(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
22 December 2005 (22.12.2005)

PCT

(10) International Publication Number
WO 2005/120299 A2

(51) International Patent Classification[7]: A47F 10/00

(21) International Application Number: PCT/US2005/018825

(22) International Filing Date: 31 May 2005 (31.05.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/576,666	3 June 2004 (03.06.2004)	US
60/576,868	3 June 2004 (03.06.2004)	US
60/624,260	2 November 2004 (02.11.2004)	US
60/645,410	20 January 2005 (20.01.2005)	US

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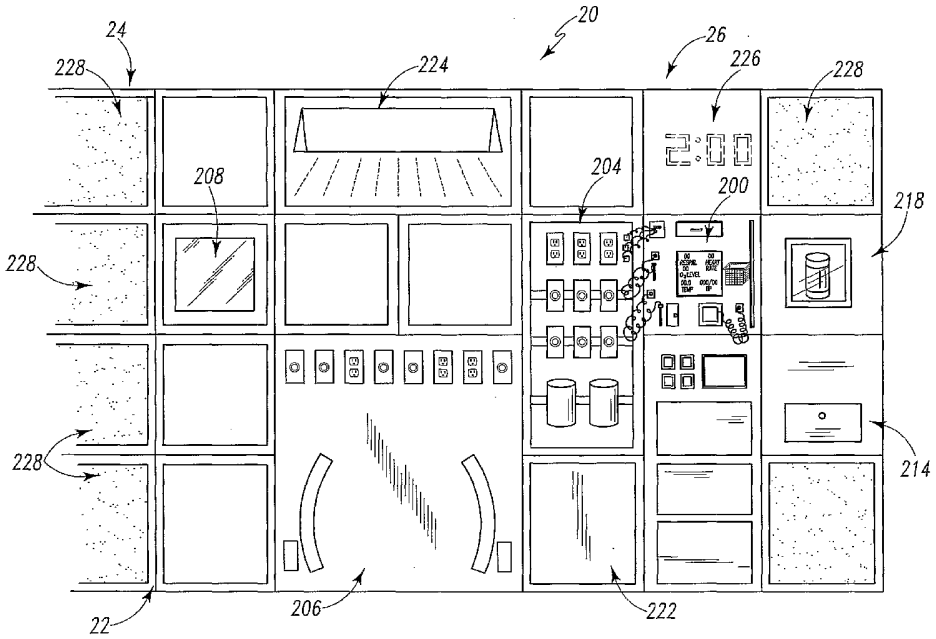
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

[Continued on next page]

(54) Title: PATIENT CARE MODULES FOR HOSPITAL WALLS



(57) Abstract: A modular wall system (20) is provided for use in a healthcare facility to divide the available floor space into rooms and to support hospital equipment modules. The system includes a plurality of frame units (100) configured to rest on the floor and extend vertically upwardly. The frame units (100) form a grid of vertically and laterally spaced apart wall spaces having a predetermined height (132) and a predetermined width (130). A plurality of patient care modules (24) is a configured to be positioned in the spaces to form a wall (26) of the healthcare facility.

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European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

PATIENT CARE MODULES FOR HOSPITAL WALLS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit, under 35 U.S.C. § 119(e), of U.S. Provisional Patent Applications Serial Nos. 60/576,666 filed June 3, 2004; 60/576,868 filed June 3, 2004; 60/624,260 filed November 2, 2004; and 60/645,410 filed January 20, 2005, each of which is hereby incorporated by reference herein.

BACKGROUND OF THE INVENTION

The present disclosure relates to adaptable clinical environments, and particularly to a modular system for constructing walls in a clinical environment.

Conventional methods for constructing walls in a healthcare facility utilize timber, steel and dry wall which are more or less permanently secured to the floor and/or the ceiling of the healthcare facility. Such traditional methods of construction involve long and unreliable construction times due to the difficulties in scheduling the various craftsmen such as carpenters, painters, plumbers, electricians and the like to complete the construction work. The rooms and spaces constructed using such traditional methods are not readily reconfigurable. Any such reconfiguration requires tearing down the existing walls. Such reconfiguration is not only costly, time consuming and disruptive, but produces a lot of dirt, dust and noise. The material that is removed is generally not reusable, and has to be disposed of.

Modular wall systems for dividing open spaces into cubicles and rooms are well known. Examples of such systems are disclosed in U.S. Patent Publication No. US 2002/0104271 and U.S. Patent No. 6,405,491, both of which are entitled "Modular Patient Room."

SUMMARY OF THE INVENTION

The present invention comprises a system that has one or more of the following features or combinations thereof, which alone or in any combination may comprise patentable subject matter.

A system for constructing walls may include a plurality of frame units having connection points and a plurality of patient care modules coupled to the frame units at the connection points to form a wall. The frame units may form a grid of

vertically and laterally spaced apart connection points having a predetermined vertical spacing and a predetermined lateral spacing. At least some of the plurality of patient care modules may have a width substantially equal to a multiple, including one, of the predetermined lateral spacing and a height substantially equal to a multiple, including one, of the predetermined vertical spacing.

Some examples of the patient care modules are a vital signs module, a service delivery module, a bed locator module, a monitor module, a viewbox module, a sharps disposal module, a computer/keyboard module, a tube drop module, a waste management module, a light module, and a clock module. It will be understood that this list is only illustrative, and not intended to be exhaustive.

Additional features, which alone or in combination with any other feature(s), such as those listed above and those listed in the appended claims, may comprise patentable subject matter and will become apparent to those skilled in the art upon consideration of the following detailed description of illustrative embodiments exemplifying the best mode of carrying out the embodiments as presently perceived.

BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description particularly refers to the accompanying figures in which:

Fig. 1 is a front elevation view showing a modular wall having a plurality of patient care modules;

Fig. 2 is a perspective view of a portion of the modular wall of Fig. 1 showing a plurality of frame units having hanger-receiving openings, a plurality of hangers received in the associated hanger-receiving openings in the frame units and various patient care modules removably supported by the hangers;

Fig. 3 is perspective view of a vital signs module showing the vital signs module having a display panel, a blood pressure cuff, a thermometer, a pulse oximeter, a cardiac monitor, storage for leads and sensors, storage for disposable probe covers, an accessory mounting track, and an accessory basket;

Fig. 4 is perspective view of a horizontal service delivery module;

Fig. 5 is perspective view of a vertical service delivery module;

Fig. 6 is a perspective view of a bed locator module;

Fig. 7 is perspective view of a flat screen monitor module;

Fig. 8 is perspective view showing a monitor module having a flat screen mounted on an articulating arm;

Fig. 9 is perspective view of a viewbox module;

Fig. 10 is perspective view of a sharps-disposal module;

Fig. 11 is perspective view of a computer and keyboard module;

Fig. 12 is a perspective view of a tube drop module;

Fig. 13 is a perspective view of a cabinet module;

Fig. 14 is a perspective view of a waste management module;

Fig. 15 is a perspective view showing a patient care module having a guide track for slidably receiving a hanger secured to the frame unit;

Fig. 16 is a block diagram showing various electrical components of the vital signs module;

Fig. 17 is a block diagram showing an alternative arrangement of the various electrical components of the vital signs module;

Fig. 18 is a perspective view of an apparatus including a headwall and an armoire showing the apparatus in an open position having first and second sections of the armoire moved to first and second sides of the headwall to provide access to a bed locator and a plurality of service connectors;

Fig. 19 is a front elevation view of the apparatus in the opened position;

Fig. 20 is a top plan view of the apparatus in the opened position;

Fig. 21 is a front elevation view of the apparatus in a closed position having the first and second sections of the armoire moved in front of the headwall; and

Fig. 22 is a top plan view of the apparatus in the closed position.

DETAILED DESCRIPTION OF THE DRAWINGS

As shown in Figs. 1 and 2, a modular system 20 for constructing walls is provided. Illustratively, the modular wall system 20 includes a plurality of infrastructure components 22 and a plurality of modules, such as, for example, patient care or headwall modules 24, coupled to the infrastructure components 22 to form a wall, such as, for example, a headwall 26. Such a system 20 may, for example, be

used for constructing walls in a healthcare facility such as, for example, a private patient room.

Referring to Fig. 1, the patient care modules 24 illustratively include a vital signs module 200 (best shown in Fig. 3), a horizontal service delivery module 202 (best shown in Fig. 4), a vertical service delivery module 204 (best shown in Fig. 5), a bed locator module 206 (best shown in Fig. 6), a flat screen monitor module 208 (best shown in Fig. 7), a monitor module 210 with a flat screen mounted on an articulating telescopic arm (best shown in Fig. 8), a viewbox module 212 (best shown in Fig. 9), a sharps-disposal module 214 (best shown in Fig. 10), a computer and keyboard module 216 (best shown in Fig. 11), a tube drop module 218 (best shown in Fig. 12), a cabinet module 220 (best shown in Fig. 13), a waste management module 222 (best shown in Fig. 14), a light module 224 (best shown in Fig. 1) and a clock module 226 (best shown in Fig. 1). In addition, decorative panel modules 228 may be provided for closing or covering modular spaces. It will be understood that this list is only illustrative, and not intended to be exhaustive.

It should be understood that although the illustrative wall 26 shown in Fig. 1 includes patient care modules 24, a modular wall may very well include other modules such as, for example, footwall modules, clinical wall modules, family zone modules, hygiene zone modules and the like (not shown). Some examples of family zone modules are a visitor hideaway bed module, a microwave module, a refrigerator module, a cabinet module, a drawer module, a foldout seat module, a reading lamp module, a television module, a shelving module, a wardrobe module, a decorative panel module, a whiteboard module, a tacksurface module and a mood panel module. Such family zone modules are disclosed in PCT/US2005/xxxxxx, entitled "Family Zone Modules for Hospital Walls," (attorney docket no. 7175-78001) which is assigned to the same assignee as the subject application and which is hereby incorporated by reference herein. The term "hospital equipment module" is used broadly, and includes a patient care module, a footwall module, a clinical wall module, a family zone module, a hygiene zone module, a door module, a window module, a fold-out bed module, a vital signs module, an equipment storage module, and the like.

As shown in Fig. 2, the infrastructure components 22 include frame units 100 and a plurality of supporting members 102. In the illustrated embodiment,

the supporting members 102 are hangers configured to be detachably coupled to the frame units 100. Each frame unit 100 includes a pair of vertical members 110 and a pair of horizontal members 112 extending between the vertical members 110 near the top and the bottom of the frame units 100 to form a generally rectangular structure with an open space or cavity 114 in the middle that extends between the front and back sides 116, 118 of the frame unit 100. Illustratively, the vertical and horizontal members 110, 112 are made from tubular members having generally rectangular cross section.

