further includes, in combination, a wheeled unit, and a cover configured to cover the wheeled unit. The cover includes an upper side and a sloping lateral structure extending from the upper side and having a lower peripheral edge.

In another aspect, the assembly further includes a brake system configured to apply a braking action to the base subassembly. The cover includes a front opening formed in the lateral structure of the cover to enable access to the brake system.

In another aspect, the brake system further includes, in combination, a brake element; and, a user-actuatable mechanism configured to move the brake element between a braking position in which the brake element is disposed in contacting engagement with a ground surface, and a release position in which the brake element is disengaged from the ground surface.

In another aspect, at least one arm of the arm subassembly includes one or more charging ports.

In another aspect, the assembly further includes one or more mounting brackets each incorporating a respective one of the one or more charging ports and configured to define a device mounting structure disposed on the arm subassembly.

In another aspect, the assembly further includes a device configured to provide an indication of a location of the assembly. The assembly adopts a loading configuration in which one or more medical devices mounts to one or more arms of the arm subassembly. The assembly further includes at least one location indicator each associated with a respective one of the one or more medical devices mounted to the one or more arms of the arm subassembly.

In another aspect, the assembly further includes an electrical subassembly. The electrical subassembly includes, in combination, one or more charging ports disposed on the arm subassembly, one or more electrical outlets disposed on the base subassembly and/or the carrier subassembly, one or more mobile device connectors disposed on the base subassembly and/or the carrier subassembly, one or more retractable power cable reels each housed in the assembly and having an input plug available to connect to an external power source and an output plug, an uninterruptible power supply, and a power distribution circuit configured to electrically couple the uninterruptible power supply and/or the one or more retractable power cable reels to the one or more charging ports, the one or more electrical outlets, and the one or more mobile device connectors.

In another aspect, the base subassembly includes, in combination, a wheeled unit, and a cover configured to cover the wheeled unit. The cover includes an upper side and a sloping sidewall structure extending from the upper side. At least one arm of the arm subassembly is configured to selectably adopt a deployed configuration and a retracted configuration. Additionally, at least one arm of the arm subassembly includes one or more charging ports.

In another aspect, the base subassembly includes, in combination, a wheeled unit, and a cover configured to cover the wheeled unit. The cover includes an upper side and a sloping foot structure extending from the upper side. At least one arm of the arm subassembly is configured to pivot about a generally horizontal axis enabling the arm to traverse through a generally vertical plane and to move between a retracted position and an extended position, and further configured to pivot about a generally vertical axis enabling the arm to traverse through a generally horizontal plane. At least one arm of the arm subassembly includes one or more charging ports. The assembly further includes one or more mounting brackets each incorporating a respective one of the one or more charging ports and configured to define a device mounting structure disposed on the arm subassembly.

In another aspect, the base subassembly includes, in combination, a wheeled unit, a brake system configured to apply a braking action to the base subassembly, and a cover configured to cover the wheeled unit and at least part of the brake system. The cover includes an upper side, a sloping sidewall structure extending from the upper side, and a front opening formed in the sidewall structure to enable access to the brake system. At least one arm of the arm subassembly is configured to pivot about a generally horizontal axis enabling the arm to traverse through a generally vertical plane and to move between a retracted position and an extended position, and further configured to pivot about a generally vertical axis enabling the arm to traverse through a generally horizontal plane. Additionally, at least one arm of the arm subassembly includes one or more charging ports. The assembly further includes one or more mounting brackets each incorporating a respective one of the one or more charging ports and configured to define a device mounting structure disposed on the arm subassembly. A device is configured to provide an indication of a location of the assembly. The assembly adopts a loading configuration in which one or more medical devices mounts to one or more arms of the arm subassembly via the one or more mounting brackets. The assembly further includes at least one location indicator each associated with a respective one of the one or more medical devices mounted to the one or more arms of the arm subassembly.

In another aspect, the base subassembly includes, in combination, a wheeled unit, a brake system configured to apply a braking action to the base subassembly, and a cover configured to cover the wheeled unit and at least part of the brake system. The cover includes an upper side, a sloping sidewall structure extending from the upper side, and a front

opening formed in the sidewall structure to enable access to the brake system. At least one arm of the arm subassembly is configured to selectively pivot and adopt a deployed configuration and a retracted configuration. The assembly further includes a rack arrangement, which comprises, in combination, a proximal end coupled to the base subassembly, a distal end, a length-adjustable generally vertical first portion extending between the proximal end and the distal end, and a length-adjustable generally horizontal second portion disposed at the distal end.

In another aspect, the assembly further includes an electrical subassembly. The electrical subassembly includes, in combination, one or more charging ports disposed on the arm subassembly, one or more electrical outlets disposed on the base subassembly and/or the carrier subassembly, one or more mobile device connectors disposed on the base subassembly and/or the carrier subassembly, one or more retractable power cable reels each having an input plug available to connect to an external power source and an output plug, an uninterruptible power supply, and a power distribution circuit configured to electrically couple the uninterruptible power supply and/or the one or more retractable power cable reels to the one or more charging ports, the one or more electrical outlets, and the one or more mobile device connectors.

These and other objects, features, and advantages of the present invention will become more readily apparent from the attached drawings and the detailed description of the preferred embodiments, which follow.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred embodiments of the invention will hereinafter be described in conjunction with the appended drawings provided to illustrate and not to limit the invention, where like designations denote like elements, and in which:

FIG. **1** presents a front, upper, right-side isometric view of an intravenous pole assembly for use in patient care settings and showing a set of retractable horizontal support arms in their extended position, in accordance with a first illustrative embodiment of the present invention;

FIG. **2** presents a rear, upper, left-side isometric view of the intravenous pole assembly illustrated in FIG. **1**;

FIGS. **3**A and **3**B present partial front elevation views of the intravenous pole assembly illustrated in FIG. **1**, more particularly showing the arrangement of horizontal support arms in their extended and retracted positions, respectively;

FIG. **4** presents a partial upper plan view of the intravenous pole assembly illustrated in FIGS. **1** and **3**A-B, more particularly showing how the deployed support arms can be pivoted forward at selected angular orientations;

FIG. **5** presents a partial, front, upper, right-side isometric view of the intravenous pole assembly illustrated in FIG. **1**, more particularly showing the components for the lower portion of the assembly;

FIG. **6** presents a front, upper, right-side isometric view of a wheeled base used in the intravenous pole assembly illustrated in FIGS. **1** and **5**;

FIG. **7** presents an enlarged, partial, front, upper, right-side isometric view of the intravenous pole assembly illustrated in FIG. **1**, more particularly showing the upper portion of the assembly loaded with medical supplies; and

FIG. **8** presents a block diagram illustration of the electrical equipment housed in the pole assembly disclosed in FIGS. **1-7**.

Like reference numerals refer to like parts throughout the several views of the drawings.

DETAILED DESCRIPTION

The following detailed description is merely exemplary in nature and is not intended to limit the described embodiments or the application and uses of the described embodiments. As used herein, the word "exemplary" or "illustrative" means "serving as an example, instance, or illustration." Any implementation described herein as "exemplary" or "illustrative" is not necessarily to be construed as preferred or advantageous over other implementations. All of the implementations described below are exemplary implementations provided to enable persons skilled in the art to make or use the embodiments of the disclosure and are not intended to limit the scope of the disclosure, which is defined by the claims. For purposes of description herein, the terms "upper", "lower", "left", "rear", "right", "front", "vertical", "horizontal", and derivatives thereof shall relate to the invention as oriented in FIG. **1**. Furthermore, there is no intention to be bound by any expressed or implied theory presented in the preceding technical field, background, brief summary or the following detailed description. It is also to be understood that the specific devices 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.

The phrase "and/or," as used herein, should be understood to mean "either or both" of the elements so joined, i.e., elements that are conjunctively presented in some cases and disjunctively presented in other cases.