The vertical members 110 of each frame unit 100 have a first plurality of connection points 120 facing the front side 116 of the frame unit 100 and a second plurality of connection points 120 facing the back side 118 of the frame unit 100. In the illustrated embodiment, the first plurality of connection points 120 is a first plurality of hanger-receiving openings 120 extending along the depth dimension and facing the front side 116 of the frame unit 100. Likewise, the second plurality of connection points 120 is a second plurality of hanger-receiving openings 120 extending along the depth dimension and facing the back side 118 of the frame unit 100. The hanger-receiving openings 120 are sized and shaped to receive the hangers 102. When inserted, the hangers 102 fit into in the hanger-receiving openings 120 in the frame units 100 so that they firmly lock in place. Illustratively, both the hangers 102 and the hanger-receiving openings 120 are generally rectangular in cross section. The hangers 102 extend generally horizontally away from the frame units 100 in a cantilevered fashion. As explained below, the lengths of the hangers 102 generally match the depth of the respective modules 24 supported by such hangers 102.

The center-to-center lateral spacing 130 between the hanger-receiving openings 120 in the vertical members 110 of each frame unit 100 along the width dimension or the x-axis is fixed. Illustratively, the center-to-center lateral spacing 130 between the hanger-receiving openings 120 is about 2 feet (about 60 centimeters). The center-to-center vertical 132 spacing between the hanger-receiving openings 120 in the vertical members 110 of each frame unit 100 along the height dimension or the z-axis is also fixed. Illustratively, the center-to-center spacing 132 between the hanger-receiving openings 120 along the height dimension is about 2 feet (about 60 centimeters).

Thus, the first and second plurality of hanger-receiving openings 120 are spaced apart from each other by a predetermined width 130 and a predetermined height 132 to form 2 feet-by-2 feet (about 60 centimeters by-60 centimeters) grids on the opposite sides 116, 118 of the frame units 100. Each module 24 has a width substantially equal to a discrete multiple, including one, of the predetermined width (2 feet or about 0.60 meter in the illustrated example) and a height substantially equal to a discrete multiple, including one, of the predetermined height (2 feet or about 0.60 meter in the illustrated example).

In the embodiment illustrated in Fig. 2, a first plurality of modules 24 is supported by the hangers 102 on the front side 116 of the frame units 100. A second plurality of modules 24 is supported by hangers 102 on the back side 118 of the frame units 100. As shown in Fig. 15, each module 24 includes a pair of oppositely disposed guide tracks or channels 140 near the upper end of the module 24 and a pair of oppositely disposed guide tracks or channels 140 near the lower end of the module 24. The upper and lower pairs of guide tracks 140 slidably receive the corresponding hangers 102 secured to the vertical members 110 of the frame units 100. The guide tracks 140 and the hangers 102 are sized to provide a sliding fit. Suitable latches are used for securing the modules 24 to the hangers 102.

The lower horizontal member 112 of each frame unit 100 has a pair of vertically extending through openings 150 for securing the frame unit 100 to the floor 152 of the healthcare facility. Likewise, the upper horizontal member 112 of each frame unit 100 has a pair of vertically extending through openings 150 for securing the frame unit 100 to the ceiling 154 of the healthcare facility where the frame unit 100 extends from the floor 152 to the ceiling 154. Any suitable fasteners 156, such as studs, pins, screws or nuts and bolts, may be used for securing the frame units 100 to the floor 152 and to the ceiling 154. In the illustrated embodiment, the frame units 100 are secured to a base board 158, instead of the floor 152, so that the modules 24 can be protected, for example, from mops, floor cleaning equipment etc. The base board 158 is, in turn, secured to the floor 152. Illustratively, the base board 158 is about 4 inches (10.16 centimeters) high.

In the illustrative embodiment, each frame unit 100 is coupled to the adjoining frame units 100 on either side thereof. In addition, the frame unit 100 closest to an existing conventional wall 160 of the healthcare facility is secured

thereto. To this end, the vertical members 110 of each frame unit 100 have a plurality of laterally extending through openings 162. Any suitable fasteners 164, such as studs, pins, screws or nuts and bolts, may be used for securing each frame unit 100 to the adjoining frame units 100 on the opposite sides thereof and to the adjoining existing wall 160.

Utility lines 172 may be routed from the mechanical room of the healthcare facility into the patient room 28. These utility lines 172 may typically be routed through one of the floor 152, the ceiling 154 or the wall 26 of the patient room 28. The horizontal members 112 have vertically extending through slots or cutouts 170 through which utility lines 172 enter the open space or the cavity 114 defined by the frame members 110, 112. The utility lines 172 are then routed from the open space 114 to the associated modules 24. Illustratively, the utility lines 172 include data lines, gas lines, vacuum lines, AC/DC power lines, hot and cold water lines and plumbing lines.

In addition, laterally extending through openings (not shown) may be formed in the vertical members 110 of the frame units 100 for passing the utility lines 172 from an open space 114 in one frame unit 100 to an open space 114 in the next adjacent frame unit 100 on either side thereof. From the open spaces 114 in the next adjacent frame units 100, the utility lines 172 are then routed to the associated modules 24. The open space 114 in the frame units 100 may be filled with sound and/or thermal insulation material.

The patient care modules 24 have a width substantially equal to a discrete multiple, including one, of the predetermined lateral spacing 130 between the hanger-receiving openings 120. Illustratively, the predetermined lateral spacing 130 between the hanger-receiving openings 120 is about 2 feet (about 60 centimeters). Thus, the width of the patient care modules 24 may be about 2 feet (about 60 centimeters), 4 feet (about 120 centimeters), 6 feet (about 180 centimeters), etc. The patient care modules 24 have a height substantially equal to a discrete multiple, including one, of the predetermined vertical spacing 132 between the hanger-receiving openings 120. Illustratively, the predetermined vertical spacing 132 between the hanger-receiving openings 120 is also about 2 feet (about 60 centimeters). Thus, the height of the patient care modules 24 may be about 2 feet

(about 60 centimeters), 4 feet (about 120 centimeters), 6 feet (about 180 centimeters), 8 feet (about 240 centimeters), etc.

While the width and the height of the modules 24 are a discrete multiple, including one, of the predetermined lateral spacing 130 and the predetermined vertical spacing 132 between the openings 120, the depth of the modules 24 may, however, vary depending on their functionality. For example, the decorative panel modules 222 are about one inch (2.54 centimeters) deep. As previously indicated, the lengths of the hangers 102 generally match the depth of the associated modules 24 supported by said hangers 102. Thus, the length of the hangers 102 used for supporting a 1 inch (2.54 centimeters) deep decorative panel modules 228 would also be about 1 inch (2.54 centimeters). Such modular wall system 20 is disclosed in PCT/US2005/xxxxxx, entitled "Modular System for Constructing Hospital Walls" (attorney docket no. 7175-78000) which is assigned to the same assignee as this application and which is hereby incorporated by reference herein.

As shown in Fig. 3, the vital signs module 200 includes a housing 250, a display panel 252, a controller 254 (best shown in Figs. 16 and 17), a non-invasive blood pressure measuring device 256, a thermometer 258, a pulse oximeter 260, a cardiac monitor 262, a storage compartment 264 for disposable probe covers, a storage compartment 266 for leads and sensors, and an accessory mounting track 268. The vital sign measuring devices 256, 258, 260 and 262 are oftentimes needed at a patient's bedside in a healthcare facility. It will be understood that the foregoing list of vital sign measuring devices is merely illustrative, and not intended to be exhaustive.

As used in the specification and claims, the term "vital sign measuring device" means a device for measuring any physiological condition or attribute of a patient including signs of life of a person such as the blood pressure, the body temperature, the blood oxygenation, the pulse or heart rate, the respiratory rate, etc. Also, the term "cardiac monitor" is used interchangeably with like terms such as an EKG monitor and a heart monitor. In Figs. 16 and 17, numeral 420 designates a vital sign measuring device for measuring a vital sign different than the blood pressure, the body temperature, the blood oxygenation, and the pulse rate.

The housing 250 is generally box-shaped, and comprises a front wall 270, a back wall 272, a pair of side walls 274, 276, a top wall 278, and a bottom wall

280. The display panel 252 is coupled to the front wall 270. The controller 254 (best shown in Figs. 16 and 17) is situated in an interior region (not shown) of the housing 250. As shown in Figs. 16 and 17, the controller 254 comprises a microcontroller 384 which receives inputs from the blood pressure measuring device 256, the thermometer 258, the pulse oximeter 260, and the cardiac monitor 262. In response to the outputs of the vital sign measuring devices 256, 258, 260 and 262, the microcontroller 384 displays graphical and/or alphanumeric data (for example, the blood pressure, body temperature, blood oxygenation, pulse rate, and respiratory rate) on the display panel 252. The data displayed on the display panel 252 may be in the form of waveforms, bar charts, pie charts, etc., if desired. In addition, the data from the vital sign measuring devices 256, 258, 260 and 262 may be transmitted to a computer network of the healthcare facility via wired or wireless communication links.

The non-invasive blood pressure measuring device 256 includes a cuff 300. The cuff 300, when not in use, is stored in a cavity or a slot 302 formed in the front wall 270. An extension cord 304 couples the blood pressure cuff 300 to a terminal 306 provided on a mounting plate 308 coupled to the front wall 270 of the housing 250. The mounting plate 308 is generally flush with the front wall 270 of the housing 250 in the illustrative example. The terminal 306 is coupled to electrical components associated with the blood pressure measuring device 256. The mounting plate 308 may form a portion of an enclosure housing electrical components of the blood pressure measuring device 256. The electrical components of the blood pressure measuring device 256 are coupled to the controller 254 as shown, for example, in Fig. 16. In operation, the cuff 300 is wrapped around a patient's upper arm for measuring the blood pressure of the patient.

In some embodiments, the vital signs module 200 includes an invasive blood pressure measuring device (not shown). The invasive blood pressure measuring device includes a catheter coupled to a transducer. The catheter is inserted into a patient's artery and the transducer is coupled to the controller 254. The display panel 252, coupled to the controller 254, displays an analog waveform based on the output of the transducer.

The thermometer 258 includes a probe 320. A holder 322 coupled to the front wall 270 releasably supports the probe 320 when the thermometer 258 is not in use. An extension cord 324 couples the probe 320 to a terminal 326 provided on a

mounting plate 328 coupled to the front wall 270 of the housing 250. The mounting plate 328 is generally flush with the front wall 270 of the housing 250 in the illustrative example. The terminal 326 is coupled to electrical components associated with the thermometer 258. The mounting plate 328 may form a portion of an enclosure housing electrical components of the thermometer 258. The electrical components of the thermometer 258 are coupled to the controller 254 as shown, for example, in Fig. 16. Disposable covers (not shown) for the probe 320 are stored in the storage compartment 264. The storage compartment 264 is movable between a closed position blocking access to the probe covers and an opened position allowing access to the probe covers. The storage compartment 264 includes a handle 330. In operation, the probe 320 is inserted in a patient's mouth for measuring the temperature of the patient.

The pulse oximeter 260 includes a mounting plate 340 coupled to the front wall 270 and a finger clip 342 coupled to a terminal 346 on the mounting plate 348 by an extension cord 344. The mounting plate 348 is generally flush with the front wall 270 of the housing 250 in the illustrated example. The terminal 346 is coupled to electrical components associated with the pulse oximeter 260. The mounting plate 348 may form a portion of an enclosure housing electrical components of the pulse oximeter 260. The electrical components of the pulse oximeter 260 are coupled to the controller 254 as shown, for example, in Fig. 16. A holder 350 is coupled to the front wall 270 to releasably support the finger clip 342 when the pulse oximeter 260 is not in use. In operation, the finger clip 342 is attached to a patient's finger for measuring oxygen saturation level in the patient's blood.