As used herein, an element or step recited in the singular and proceeded with the word "a" or "an" should be understood as not excluding plural elements or steps, unless such exclusion is explicitly recited.

Shown throughout the figures, the present invention is directed toward a smart intravenous pole assembly for use in supporting, carrying and safely organizing various items of medical equipment and supplies utilized in a treatment setting or health care environment, such as an operating room theater and/or workstation of a critical care unit.

Referring initially to FIGS. **1-2**, a standalone, smart intravenous ("IV") pole or tower assembly, hereinafter assembly **100**, is illustrated in accordance with an exemplary embodiment of the present invention. The illustrated assembly **100** is shown in its upright, deployed, operation-ready configuration. The assembly **100**, in one form, is configured as an erect, standing structure having a variable-sized, multi-rack arrangement configured to mount and power various medical devices (e.g., IV infusion pumps), and to hang and support various medical supplies (e.g., fluid bags). The assembly **100** can be self-powering (e.g., onboard, resident power supply) and/or powered by connection to an external power source. The assembly **100** is portable and mobile. The assembly **100** features a resource management capability that facilitates the monitoring of onboard medical equipment and medical supplies loaded onto assembly **100**. In one form, assembly **100** includes a sensor, module, or other suitable device that emits a signal with location data indicating a location of a particular assembly **100**. Such a location indicator can be housed or deployed at any part of assembly **100**. The signal module transmits a unique signal

(i.e., different from similar assemblies that may emit a different signal) to a receiver in communication with a computing device that receives the signal and is capable of pin-pointing the location of the assembly sending the unique signal within a space (e.g., within a particular floor in a hospital building).

A computing device capable of receiving a signal emitted from the assembly to provide the assembly location refers to a device with a processor, memory, network interface, and a storage device. Computing devices are capable of executing instructions. The term computing device includes, but is not limited to, a personal computer, server computers, computing tablets, set-top boxes, video game systems, personal video recorders, telephones, cellular, telephones, digital telephones, personal digital assistants (PDAs), portable computers, notebook computers, and laptop computers. Computing devices may run an operating system, including, for example, variations of the Linux, Unix, MS-DOS, Microsoft Windows, Palm OS, Symbian OS, and Apple Mac OS X operating systems. Computing devices also include communications software that allows for communication over network. Depending on the electronic device, the communications software may provide support for communications using one or more of the following communications protocols or standards: the User Datagram Protocol (UDP), the Transmission Control Protocol (TCP), the Internet Protocol (IP), and the Hypertext Transport Protocol (HTTP); one or more lower-level communications standards or protocols such as, for example, the 10 and/or 40 Gigabit Ethernet standards, the Fiber Channel standards, one or more varieties of the IEEE 802 Ethernet standards, Asynchronous Transfer Mode (ATM), X.25. Integrated Services Digital Network (ISDN), token ring, frame relay, Point to Point Protocol (PPP), Fiber Distributed Data Interface (FDDI); and other protocols. Electronic devices may include a network interface card, network chip, or network chipset that allows for communication over network. Computing devices communicating with one another, in some exemplary embodiments, are interconnected to the Internet through many interfaces, including a network, such as a local area network (LAN) or a wide area network (WAN), dial-in-communications, cable modems, and special high-speed ISDN lines.

With continued reference to FIGS. **1** and **2**, the assembly **100**, in its upright operational orientation, generally includes a front side **102**, a rear side **104**, a respective right and left side **106***a,b*, and a respective upper and lower end **108***a,b*. The assembly **100** generally includes a first subassembly or lower portion generally illustrated at **110** and disposed at a lower or bottom space of the upright assembly **100**, a second subassembly or intermediate portion generally illustrated at **112** and disposed at a mid-level or intermediate space of the upright assembly **100**, and a third subassembly or upper portion generally illustrated at **114** and disposed at an upper or top space of the upright assembly **100**. The intermediate portion **112** is generally interposed between the lower portion **110** and upper portion **114**.

The assembly **100** includes a chassis, frame or main support structure generally illustrated at **120**, which is configured to provide assembly **100** with an erect, upright, stabilized, standing structure. The frame **120** facilitates the support and integration of the lower portion **110**, intermediate portion **112**, and upper portion **114** of assembly **100** into a single integrated and interconnected unit. The frame **120** includes a wheeled base or deck subassembly generally illustrated at **130**, a main or central hub or carrier subassembly generally illustrated at **126**, and a support post arrangement generally illustrated at **128**. In one form, the support post arrangement **128** includes a pair of fixed, parallel, elongate, vertically-oriented, spaced-apart first support pole **122** and second support pole **124** each extending from and mounted at a lower end to the wheeled base subassembly **130** and mounted at an upper end to main hub carrier subassembly **126**. Although the support post arrangement **128** is shown with a pair of support poles or posts **122**, **124**, this depiction is illustrative and should not be considered in limitation of the present invention, as any number of suitable support-type poles or columns can be used. The pair of support poles **122**, **124** directly support the overlying hub subassembly **126** and its payload. The pair of support poles **122**, **124** are adapted to provide and otherwise define the vertical spacing between lower portion **110** and intermediate portion **112** of assembly **100**. The wheeled base subassembly **130** is adapted to support the intermediate portion **112** and upper portion **114** of assembly **100**. The wheeled base subassembly **130** forms part of the lower-level, first subassembly **110**. The main hub carrier subassembly **126** forms part of the mid-level, second subassembly **112**. Although the support of main hub carrier subassembly **126** above wheeled base subassembly **130** is implemented with a multi-post arrangement, any other suitable support structure can be used. In particular, although frame **120** utilizes a multi-post structure in the form of support post arrangement **128** to provide the support of intermediate portion **112** relative to lower portion **110**, any type of suitable support structure well known to those skilled in the art can be used.

Referring to FIGS. **1** and **2**, with reference to FIG. **7**, the upper portion or upper-level third subassembly **114** of assembly **100** is configured at least in part as a variable-sized, T-shaped, mast-and-boom, rack combination including a height-adjustable feature in the vertical dimension, and a length-adjustable feature in the transverse or horizontal dimension. In one form, the upper-level third subassembly **114** includes, in combination, a length-adjustable, mast-like, vertically-extending, elongate, height-setting and height-variable central pole **116**; a length-adjustable, boom-like, horizontally-extending, transverse, hanging-capable, cross-bar rack device **206**; and, a rotatable, sleeve-like, bar-supporting, connection hub device **210** configured to rotatably mount the transverse cross-bar rack device **206** to central pole **116**. The combination of length-adjustable vertical pole **116** and the length-adjustable horizontal cross-bar rack device **206** has a generally T-shaped configuration (i.e., the vertical pole **116** refers to the stem and the horizontal bar device **206** refers to the arm of the uppercase letter "T").

The upper-level third subassembly **114** further includes a set **212** of individual spaced-apart hook devices **214** carried by the transverse cross-bar rack device **206** along its length. Each hook device **214** is double-sided or double-hooked, enabling it to carry and support containers on both sides of the transverse hanging bar rack device **206**. The cross-bar rack device **206** is capable of hanging and otherwise supporting a number of infusion bags **702** (and associated conveyance tubing) via hook devices **214**. For example, in the exemplary implementation shown in the figures, the horizontal cross-bar rack device **206** includes a set **212** of six double-sided hook devices **214**, enabling a total capacity of twelve infusion bags **702** to be hung. The height-variable vertical pole **116** includes an upper end **226** receiving connection hub device **210** mounted thereon, and a lower end **228** mounted to the lower portion **110** of assembly **100**. In one form, the height-variable vertical pole **116** is centrally interposed between the pair of support poles **122**, **124** of frame **120** at its lower end **228**. The main hub subassembly

126 of second subassembly 112 is appropriately configured to receive central pole 116, which extends through main hub subassembly 126. The main hub subassembly 126 helps position, locate, and support central pole 116 and maintain its vertical orientation.