The cardiac monitor 262 includes a mounting plate 360 coupled to the front wall 270 and a plurality of electrodes 362 coupled to associated terminals 364 on the mounting plate 360 by respective leads 366. The mounting plate 360 is generally flush with the front wall 270 of the housing 250 in the illustrated example. The terminals 364 are coupled to electrical components associated with the cardiac monitor 262. The mounting plate 360 may form a portion of an enclosure housing electrical components of the cardiac monitor 262. The electrical components of the cardiac monitor 262 are coupled to the controller 254 as shown, for example, in Fig. 16. The electrodes 362 and the leads 366 are stored in the storage compartment 266 when the cardiac monitor 362 is not in use. The storage compartment 266 is movable

between a closed position blocking access to the electrodes 362 and the leads 366 and an opened position allowing access to the electrodes 362 and the leads 366. The storage compartment 266 includes a handle 368. In operation, the electrodes 362 are attached to a patient's chest for measuring the pulse rate of the patient.

In the illustrated embodiment, the cardiac monitor 262 measures a patient's respiratory rate and monitors for any signs of apnea in addition to measuring the pulse rate and the cardiac rhythm. However, when the vital signs module 200 is installed in a Med/Surge area of a healthcare facility, the vital signs module 200 may include a separate apnea monitor. In some embodiments, the cardiac monitor 262 only measures the pulse rate. In such instances, the vital signs module 200 may include a separate respiratory rate measuring device.

The accessory mounting track 268 is coupled to the front wall 270 of the housing 250 such that the accessory mounting track 268 extends generally vertically relative to a floor of the healthcare facility. In some embodiments, the accessory mounting track 268 extends in a generally horizontal direction. The accessory mounting track 268 is configured to support one or more accessories, such as an accessory basket 282, and bottles (not shown).

Each vital sign measuring device includes at least one vital sign measuring sensor which is configured to be coupled to a patient whose vital signs are to be monitored. Thus, the blood pressure measuring device 256 includes a cuff 300; the thermometer 258 includes a probe 320; the pulse oximeter 260 includes a finger clip 342; and the cardiac monitor includes 262 includes a plurality of electrodes 362. In the illustrated embodiment, the sensors 300, 320, 342 and 362 of the respective vital sign measuring devices, such as the blood pressure measuring device 256, the thermometer 258, the pulse oximeter 260 and the cardiac monitor 262, are coupled to the controller 254 via associated extension cords 304, 324, 344 and leads 366.

In some embodiments, one or more of the vital sign measuring devices 256, 258, 260 and 262 may be coupled to the controller 254 by associated wireless communication links. A wireless communication link may comprise a wireless transmitter coupled to a sensor 300, 320, 342 and 362 and a wireless receiver coupled to the controller 254. The wireless transmitter and receiver may each comprise an antenna for transmitting the wireless signals and for receiving the wireless signals respectively. In some other embodiments, a wireless communication link may

comprise a first wireless transceiver coupled to a sensor 300, 320, 342 and 362 and a second wireless transceiver coupled to the controller 254. The vital sign measuring devices 256, 258, 260 and 262 equipped with wireless communication links are configured to be used in proximity to the controller 254 to permit wireless communication therebetween. The vital signs module 200 may include an alarm which may be triggered in the event the patient carrying the at least one sensor 300, 320, 342 and 362 moves outside the wireless communications range of the associated wireless communication link.

As shown in Fig. 16, an output of the blood pressure measuring device 256 is coupled to a signal conditioning circuit 380 on a line 382. An output of the signal conditioning circuit 380 is coupled to the microcontroller 384 on a line 386. An output of the thermometer 258 is coupled to a signal conditioning circuit 390 on a line 392. An output of the signal conditioning circuit 390 is coupled to the microcontroller 384 on a line 396. An output of the pulse oximeter 260 is coupled to a signal conditioning circuit 400 on a line 402. An output of the signal conditioning circuit 400 is coupled to the microcontroller 384 on a line 406. An output of the cardiac monitor 262 is coupled to a signal conditioning circuit 410 on a line 412. An output of the signal conditioning circuit 410 is coupled to the microcontroller 384 on a line 416.

An output of the vital sign measuring device 420 is coupled to a signal conditioning circuit 430 on a line 432. An output of the signal conditioning circuit 430 is coupled to the microcontroller 384 on a line 436. As indicated above, the vital sign measuring device 420 represents a vital sign measuring device for measuring a vital sign different than the blood pressure, the body temperature, the blood oxygenation, and the pulse rate. Each signal conditioning circuit 380, 390, 400, 410 and 430 converts the output of the associated vital sign measuring device 256, 258, 260, 262 and 420 to a form suitable for application to the microcontroller 384. The signal conditioning circuits 380, 390, 400, 410 and 430 may comprise any type of electrical circuitry including one or more of the following: an A/D converter, an amplifier, a filtering circuit, and a smoothing circuit.

An output of the microcontroller 384 is coupled to a driver circuit 440 on a line 442. An output of the driver circuit 440 is coupled to the display panel 252 on a line 446. The driver circuit 440 converts the output of the microcontroller 384 to

a form suitable for application to the display panel 252. The driver circuit 440 may comprise any type of electrical circuitry including one or more of the following: a D/A converter, an amplifier, and a filtering circuit. Data (for example, the blood pressure, body temperature, blood oxygenation, pulse rate, and respiratory rate) representing the outputs of the vital sign measuring devices 256, 258, 260 and 262 is displayed on the display panel 252. In some embodiments, the display panel 252 may be additionally configured to display the operational status of the vital sign measuring devices 256, 258, 260 and 262 including information concerning one or more of the following: the device alarm status and the device settings.

Fig. 17 shows an alternative arrangement of the various electrical components of the vital signs module 200. As shown therein, the signal conditioning circuits 380, 390, 400 and 410, the microcontroller 384 and the driver circuit 440 are all coupled to a bus 448 in a peer-to-peer configuration, instead of a master-slave configuration shown in Fig. 16. In the embodiments shown in Figs. 3, 16 and 17, four vital sign measuring devices 256, 258, 260 and 262 are coupled to the microcontroller 384. However, it will be understood that a different number (greater than four or less than four) of vital sign measuring devices may be coupled to the microcontroller 384.

In some embodiments, the display panel 252 may comprise a touchscreen display panel (not shown). In a first mode, the touchscreen display panel may be operable to display patient vital signs data. In a second mode, the touchscreen display panel may be operable to display a plurality of icons that are touchable to provide inputs to the vital sign measuring devices 256, 258, 260 and 262. The touchscreen display panel is operable to display patient vital signs data and the icons at the same time. The touchscreen display panel is also operable to display patient vital signs data and operable to display the icons at different times.

In some embodiments, the vital signs module 20 includes a user interface device such as an alphanumeric keyboard (not shown) configured to provide inputs to the vital sign measuring devices 256, 258, 260 and 262 and/or an electronic data entry device, such as a bar code scanner, a retinal scanner, etc. The vital signs module 200 may also include a data port (not shown) coupled to the controller 254, if desired. Data may be uploaded to and/or download from the controller 254 through the data port. In some embodiments, the vital signs module 200 may include an aural or visual alarm.

Fig. 4 shows a horizontal service delivery module 202. Fig. 5, on the other hand, shows a vertical service delivery module 204. The service delivery modules 202, 204 provide utilities, such as electrical power, medical gas, vacuum, and the like, to a patient and other patient care equipment (not shown) such as, for example, heart and lung monitors, ventilators, infusion pumps, intravenous pumps, defibrillators and the like. Each service delivery module 202, 204 includes a cabinet 500 and a pair of doors 502 that slide sideways in Fig. 4 or up and down in Fig. 5. A control button (not shown) may be provided to open and close the doors 502. The doors 502 may be transparent or opaque. The doors 502 may have decorative inserts.

Each service delivery module 202, 204 includes a plurality of service connectors 504. In the illustrated embodiment, the service connectors 504 include electrical power outlets 506 to provide electrical power, medical gas outlets 508 to provide medical gas, such as, for example, any one or more of oxygen, nitrogen, air and the like, and negative pressure outlets 510 coupled to a negative pressure source (not shown) to provide negative pressure. The negative pressure source may, for example, be a central negative pressure source of the healthcare facility or a vacuum pump located in the patient room, or at some other suitable location. In the illustrated embodiment, a slide 512 supports the negative pressure outlets 510, a bottle 514 for bodily fluids and an accessory basket 516 (best shown in Fig. 4). The outlets 510, the bottle 514 and the basket 516 can be moved along the slide 512.

A plurality of service delivery lines and conduits 518 extend from equipment located remotely from the patient room to the service connectors 504. The service delivery lines 518 may be routed through one of the ceiling, or the floor or the walls of the patient room. Each service delivery module 202, 204 includes one or more task lights 520 that turn on when the doors 502 are opened. The service connectors 504 may include data ports (not shown) to transmit data, such as, for example, any one or more of audio data, video data, and informational data, to the patient room. The service delivery modules 202, 204 may include communication equipment (not shown) such as, for example, a phone, a nurse call button, code buttons, and the like.

Referring to Fig. 6, the bed locator module 206 has a bed-receiving space or cavity 530 and a hospital bed (not shown) is configured to nest in the bed-receiving space or cavity 530. The bed locator module 206 includes a pair of bumper

pads 532 to prevent accidental damage to the hospital bed or to the patient care equipment. The bed locator module 206 includes a plurality of service connectors 534. The service connectors 364 include electrical power outlets, medical gas outlets, negative pressure outlets and data communication ports. The bed locator module 206 may include a bottle slide (not shown) supporting a bottle for bodily fluids. The bed locator module 206 may include communication equipment, such as a phone, nurse call button, and the like (not shown).

The monitor module 208 shown in Fig. 7 includes a stationary flat screen 540 coupled to a service delivery line 542. The monitor module 210 shown in Fig. 8 includes a cabinet 550 configured to form an interior cavity or space 552. A flat screen 554 is mounted on an articulating telescopic arm 556 coupled to the cabinet 550. The flat screen 554 is movable between a first position abutting the cabinet 550 and a second position spaced apart from the cabinet 550. When the flat screen 554 is in the first position abutting the cabinet 550, the articulating telescopic arm 556 is retracted into the interior cavity or space 552. A service delivery line 558 may be threaded through the articulating arm 556 and coupled to the flat screen 554.

Referring to Fig. 9, the viewbox module 212 includes a cabinet 570 having an interior space (not shown) that houses a lighting unit coupled to a service delivery line 572 and a translucent screen 574 that encloses the interior space. An x-ray holder 576 extends laterally along the top edge of the cabinet 570 for supporting an x-ray film 578. The viewbox module 212 includes a control button 580 for operating the lighting unit. As shown in Fig. 10, the sharps-disposal module 214 includes a slidable drawer 580 for collecting sharps such as, for example, used needles, used syringes, used knives, used blades, and the like for later disposal. The sharps-disposal module 214 may include a grinder (not shown) or a compacter (not shown).