The height-variable vertical pole 116 is configured as a vertically-oriented telescoping device enabling a user to adjust the height of vertical pole 116, which effectively changes the vertical clearance or separation relative to the underlying central hub subassembly 126. In doing so, the height adjustment also varies and otherwise changes the height or elevation of the upper horizontal cross-bar rack device 206, which is mounted transversally or orthogonally to vertical pole 116. Any conventional means well known to those skilled in the art can be used to adjust the telescoping feature of vertical pole 116 and selectively raise or lower it. For example, vertical pole 116 can be equipped with a lever-type clamping handle generally illustrated at 118 to loosen or tighten the coupling of the telescoping sections of vertical pole 116. The user, for example, can appropriately maneuver or rotate the handle 118 in one direction to release the telescoping sections from their firm mutual engagement, displace the telescoping sections accordingly to enact the desired height adjustment, then rotate the handle 118 in another direction to clamp the telescoping sections together to secure and maintain the new vertical extension of vertical pole 116. The telescoping feature of vertical pole 116 can include any number of individual telescoped arms or sections.

The length-adjustable, transverse, cross-bar rack device 206 is configured in one form as a bilateral telescoping assembly including, in combination, an identical right side and a left side telescoping device 208*a,b*, respectively. Each one of the telescoping devices 208*a,b* has a multi-arm configuration including, for example, a set of telescoping arms 216*a,b,c* each carrying a respective hook device 214. Each multi-armed telescoping device 208*a,b* is independently adjustable. For example, depending on need, the right side telescoping device 208*a* can be fully extended and the left side telescoping device 208*b* partially extended, or vice-versa. Generally, the telescoping devices 208*a,b* can each be deployed in any combination of full extension, partial extension, or no extension. Each telescoping device 208*a,b* is connected at a proximal end 218 to the bar-supporting upper hub 210. Each telescoping device 208*a,b* also includes a distal free end 220. Each telescoping device 208*a,b* extends in a generally orthogonal relationship from vertical pole 116.

The bar-supporting, upper hub device 210 is configured to carry and support each one of the right side and left side telescoping devices 208*a,b* of the length-adjustable, transverse cross-bar rack device 206. In particular, each one of the telescoping devices 208*a,b* is mounted at its proximal end 218 to the bar-supporting hub device 210 so that each telescoping device 208*a,b* maintains its horizontal orientation extending away from vertical pole 116. The hub device 210 can be implemented in any conventional means known to those skilled in the art. For example, the bar-supporting hub device 210 can be configured as a collar or sleeve concentrically mounted on vertical pole 116. The hub device 210 can be configured as a fixed, stationary article or a rotary article. In the rotary configuration, the bar-supporting hub device 210 can rotate relative to vertical pole 116. In this manner, the horizontal cross-bar rack device 206 rotates in tandem or unison with any rotation of hub device 210. The individual hook devices 214 carried by the right side and left side telescoping devices 208*a,b* of the transverse cross-bar rack device 206 can be configured in any conventional manner well known to those skilled in the art. For example, each hook device 214 can have a bilateral pigtail-shaped arrangement having a pair of pigtail hook fasteners, one on each side of the respective telescoping device 208*a,b*. The hook device 214 is positioned generally orthogonal to the generally elongate and linear shape of telescoping device 208*a,b*. The hook device 214 is suitable to hold and support a medical-type fluid bag (e.g., infusion bag 702) hanging from its pigtail-shaped hook end. The upper portion 114 of assembly 100, via the arrangement of hook devices 214, can support articles including, but not limited to, fluid solution bags used by an anesthesiologist care team, critical care staff, and other personnel who are involved, for example, in treatment settings including, but not limited to, pre-operative, operative, and post-operative environments.

The movable feature of upper portion 114 of assembly 100 offers several independent degrees of freedom. The upper portion 114 is configured to enable movements along a vertical or longitudinal axis, a horizontal or transverse axis, and an angular or rotational direction. In particular, the vertical height or extension of central vertical pole 116, and so the elevation of the horizontally-extending transverse cross-bar rack device 206, can be varied and/or adjusted (i.e., raised or lowered) by appropriately changing the telescoping relationship between the telescoped sections of central vertical pole 116. This adjustment to the extension of vertical pole 116 effectuates a change or variation in height along the vertical direction. The height-adjustable central vertical pole 116 enables the upper section 114 to be vertically movable relative to the intermediate portion 112 and lower portion 110 of assembly 100, in order to adjust its height and create more or less space to suspend solution bags 702 from the transverse cross-bar rack device 206.

Additionally, the horizontal extension of the transverse cross-bar rack device 206 can be varied and/or adjusted by appropriately changing the telescoping relationship between the set of telescoping arms 216*a,b,c* of the right side and left side telescoping devices 208*a,b*. This adjustment to the extension of transverse cross-bar rack device 206 effectuates a change or variation in length in the horizontal direction. Moreover, the angular orientation of the transverse cross-bar rack device 206 can be varied and/or adjusted by appropriately changing the rotational position of the bar-supporting rotary hub 210. This adjustment to the bar-supporting rotary hub 210 makes a commensurate rotational adjustment to the angular position of the transverse cross-bar rack device 206. All of these adjustments, changes, and variations in position and dimension can be made on an as-needed basis to accommodate the spacing and access requirements of the healthcare setting, such as situating medical supplies at a location deemed more suitable for the attending clinical team and/or patient.

Referring now to FIGS. 1-2 and 5-6, the lower portion or lower-level first subassembly 110 of assembly 100 includes, in combination, the wheeled base subassembly 130 configured at least in part to make assembly 100 mobile and transportable, and an electrical unit or assembly generally illustrated at 236 and configured at least in part to provide a power supply and electrical interfaces to support power and data connections. Shown individually in FIG. 6, the wheeled base subassembly 130 is able to move and station assembly 100 at any location where it is needed, including, but not limited to, an operating room theater, hospital room and hallways, and intensive care unit facility.

Referring specifically to FIG. 6, the wheeled base subassembly 130 includes a chassis or frame generally illustrated

at **238** including a pair of vertically-extending, spaced-apart sidewalls **250***a,b* and an upper pole-receiving and pole-supporting plate **252** extending horizontally between the pair of vertical sidewalls **250***a,b*. The chassis **238** has a generally rectangular-shaped configuration and forms a sturdy, robust base structure to support the weight and loading of assembly **100** in a stable, tip-resistant configuration. The wheeled base subassembly **130** is equipped at each one of its four corners with a swiveling wheel assembly **280** including, in combination, a chassis-coupling bracket **282** and a swivel-type caster wheel arrangement **284** including a swivel wheel **286**. The swiveling wheel assembly **280** is configured to provide wheel **286** with multi-directional and/or omnidirectional movement, i.e., wheel **286** can pivot or swivel in a full revolution or 360 degrees of freedom. The chassis-coupling bracket **282**, in one form, extends in a generally diagonal direction from a respective corner of the base chassis **238**, so that the set of caster wheel arrangements **284** are disposed in a sufficient spaced-apart relationship to chassis **238** to enhance the stability of the wheeled base subassembly **130**. The wheeled feature of base subassembly **130** provides assembly **100** with a sharp turning radius, enabling it to maneuver easily within the limited space of some application environments, such as a critical care unit already staffed with multiple pieces of equipment and personnel.