Referring to Fig. 11, the computer and keyboard module 216 includes a cabinet 590 having a shelf-receiving cavity 592 and a shelf 594 supported by the cabinet 590 for movement between a storage position in which the shelf 594 is positioned in the cavity 592 and a use position in which the shelf 594 is positioned outside the cavity 592. In the use position, the shelf 594 is configured to extend horizontally from the cabinet 590 in a cantilevered fashion. When the shelf 594 is in the storage position, the outwardly facing wall of the shelf 594 is flush with the

outwardly facing wall of the cabinet 590. The computer and keyboard module 216 includes a flat screen 596 supported in the cavity 592 and a tiltable keyboard 598 supported on the shelf 594.

As shown in Fig. 12, the pneumatic tube drop module 218 includes a cabinet 600 having a tube drop-receiving cavity or space for housing a tube drop 602. The cabinet 600 has a door 604 to provide access to the tube drop 602, and a control button 606 to open and close the door 604. A supply and delivery tube 608 is coupled to the pneumatic tube drop module 218 so that supplies (for example, drugs, wound dressings, sterilized syringes, etc.) and communications (for example, prescription, patient charts, etc.) can be retrieved from and delivered to the patient room. The door 604 may be transparent or opaque. The door 604 may have decorative inserts. As shown in Fig. 13, the cabinet module 220 includes a storage cabinet 620 and a door 622 that slides up and down with respect to the cabinet 620. The door 622 may be transparent or opaque. The door 622 may have decorative inserts. It should be understood however that although the illustrative cabinet 620 shown in Fig. 13 is oriented horizontally, it may very well be oriented vertically.

As shown in Fig. 14, the waste management module 222 includes a trash bin 630 for collecting trash, a sharps-disposal bin 632 for collecting sharps such as, for example, used needles, used syringes, used knives, used blades, and the like, a biohazard-disposal bin 634 for collecting biohazard material such as, for example, patient bodily fluids, patient tissue, and the like, and a soiled linen bin 636 for soiled linen such as, for example, gowns, sheets, towels, etc. The waste management module 222 is configured to be accessible from inside the patient room so that all the waste items are deposited into the respective bins 630, 632, 634 and 636 from inside the patient room, and accessible from outside the patient room, such as, for example, the hospital corridor so that the waste items can be removed from the respective bins 630, 632, 634 and 636 without having to go into the patient room.

In some embodiments, a plurality of conveyor tubes 640, 642, 644 and 646 are coupled to the associated trash bin 630, sharps-disposal bin 632, biohazard-disposal bin 634 and soiled linen bin 636. The conveyor tubes 640, 642, 644 and 646 are configured to transport the accumulated trash, sharps, biohazard material and soiled linen from the respective bins 630, 632, 634 and 636 to a pick-up module (not shown) located in the hospital corridor, where trash, sharps, biohazard material and

soiled linen are collected by house-keeping for later disposal. The trash, sharps and biohazard material may be compacted or ground prior to their transfer to the pick-up module. To this end, the trash bin 630, the sharps-disposal bin 632 and the biohazard-disposal bin 634 may include a compacter (not shown) or a grinder (not shown) as the case may be.

The waste management module 222 includes a cabinet 650 having a plurality of bin-receiving cavities or spaces for housing the trash bin 630, the sharps-disposal bin 632, the biohazard-disposal bin 634 and the soiled linen bin 636 respectively. The cabinet 650 has a door 652 to provide access to the trash bin 630, and a control button 654 to open and close the door 652. The cabinet 650 has a door 656 to provide access to the sharps-disposal bin 632, and a control button 658 to open and close the door 656. The cabinet 650 has a door 660 to provide access to the biohazard-disposal bin 634, and a control button 662 to open and close the door 660. The cabinet 650 has a door 664 to provide access to the soiled linen bin 636, and a control button 666 to open and close the door 664.

Figs. 18-22 show an apparatus 700 comprising an armoire 702 and a headwall 726. In the illustrated embodiment, the headwall 726 is configured as a patient care module 24. The armoire 702 comprises first and second sections 728, 730. The illustrative headwall 726 projects outwardly from a wall 704 of a healthcare facility as shown, for example, in Figs. 20 and 22. The armoire 702 is movable between a first position shown in Figs. 21 and 22 in front of the headwall 726 and a second position shown in Figs. 18-20 alongside the headwall 726. When positioned in front of the headwall 726, the armoire 702 blocks from view at least some of a plurality of service connectors 754, thereby providing a facade similar to that of a hotel or a family room so that a patient, family members and visitors find the hospital environment less intimidating. The apparatus 700 may be useful where surgery facilities have pre/post-op rooms with a headwall having service connectors for electrical power, medical gases, vacuum, etc. which may be needed during the initial phases of post-op recovery. However, the presence of medical gases etc. while a patient is in the pre/post-op room for pre-op may raise apprehension on the part of the patient, family members and visitors. As indicated above, when positioned in front of the headwall 726, the armoire 702 blocks from view at least some of a plurality of service connectors 754 to provide less intimidating hospital environment.

As shown in Figs. 18-20, the sections 728, 730 are movable to the respective second positions alongside the headwall 726 to provide access to the service connectors 754. As shown in Fig. 22, the first section 728 moves in a rearward direction 732 toward the wall 704 after it is moved in a lateral direction 734 to a first side 736 of the headwall 726. Likewise, the second section 730 moves in a rearward direction 738 toward the wall 704 after it is moved in a lateral direction 740 to a second side 742 of the headwall 726. In alternative arrangements, the headwall 726 is recessed into the wall 704 and sections 728, 730 are movable laterally but do not move rearwardly to positions alongside the headwall 726.