The wheeled base subassembly **130** further includes a pair of pole-receiving, bore-shaped tubular elements **288***a,b* extending downwards from the underside of upper horizontal plate **252** of chassis **238**. The tubular elements **288***a,b* respectively, include an open upper or top end **290***a,b* and a terminal closed lower or bottom end. The tubular elements **288***a,b* are sufficiently sized, shaped and dimensioned so that their lower end terminus maintains an adequate spaced-apart relationship to the underlying ground surface that wheeled base subassembly **130** engages. During assembly, the pair of first support pole **122** and second support pole **124** are each received and inserted within the pair of tubular elements **288***a,b*, respectively, via the open top ends **290***a,b*. The poles **122**, **124** slide through their respective tubular elements **288***a,b* until they contact the closed bottom ends, where the poles **122**, **124** remain in a fixed, seated position. The tubular elements **288***a,b* are appropriately sized, shaped and dimensioned to ensure that support poles **122**, **124** can slidably displace through them. The insertion of support poles **122**, **124** in tubular elements **288***a,b* provides a secure mounting of poles **122**, **124**.

The wheeled base subassembly **130** further includes a foot-actuated, parking-type brake system generally illustrated at **300** configured to selectively and releasably apply a braking action to stop and/or prevent movement of assembly **100** and secure it in place. The brake system **300** would be activated, for example, when assembly **100** is stationed at its operational location (e.g., surgical room). The brake system **300** includes, in combination, a foot-activated brake pedal device **302**, a movable rubber stem floor stop **304**, and a mechanism generally illustrated at **306** configured to control the movement of rubber stem floor stop **304** in response to user actuation of brake pedal device **302**. The mechanism **306** controls the up and down movement of rubber stem floor stop **304** in response to the actuation of brake pedal device **302**. In particular, the floor stop **304** is selectively movable between a released, non-braking position in which floor stop **304** is spaced-apart from the floor surface in a non-contact relationship to permit mobility of assembly **100**, and a locked, braking position in which floor stop **304** is displaced into frictional, contacting engagement with the ground or floor surface to resist and/or prevent movement of assembly **100**. The bottom, ground-contacting surface of floor stop **304** is preferably sized, shaped and dimensioned to provide optimal brake-inducing frictional engagement with the travel surface it contacts. The mechanism **306**, in one form, employs a lever arrangement to translate the activation of pedal device **302** into an appropriate vertical displacement of floor stop **304**. The floor stop **304** is normally in an elevated position relative to the ground, during non-activation of brake pedal **302**. For ease of assembly, maintenance and compactness, the braking element is preferably provided in the form of a single such floor stop **304**, which is suitably sized, shaped and dimensioned for this all-in-one braking applicator. However, it should be apparent to those skilled in the art that more than one braking element **304** can be used to simultaneously, frictionally engage the driving surface at multiple points of contact.

The brake pedal device **302** includes a locking pedal **308** and a release pedal **310** to facilitate the braking and non-braking modes of wheeled base subassembly **130**, respectively. The locking pedal **308** and release pedal **310** are independently activated. During a braking action, the user depresses the locking pedal **308**, which activates and cooperates with mechanism **306** to move and dispose the rubber stem floor stop **304** into frictional engagement with the ground, which arrests and otherwise impedes further movement of assembly **100**. During the braking period, the locking pedal **308** remains depressed and pivoted relative to release pedal **310**, so that release pedal **310** adopts an elevated position relative to locking pedal **308**, making it easy to access and accurately target. During a release action, the user depresses the release pedal **310**, which activates and cooperates with mechanism **306** to release floor stop **304** from its frictional engagement with the ground and to place the released floor stop **304** in an elevated position relative to the ground, rendering assembly **100** mobile again. At the same time, the locking pedal **308** returns to its original, pre-locking position.

Referring still to FIGS. **1-2** and **5**, the lower-level first subassembly **110** includes a skirt-shaped barrier or protective covering in the form of a shield, shell or cover **160** configured to cover the wheeled base subassembly **130** and to provide a front opening generally illustrated at **162** for access to brake pedal **302**. The cover **160** includes a generally rectangular-shaped body generally illustrated at **164** having a generally planar upper or top side **166** defining a mounting platform, an open bottom generally illustrated at **168** configured to make space for the wheeled base subassembly **130**, and a lateral, multi-sided, foot-type structure generally illustrated at **170** configured to fully, peripherally enclose the wheeled base subassembly **130**. In one form, the lateral structure **170** is configured as a sidewall arrangement, which includes a set of peripheral sidewalls each extending and/or depending generally downward and outward from upper side **166** at a respective edge thereof. In its sidewall configuration, the lateral structure **170** includes a front side **172**, a rear side **174**, a right side **176**, and a left side **178**. In order to establish a footprint compatible with the geometry of the enclosed wheeled base subassembly **130**, each side of the lateral structure **170** preferably transitions to an adjoining side using a generally rounded or curved corner **182** to accommodate an appropriately-sized fit or capture of a respective caster wheel arrangement **284** and its associated chassis-coupling bracket **282** (FIG. **6**). The lateral structure **170** defines a bottom edge periphery generally illustrated at **180**. Each sidewall of lateral structure **170** forms a ramp-

like, sloping surface extending downward and outward from the top side **166** to the bottom edge periphery **180**.

The upper or top side **166** of base cover **160** is adapted with suitable openings (not shown) to receive the first support pole **122** and second support pole **124** so that poles **122**, **124** can access and make passage into the pair of pole-receiving tubular elements **288***a,b* of chassis **238** of wheeled base subassembly **130**. The cover **160** extends completely over and contains the wheeled base subassembly **130** shown in FIG. **6**. A suitable means can be provided to attach cover **160** to chassis **238** of subassembly **130** to fix its location.

A retention railing **138** is disposed at upper side **166** of cover **160**. The retention railing **138** has a generally U-shaped configuration, in which its free ends have a bent or angled form that extend from upper side **166** of cover **160** so that its generally central body portion defines a forward guard rail elevated from upper side **166**. The retention railing **138** defines an interior holding space configured to receive, hold, and retain medical equipment disposed on upper side **166** of cover **160** at a forward, front location. The lower edge **180** of base cover **160** is adapted to be sufficiently close to the ground to prevent items and other potential entanglements lying on the floor from going underneath it and interfering with wheels **286** (e.g., floor cables), yet sufficiently far away from the ground to allow assembly **100** to move freely via its wheeled maneuvering and transport.

Referring briefly to FIG. **5**, the lower portion or lower-level first subassembly **110** of assembly **100** is able to securely receive, hold and otherwise carry a variety of pieces of medical equipment and supplies during operational loading. Generally, assembly **100** provides a centralized location for housing various medical devices, accessories and supplies. For example, an air blower device generally illustrated at **600** can be housed, retained and carried by assembly **100** in the interior holding space defined by retention railing **138** disposed at the upper side **166** of base cover **160**. The blower device **600** can provide temperature management to the ambient environment. A cup or blood reservoir generally illustrated at **602** can be releasably attached to one of the support poles **122**, **124**. A massive transfusion set generally illustrated at **604** (including pump and blood reservoir) can be securely and removably mounted to one of the support poles **122**, **124**. A fluid warmer device generally illustrated at **606** can be securely and removably mounted to one of the support poles **122**, **124**. The pole-mounted medical equipment **602**, **604**, **606** is adequately positioned along poles **122**, **124** to provide easy access by medical personnel. The air blower device **600** is suitably positioned at a low enough location on the upper side **166** of base cover **160** to provide an adequate airflow near the ground surface. The medical equipment and/or device can be mounted to the poles **122**, **124** using any conventional means well known to those skilled in the art. For example, a releasable, adjustable, press-fit clamp can be used to mount the devices on poles **122**, **124**, allowing height and rotation adjustment. In particular, depending on need and available space, the mounted medical devices can be placed at any suitable point along the exposed vertical section of poles **122**, **124** and oriented at any rotational position to enhance access and usability.

Referring again to FIGS. **1** and **2**, the electrical subassembly **236** of the lower portion or lower-level first subassembly **110** of assembly **100** includes a rechargeable, uninterruptible power supply (UPS) unit generally illustrated at **140**. The UPS unit **140** includes, in combination, a housing or enclosure **142** and a UPS device housed in enclosure **142**. The housing **142** can be divided into a lower compartment generally illustrated at **144** housing the UPS device, and an upper compartment generally illustrated at **146** housing a retractable cable reel (not shown). The UPS unit **140** provides backup power to all medical electronics loaded onto assembly **100**, in the event that external power is unavailable or interrupted. The location of UPS unit **140** on the wheeled base subassembly **130** of lower portion **110** can be made in any convenient manner. In one form, for example, the UPS unit **140** is located at a rear section of the upper side **166** of base cover **160**, while the railing **138** is located at a forward section.

The electrical subassembly **236** further includes an electrical grid or hub housed in UPS unit **140** and configured to distribute electricity from multiple energy sources to multiple devices loaded onto assembly **100**. The assembly **100** can be powered by connection to an external power source or by utilization of the onboard, resident power source (i.e., UPS device housed in UPS unit **140**). For example, referring to FIG. **6**, the wheeled base subassembly **130** can be adapted to carry a retractable cable reel assembly **292** having a coiled reel body **294** configured to feed out a power cable having a bottom-exiting power input plug **296**. The retractable cable reel **292** can be carried, for example, at the rear end of chassis **238** of subassembly **130**. The bottom-exiting power input plug **296** can be routed through an exit aperture formed in the rear side **174** of base cover **160** (FIG. **2**) and plugged into an outlet of the external environment, e.g., a wall outlet in a hospital room. Another retractable cable reel housed in the upper compartment **146** of housing **142** of UPS unit **140** includes a cable-connected electrical input plug **224** that is routed vertically through the hollow interior of the height-variable central vertical pole **116** until it exits from an opening at the top of pole **116** (FIG. **2**). This top-exiting power input plug **224** can be plugged into an outlet of the external environment, e.g., a ceiling outlet in a hospital room. The electrical subassembly **236** further includes an electrical panel generally illustrated at **240** (FIG. **2**) having a set of communication and power interfaces, such as electrical outlets and USB ports. The electrical panel **240** enables external cable connections to be made to electrical subassembly **236**, in order to provide power and data communication to assembly **100**. For example, the electrical outlets of electrical panel **240** enable a user to make a connection from an external power supply (e.g., local power gird) to assembly **100** to supply power. The USB ports of electrical panel **240** enable connection to a wide variety of peripheral devices for charging purposes, e.g., a mobile device, portable computer device, and a laptop. Alternately, the electrical outlets of electrical panel **240** can be used to provide power from the UPS device to other sections of assembly **100**, in which case a user needs to supply a cable to make the connection. The electrical outlets of electrical panel **240** provide an additional and/or alternate means of providing power to assembly **100**, in addition to the UPS device housed in UPS unit **140** and the cable hook-ups to external power sources via the bottom-exiting power input plug **294** and top-exiting power input plug **224**. The UPS unit **140** may be further equipped with other options, including, but not limited to, ventilation ports **242** formed in housing **142** to maintain proper temperature management of the enclosed electrical equipment, a UPS device status display **244**, fuses, and pilot lights.

Referring now to FIGS. **1-4** and **7**, the intermediate or mid-level portion **112** of assembly **100** is configured at least in part as a multi-arm, power-feeding, rack apparatus to hold, support and otherwise carry various medical supplies

and devices, including, but not limited to, infusion pumps. The mid-level second subassembly or middle portion **112** of assembly **100** includes the main hub or carrier subassembly **126**. The carrier subassembly **126** includes a hub portion generally illustrated at **400** and a rack-forming arm subassembly generally illustrated at **402** and carried by hub portion **400**. The rack-forming arm subassembly **402** includes a pair of upper-level fixed-length arms **410***a,b*, a pair of mid-level or intermediate fixed-length arms **412***a,b*, and a pair of lower-level fixed-length arms **414***a,b*. The arms of arm subassembly **402** are configured in a tree-like, multi-branch arrangement. Each arm of the arm subassembly **402** is configured, in one form, as a power-capable infusion pump holder, i.e., each arm is equipped to provide power to the mounted or loaded infusion pump. Additionally, each arm of the arm subassembly **402** is capable of rotational or pivoting motion about a vertical axis to displace the arms in a transverse or horizontal plane (FIG. **4**), and is further capable of rotational or pivoting motion about a horizontal axis (anterior-to-posterior direction) to displace the arms in the frontal or vertical plane so as to facilitate the transition of the arm between a deployed, extended orientation (FIG. **3**A) and a stowed, retracted orientation (FIG. **3**B). Unless otherwise noted, each arm of the rack-forming arm subassembly **402** is identically constructed and has the same functionality, so a reference to one applies equally to the other. Although a set of three pairs of arms is shown, the depiction of six horizontal retractable arms is merely illustrative and should not be considered in limitation as it should be apparent to those skilled in the art that any number of arms can be employed.

The hub portion **400** of main carrier subassembly **126** includes a generally rectangular-shaped body generally illustrated at **420** having a top side **422**, a bottom side **424**, a front side **426**, a rear side **428**, and a pair of right and left sides **430***a,b*. Each corresponding pair of arms of arm subassembly **402** are generally disposed at opposite sides of the body **420** of hub portion **400**. For example, the pair of upper arms **410***a,b*, are generally disposed at the opposite right and left sides **430***a,b*, respectively, of body **420**; the pair of intermediate arms **412***a,b* are disposed at the opposite right and left sides **430***a,b*, respectively, of body **420**; and, the pair of lower arms **414***a,b* are disposed at the opposite right and left sides **430***a,b*, respectively, of body **420**. The arm subassembly **402** is carried by the main carrier subassembly **126** at hub portion **400**. The pairs of arms **410***a,b*, **412***a,b*, and **414***a,b* are disposed in a spaced-apart relationship along a vertical or longitudinal dimension of hub portion **400**. Additionally, in one form, the arm lengths may be uniform or variable. For example, as depicted, the arm lengths from one level to the next may get progressively shorter or longer, i.e., the lower-level arms **414***a,b* are the longest (and same or equal length), the mid-level arms **412***a,b* are the next longest (and equal length), and the upper arms **410***a,b* are the shortest (and equal length). The body **420** of hub portion **400** can be adapted to allow the central vertical pole **116** to extend through its interior space, in which pole **116** passes through apertures or pole-receiving holes formed in the bottom side **424** and top side **422**. The upper or distal ends of the pair of support posts **122**, **124** are attached to the bottom side **424** of hub body **420**.

The illustrative right-side lower arm **414***a* is mounted to the hub portion **400** of main carrier subassembly **126** by a multi-axial pivot joint generally illustrated at **440**. For example, in one form, the multi-axial pivot joint **440** is implemented as a biaxial ball-and-socket joint, offering independent rotation about two reference axes and corresponding movement (displacement) in two planes. However, this implementation is merely illustrative and should not be considered in limitation of the present invention, as it should be apparent to those skilled in the art that any other suitable multi-axial pivot joint can be used. For example, the multi-axial pivot joint **440** can be configured as an articulating, double-bracket, linkage structure having two shafts defining two different axes of rotation. In this configuration, each shaft-and-bracket combination cooperates with the other shaft-and-bracket combination to allow a workpiece attached to it (i.e., arm **414***a*) to rotate about a first axis defined by a first one of the shafts and to rotate about a second axis defined by the second one of the shafts. In another multi-axis pivot configuration, the proximal end **442** of illustrative arm **414***a* is rotationally or pivotably coupled to a pivot axis extending between the sides of a U-shaped bracket, defining a horizontal axis of rotation for arm **414***a* enabling it to pivot and displace through a vertical plane. The opposite end of this U-shaped pivot bracket is fixedly coupled to a bracket-type sleeve rotatably mounted to a vertical shaft, defining a vertical axis of rotation for arm **414***a* enabling it to pivot and displace through a transverse plane. This vertical shaft defines the vertical axis of rotation for all of the same-sided arms **410***a*, **412***a*, and **414***a*. The multi-axis pivot joint **440** is preferably configured to ensure that arm **414***a*, when deployed, maintains a horizontal orientation (i.e., arm **414***a* cannot pivot below the horizontal plane). This can be implemented, for example, by resting or seating a portion of the proximal end **442** of illustrative arm **414***a* in the saddle of the U-shaped pivot bracket.

The illustrative right-side lower arm **414***a* has proximal end **442** and distal end **444** (FIG. **3**A). The arm **414***a* includes a generally elongate body **446** extending between the proximal end **442** and the distal end **444**. The lower arm **414***a* is coupled at its proximal end **442** to pivot joint **440** in a pivot-ready, pivot-capable, articulating relationship. In this manner, each arm of arm subassembly **402** forms an articulating relationship to the hub portion **400** of main carrier subassembly **126**. The articulation of the arms is configured to enable the same-side arms (i.e., the set of left-side arms **410***b*, **412***b*, and **414***b* and the set of right-side arms **410***a*, **412***a*, and **414***a*) to pivot or rotate about a respective common vertical axis and move through a distinct transverse or horizontal plane. Each corresponding pair of right-side and left-side arms (e.g., right-side and left-side arms **410***a,b*) preferably rotates through its own common transverse plane. Thus, in the configuration shown, the three sets of corresponding arm pairs **410***a,b*, **412***a,b*, and **414***a,b* are capable of deployment and transverse rotation through three individual horizontal planes. In their deployed configuration, as shown in FIGS. **1**-**2**, the arms of arm subassembly **402** extend away from hub portion **400** of main carrier subassembly **126**. As shown in FIG. **4**, any one of the arms can be independently pivoted or rotated about the vertical axis of its respective pivot joint to another angular displacement. For example, the right-side arms can be pivoted into a staggered relationship (i.e., different angular displacements), so that the lower-level right-side arm **414***a* is rotated the most, the upper-level right-side arm **410***a* is rotated the least, and the mid-level right-side arm **412***a* is rotated intermediate the other two. The same or similar relationship can be produced for the left-side arms **410***b*, **412***b*, and **414***b*. The pivoting relationship shown in FIG. **4** is for illustrative purposes only and merely exemplary, as it should be apparent to those skilled in the art that any arm can be displaced (rotated) through its respective transverse plane of movement independently of the other arms. The forward rotation of the

arms of arm subassembly **402** may be beneficial to bring the items loaded onto the arms closer to the personnel who need to access them (e.g., FIG. **7**). In one form, the arms of arm subassembly **402** have a generally ninety degree range of motion through the respective transverse plane. During deployment, the illustrative right-side lower arm **414***a* can pivot, for example, from an orientation generally orthogonal to the right side **430***a* of body **420** of hub portion **400** of carrier subassembly **126** (e.g., FIGS. **1** and **2**), to an orientation generally orthogonal to the front side **426**.

The hub portion **400** of carrier subassembly **126** is suitably adapted to accommodate the movement or pivoting rotation of each arm of the rack-forming arm subassembly **402** through its respective transverse plane. For example, in reference to the illustrative right-side lower arm **414***a*, a cut-out or recessed arm-guiding slot generally illustrated at **450** is formed in the body **420** of hub portion **400** and cooperates with illustrative arm **414***a* to facilitate its range of motion about a vertical axis through the horizontal or transverse plane. A similar such cut-out **450** is associated with each other arm of the rack-forming arm subassembly **402**. The cut-out or arm-guiding slot **450** generally extends between a lateral side of body **420** (i.e., right side **430***a*) and the front side **426** of body **420**. The pivot joint **440**, in one form, is located within the cut-out **450**. This side-to-front extension of cut-out **450** enables a range of motion for arm **414***a* that extends continuously between a first orientation (i.e., extending laterally or in the rightward direction generally orthogonal to right side **430***a*) and a second orientation (i.e., extending in the frontward direction generally orthogonal to front side **426**). The cut-out **450** is suitably formed to cooperate with the configuration of arm **414***a* to enable the transverse plane movement of arm **414***a*. For example, the pivoting transition of lower arm **414***a* from its lateral position to its anterior position entails an angular displacement that may require cut-out **450** to have a curvature extending from the right side **430***a* to the front side **426** through the adjoining edge. One feature of using a cut-out **450** to guide the movement of arm **414***a* is that the accompanying pivot joint **440** remains largely hidden-away or out of view in the recess-type configuration of cut-out **450**.

Referring still to FIGS. **1-4** and **7**, with specific reference to FIG. **3**A, the illustrative arm **414***a*, as stated previously, is capable of rotating or pivoting about a horizontal axis through a vertical plane. This movement is useful to transition the arm **414***a* between its generally horizontally-extending deployed position (FIG. **3**A) and its generally vertically-extending stored or retracted position (FIG. **3**B). For this purpose, the hub portion **400** of carrier subassembly **126** is suitably adapted to accommodate the pivoting rotation of each arm into a generally vertical position to facilitate retraction and stowage. In one form, for example, in reference to the illustrative right-side lower arm **414***a*, a generally vertically-extending, arm-receiving slot, channel or recess generally illustrated at **452** is formed in the body **420** of hub portion **400** at right side **430***a* to receive lower arm **414***a* as it is pivoted into a generally vertical position (corresponding to a retracted, stowage-ready position). The arm-receiving channel **452** is shared in common by all of the retracted same-side arms (e.g., right-side upper arm **410***a*, right-side intermediate arm **412***a*, and right-side lower arm **414***a*). A similar such arm-receiving slot **452** is formed at left side **430***b* of body **420** to accommodate the retracted placement, seating and stowage of the left-side arms **410***b*, **412***b*, and **414***b*.

In their originally deployed condition, without any forward angular displacement, the same-side set of arms all generally lie in a common vertical plane generally perpendicular to one of the lateral sides of body **420**, e.g., the right-side upper arm **410***a*, right-side intermediate arm **412***a*, and right-side lower arm **414***a* lie in a shared, common vertical plane (FIGS. **1-2**). During retraction, the deployed arms are first returned to their most rearward position (FIG. **3**A) (i.e., no forward-directed angular displacement) and then the arms are each pivoted upwards into a generally vertical position for collective placement and seating in arm-receiving slot **452** (FIG. **3**B). The arm-receiving slot **452** can be sized, shaped and dimensioned to create a recess producing different retraction profiles or folding arrangements of the retracted arms. FIG. **3**B depicts one such profile, in which the raised, retracted arms have a generally vertical alignment. In order to present such a streamlined appearance, and allow all the same-sided arms to be pivoted vertically upward through the same vertical plane and yet fold together in general vertical alignment, the vertically-extending arm-receiving slot **452** formed laterally in body **420** is made to extend sufficiently deep into the respective right and left sides **430***a,b* to accommodate the reception and placement of all three same-sided arms in a general vertical orientation. This streamlining feature stows the retracted arms in an arrangement that limits snagging or interference due to arm protrusions, especially during transport. The arms at one side can be deployed and/or retracted in any combination. For example, in a superior arm-hanging option, the right-side upper-level arm **410***a* is deployed (extended horizontally, no angular displacement), while the other two arms **412***a* and **414***a* are retracted. In an inferior option, the lower-level arm **414***a* is deployed while the other two arms **410***a*, **412***a* are retracted. In a median option, the mid-level arm **412***a* is deployed while the other two arms **410***a*, **414***a* are retracted.

Referring still to FIGS. **1** and **2**, with reference to FIG. **7**, each arm of the rack-forming arm subassembly **402** of the mid-level carrier subassembly **126** is configured to mount and carry a set of medical devices, including, but not limited to, infusion pumps. For example, FIG. **7** depicts an illustrative loading arrangement in which the individual arms of the upper-level **114**, mid-level **112** and lower-level **110** each receive one, two, and three infusion pumps **700**, respectively, for a total of twelve available pumps **700**. Different types of mounting relationships are possible. In a cabled option, in which the mounted infusion pump **700** uses a cabled power hookup, the pump **700** can be releasably mounted to illustrative left-side upper arm **410***b* using an adjustable and re-positionable quick-connect bracket **710** (FIG. **2**). A power cable then runs from the bracket-mounted pump **700** to an available socket or electrical outlet in assembly **100**.

Alternately, in a cable-free or cable-less application, each arm of the rack-forming arm subassembly **402** is configured as a power rail equipped with a set of cordless power-delivery interfaces. For example, in the illustrative right-side lower-level arm **414***a*, a set **470** of three cordless contact-charging, mounting brackets or charging ports **472** is disposed in a spaced-apart relationship along the length of arm **414***a*. In this cordless option, the infusion pump **700** comes fitted with a compatible bus-type interface or port that mates with the interface or charging port provided by the cordless contact charging bracket **472** installed on arm **414***a*. The releasable mounting of the infusion pump **700** simply entails connecting the interfaces together, e.g., sliding the interface port at the back side of infusion pump **700** onto its dedicated cordless contact charging bracket **472** to form a power-communicating, mounting relationship offering a plug-and-

play capability. Assembly **100** provides increased capacity for medical assets. For example, the six horizontal retractable arms offer a capacity for twelve IV infusion pumps, some or all of which may be used on an as-needed basis. If some arms are not loaded, and remain idle, they can be retracted upwards and independently stowed away. In use, the arms can be adjusted to position or move the arms forward closer to the needed work area (e.g., patient) or application. The charging port **472** can have any conventional construction, including, but not limited to, a physical connector that mates with another connector (e.g., a type of plug) to electrically connect two devices.

Referring to FIG. **2**, the carrier subassembly **126** of mid-level portion **112** of assembly **100** includes a rear or back-facing, posterior electrical panel generally illustrated at **460** disposed at the rear side **428** of body **420** of hub portion **400** of carrier subassembly **126**. The rear electrical panel **460** includes a set **462** of electrical outlets **464** available to provide power to any electronics loaded onto assembly **100**. For example, the rear electrical panel **460** can provide power to the array of cabled infusion pumps **700** loaded onto the rack-forming arm subassembly **402**. This powering feature is especially useful when the infusion pumps **700** have a cabled arrangement. In the cabled version, the mounted infusion pumps **700** are provided with a power cord connecting them to one of the electrical outlets **464** housed on the rear electrical panel **460**. The electrical panel **460** will be configured to provide the number of electrical outlets **464** commensurate at least with the capacity or maximum number of cabled infusion pumps **700** mounted to arm subassembly **402**. The rear electrical panel **460** includes a cable organizer or comb generally illustrated at **466** configured to organize any cables extending between the mounted infusion pumps **700** and the electrical outlets **464** of rear electrical panel **460**. The cable organizer comb **466** includes multiple individual cord organizing elements **468**. The posterior cable organizer **466** provides a means to efficiently and securely the coils of each power cable independently from the other cables.

The upper-level third subassembly or upper portion **114** of assembly **100** can be equipped with various optional features to enhance the user experience and provide additional versatility. An oval-shaped, circular or elliptical, peripheral handle bar **500** can be provided at an appropriate location to facilitate better control for maneuvering assembly **100** during transport and other occasions of mobility. In one form, for example, the drive-type handle bar **500** encircles the set of height-variable vertical pole **116** and first and second fixed support poles **122**, **124** at a point below main hub and carrier subassembly **126**. The handle bar **500** can be attached to assembly **100** in any conventional manner. The handle bar **500** can be optionally equipped with a loop strap for additional control. An open-top, front mesh auxiliary basket **502** can be disposed at the front side **426** of body **420** of hub portion **400** of carrier subassembly **126**. The basket **502** can hold an assortment of loose items (e.g., glove box) and/or secure hardware connected to the patient, such as a cardiac pacemaker. A front foldable tray **504** can be disposed at the front side **426** of body **420** of hub portion **400** of carrier subassembly **126**. The tray **504** is pivotably or hingedly mounted to the front side **426**. When not in use, tray **504** adopts a retracted or folded-up position in which it lies against front side **426** in a generally parallel and/or abutting relationship. When deployed, tray **504** adopts a pivoted or folded-down position in which it extends horizontally forward from front side **426** in a cantilever-type configuration. The tray **504**, for example, provides a working surface for various tasks, such as prepping medications. The deployed tray **504** reveals a set of electrical connections accessible at the front side **426** of body **420** of hub portion **400** of carrier subassembly **126**, such as an electrical outlet and USB charger. These tray-adjacent electrical connections facilitate the charging of personal mobile devices and electronics of staff personnel, who can place the recharging devices on deployed tray **504**.

Referring now to FIG. **8**, a block diagram **800** is shown describing the network of electrical equipment housed in assembly **100**, according to one aspect of the present invention. At the power input side, the uninterruptible power supply (UPS) component **810** encompasses the UPS device housed in UPS unit **140** of assembly **100**, as shown in the figures. The retractable power reels component **812** encompasses the retractable cable reel **292** carried by the wheeled base subassembly **130** (including the top-exiting retractable electrical plug **224** emerging from the top end **226** of central vertical pole **116**) and the retractable cable reel (not visible) housed, for example, in the upper compartment **146** of housing **142** of UPS unit **140** (including the bottom-exiting retractable electrical plug emerging from the rear side **174** of base cover **160**). The top-exiting and/or bottom-exiting electrical plugs associated with the retractable cable reels component **812** housed in assembly **100** are electrically connected to convenient outlets in the ambient environment (e.g., ceiling outlet or wall outlet in an operating room or care facility), which establish power connections to an external power supply **900**. At the power input side, then, power is delivered by the onboard UPS component **810** or by the external power source **900** via connection using the retractable power cable reels component **812**. At the power output side, power is delivered to various devices housed in assembly **100**, including, but not limited to, charging ports **820** for the cable-free infusion pumps **700** mounted on the pivotable arms of the rack-forming arm subassembly **402** (corresponding to the set of charging brackets **470**), electrical outlets **822**, and USB ports **824**. The electrical outlets **822** include, for example, the outlets forming part of the electrical panel or console **240** of electrical assembly **236** of lower portion **110** at the UPS housing **142** (FIG. **2**), and the outlets **462** forming part of the rear electrical panel **460** of middle portion **112** at the rear side of carrier subassembly **126** (FIG. **2**). The USB ports **824** include, for example, the USB ports stationed near the foldable tray **504** at the front side **426** of the hub portion **400** of carrier subassembly **126**. A power distribution circuit **830** distributes power from the power input side (i.e., UPS or external power supply) to the power output side (i.e., infusion pump charging ports, electrical outlets, USB ports). Any conventional circuit **830** well known to those skilled in the art can be used to provide this power distribution functionality. The assembly **100** would be equipped with the necessary cabling and/or wiring to communicate and/or route output power from the power distribution circuit **830** to the destination devices or equipment (i.e., infusion pump charging ports, electrical outlets, USB ports). The power distribution circuit **830**, for example, can be implemented as a printed circuit board (PCB) installed at any suitable location in assembly **100**, such as UPS unit **140** of the lower-level portion **110**.

The disclosed smart IV pole **100** may additionally include a remote application or program, an "app", that can control the different devices connected to the smart IV pole **100**. The app may be actuated by a wired controller or may be located on a wireless device connected to the different devices by known means. Lastly, the smart IV pole includes sensors for medical device location system for the equipment installed.

Since many modifications, variations, and changes in detail can be made to the described preferred embodiments of the invention, it is intended that all matters in the foregoing description and shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense. Thus, the scope of the invention should be determined by the appended claims and their legal equivalents.

What is claimed is:

1. A stand assembly, comprising:
- a base subassembly;
- a carrier subassembly disposed above the base subassembly;
- an arm subassembly mounted to the carrier subassembly and including one or more arms pivotably connected to the carrier subassembly; and
- an electrical subassembly comprising:
  - one or more charging ports disposed on the arm subassembly;
  - one or more electrical outlets disposed on the base subassembly or the carrier subassembly:
  - one or more mobile device connectors disposed on the base subassembly or the carrier subassembly:
  - one or more retractable power cable reels, each housed in the assembly and having an input plug available to connect to an external power source and an output plug;
  - an uninterruptible power supply; and
  - a power distribution circuit configured to electrically couple the uninterruptible power supply and/or the one or more retractable power cable reels to the one or more charging ports, the one or more electrical outlets, and the one or more mobile device connectors.

2. The stand assembly of claim **1**, wherein at least one arm of the arm subassembly is configured to selectively adopt a deployed configuration and a retracted configuration.

3. The stand assembly of claim **1**, wherein at least one arm of the arm subassembly is configured in a first mode to pivot about a generally horizontal axis enabling the arm to traverse through a generally vertical plane, and configured in a second mode to pivot about a generally vertical axis enabling the arm to traverse through a generally horizontal plane.

4. The stand assembly of claim **3**, wherein the first mode facilitates retraction of the arm into a generally vertical orientation and facilitates extension of the arm into a generally horizontal orientation.

5. The stand assembly of claim **1**, further comprising:
- an upper-level third subassembly comprising:
  - a vertical pole mounted to the base subassembly; and
  - a cross-bar rack device mounted to the vertical pole.

6. The stand assembly of claim **5**, wherein the cross-bar rack device further comprises:
- a right side telescoping device mounted to a hub device, wherein the hub device is mounted to the vertical pole;
- a left side telescoping device mounted to the hub device;
- at least one hook disposed on the right side telescoping device or the left side telescoping device.

7. The stand assembly of claim **1**, wherein the base subassembly further comprises:
- a wheeled base subassembly; and
- a cover configured to cover the wheeled base subassembly.

8. The stand assembly of claim **7**, further comprises a brake system configured to apply a braking action to the base subassembly.

9. The stand assembly of claim **8**, wherein the brake system comprises:
- a brake element; and
- a user-actuatable mechanism configured to move the brake element between a braking position in which the brake element is disposed in contacting engagement with a ground surface, and a release position in which the brake element is disengaged from the ground surface.

10. The stand assembly of claim **1**, further comprises:
- a device configured to emit a signal that indicates a location of the assembly;
- a loading configuration adoptable by the assembly in which one or more medical devices mounts to one or more arms of the arm subassembly; and
- at least one location indicator each associated with a respective one of the one or more medical devices mounted to the one or more arms of the arm subassembly.

11. The stand assembly of claim **1**, wherein the base subassembly comprises:
- a wheeled base subassembly, and
- a cover configured to cover the wheeled base subassembly,
  - wherein the cover includes an upper side and a sidewall extending from the upper side, and
  - wherein at least one arm of the arm subassembly includes one or more charging ports.

12. The stand assembly of claim **1**, wherein the base subassembly comprises:
- a wheeled base subassembly; and
- a cover configured to cover the wheeled base subassembly,
  - wherein the cover includes an upper side and a lateral structure extending from the upper side; and
  - wherein at least one arm of the arm subassembly is configured to pivot about a generally horizontal axis enabling the arm to traverse through a generally vertical plane and to move between a retracted position and an extended position, and further configured to pivot about a generally vertical axis enabling the arm to traverse through a generally horizontal plane.

13. The stand assembly of claim **1**, wherein the base subassembly comprises:
- a wheeled base subassembly;
- a brake system configured to apply a braking action to the base subassembly; and
- a cover configured to cover the wheeled base subassembly and at least part of the brake system,
  - wherein at least one arm of the arm subassembly is configured to pivot about a generally horizontal axis enabling the arm to traverse through a generally vertical plane and to move between a retracted position and an extended position, and further configured to pivot about a generally vertical axis enabling the arm to traverse through a generally horizontal plane.

14. The stand assembly of claim **1**, wherein the base subassembly comprises:
- a wheeled base subassembly;
- a brake system configured to apply a braking action to the base subassembly;
- a cover configured to cover the wheeled base subassembly and at least part of the brake system,

wherein at least one arm of the arm subassembly is configured to selectively pivot and adopt a deployed configuration and a retracted configuration; and

an upper-level third subassembly comprising:

a vertical pole mounted to the base subassembly; and

a cross-bar rack device mounted to the vertical pole, wherein the cross-bar rack device comprises:

a right side telescoping device mounted to a hub device, wherein the hub device is mounted to the vertical pole; and

a left side telescoping device mounted to the hub device.

15. A stand assembly, comprising:

a base subassembly including:

a wheeled base subassembly;

a brake system configured to apply a braking action to the wheeled base subassembly; and

a cover configured to cover the wheeled base subassembly and at least part of the brake system,

wherein the cover includes an upper side, a sidewall extending from the upper side, and a front opening in the sidewall to enable access to the brake system;

a upper-level third subassembly comprising:

a vertical pole mounted to the base subassembly; and

a cross-bar rack device mounted to the vertical pole, wherein the cross-bar rack device comprises:

a right side telescoping device mounted to a hub device, wherein the hub device is mounted to the vertical pole;

a left side telescoping device mounted to the hub device;

a carrier subassembly disposed above the base subassembly;

an arm subassembly mounted to the carrier subassembly and including one or more arms pivotably connected to the carrier subassembly;

wherein at least one arm of the arm subassembly is configured to selectively adopt a deployed configuration and a retracted configuration;

wherein at least one arm of the arm subassembly includes one or more charging ports; and

one or more charging brackets disposed on the arm subassembly.

16. A stand assembly, comprising:

a device configured to emit a signal indicating a location of the stand assembly;

a base subassembly including:

a wheeled base subassembly;

a brake system configured to apply a braking action to the wheeled base subassembly;

wherein the brake system includes a brake element and further includes a mechanism configured to move the brake element between a braking position in which the brake element is disposed in contacting engagement with a ground surface, and a release position in which the brake element is disengaged from the ground surface, and

a cover configured to cover the wheeled base subassembly and at least part of the brake system,

wherein the cover includes an upper side, a sidewall extending from the upper side, and a front opening in the sidewall to enable access to the brake system;

an upper-level third subassembly comprising:

a vertical pole mounted to the base subassembly; and

a cross-bar rack device mounted to the vertical pole, wherein the cross-bar rack device comprises:

a right side telescoping device mounted to a hub device, wherein the hub device is mounted to the vertical pole;

a left side telescoping device mounted to the hub device;

a carrier subassembly disposed above the base subassembly;

a support subassembly configured to support the carrier subassembly and including one or more support posts;

an arm subassembly mounted to the carrier subassembly and including one or more arms pivotably connected to the carrier subassembly,

wherein at least one arm of the arm subassembly is configured to pivot about a generally horizontal axis enabling the arm to traverse through a generally vertical plane in a range of movements including a retracted position and an extended position, and further configured to pivot about a generally vertical axis enabling the arm to traverse through a generally horizontal plane, and

wherein at least one arm of the arm subassembly includes one or more charging ports;

one or more charging brackets each incorporating a respective one of the one or more charging ports; and

an electrical subassembly comprising:

one or more electrical outlets disposed on the base subassembly and/or the carrier subassembly;

one or more mobile device connectors disposed on the base subassembly and/or the carrier subassembly;

one or more retractable power cable reels each having an input plug available to connect to an external power source and an output plug;

an uninterruptible power supply; and

a power distribution circuit configured to electrically couple the uninterruptible power supply and/or the one or more retractable power cable reels to the one or more charging ports, the one or more electrical outlets, and the one or more mobile device connectors,

wherein the assembly adopts a loading configuration in which one or more medical devices mounts to the one or more mounting brackets on the arm subassembly, and in which one or more containers hang from the rack subassembly.

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