Tracks coupled to a floor 746 or a ceiling 748 of a hospital room 744 may be provided for guiding the movement of the sections 728, 730 between the first positions in front of the headwall 726 and the second positions alongside the headwall 726. The sections 728, 730 may include track-engaging wheels, casters, rollers, or the like, to facilitate the movement of the sections 728, 730. In some embodiments, a linkage system (not shown) coupled to the sections 728, 730 is provided. Such linkage system guides the movement of the sections 728, 730 between the first and second positions. The linkage system may be supported by the floor 746 or the ceiling 748 of the room 744 or by a support structure extending upwardly from the floor 746 of the room 744. Other linkage systems may simply interconnect the headwall 726 and the sections 728, 730 without support from other structures. In some embodiments having such linkage systems, the sections 728, 730 have wheels, casters, rollers, or the like, which roll upon the floor 746 of the room 744. In other embodiments, the linkage system suspends the sections 728, 730 off the floor 46.

Electric motors (not shown), such as linear actuators, for example, may be provided to move the sections 728, 730 between the first and second positions. It will be appreciated that hydraulic actuators, gas springs, and the like may be used in lieu of the electric motors to assist the caregiver in moving the sections 728, 730. In some embodiments, retainers or latches (not shown) may be provided to releasably hold the sections 728, 730 in the first and second positions.

As shown in Figs. 18 and 19, the headwall 726 includes a first portion 750 and a second portion 752 in the illustrative example. The first portion 750 comprises a service chase which includes the plurality of service connectors 754. The second portion 752 includes an upper portion 756 and a lower portion 758. The upper

portion 756 includes a back wall 760 and a pair of curved side walls 762. The lower portion 758 includes a bed locator 764 and a bumper 766. As shown in Fig. 20, a hospital bed 770 may be rolled into a position adjacent the bed locator 764 after the sections 728, 730 are moved to the second positions alongside the headwall 726. The bumper 766 protects the headwall 726 from accidental or incidental contact with the hospital bed 770, or other equipment, such as carts. The bed 770 is positioned near the bed locator 764 between the sections 728, 730 and adjacent the service connectors 754. An overhead light 772 is coupled to the back wall 760 of the second portion 752. A light switch 774 is located at a convenient location on the back wall 760 or side walls 762. In some embodiments, the light 772 may be automatically turned on the when the sections 728, 730 are moved to the second positions alongside the headwall 726. In some embodiments, the second portion 752 may include a patient examination light (not shown) mounted on an articulating and/or a telescopic arm.

It is contemplated by this disclosure that the service connectors 754 may provide various types of services or utilities associated with patient care. Thus, some of the service connectors 754 may be electrical power outlets to supply electrical power. Some of the service connectors 754 may be medical gas outlets to provide medical gases, such as, for example, any one or more of oxygen, nitrogen, and air. Some of the service connectors 754 may be negative pressure outlets to supply vacuum. Some of the service connectors 754 may be data communication ports to receive and transmit data, such as, for example, any one or more of audio data, video data, and informational data. A plurality of service delivery lines and conduits extend from equipment located remotely from the patient room 744 to the associated service connectors 754. The service lines may be routed through one or more of the walls 704, the floor 746 or the ceiling 748 of the patient room 744.

Illustratively, as shown in Figs. 18 and 19, the section 728 includes a storage cabinet 780, a tack surface 782 and a shelf 784. The cabinet 780 has two drawers 786, and is located near a lower end of the first section 728. Each drawer 786 includes a handle 788. An upper surface 790 of the cabinet 780 provides a countertop or a writing surface. The shelf 784 is located near an upper end of the first section 728. The tack surface 782 is located between the shelf 784 and the cabinet 780. In the illustrative example, the second section 730 comprises a wardrobe including a shelf 792 near an upper end of the second section 730 and a rod 794 for hanging

clothes. The second section 730 includes a pair of doors 796. Each door 796 has a handle 798. Each door 796 may be swung open and slid inwardly along a narrow track or opening adjacent a side of the second section 730 to a storage position. The headwall 726 and the armoire 702 have a baseboard 800 along respective lower borders thereof.

Illustratively, the dimensions of the apparatus 700 are as follows: 1) each armoire sections 728, 730 is about 2 feet (about 60 centimeters) wide, 7 feet (about 210 centimeters) high and 2 feet (about 60 centimeters) deep, 2) the first portion 750 of the headwall 726 is about 1 foot (about 30 centimeters) wide, 7 feet (about 210 centimeters) high and 1 foot (about 30 centimeters) deep, and 3) the second portion 752 of the headwall 726 is about 3 feet (about 90 centimeters) wide and 7 feet (about 210 centimeters) high. The depth of the curved side walls 762 varies from a maximum depth of 1 foot (about 30 centimeters) at its outer ends to a minimum depth of 6 inches (about 15 centimeters) in the middle.

It is contemplated by this disclosure that the one or more sections comprising the armoire and the headwall may be configured in any number of ways as desired. Accordingly, the illustrative example is not in any way intended to be limiting. For example, while the illustrative headwall 726 is a tall unit extending upwardly from the floor 746, shorter headwalls coupled to the room wall 704 and spaced from the floor 746 (such as those shown in U.S. Pat. Nos. 4,646,211; 4,821,470 and 5,966,760) are within the scope of this disclosure.

The outer appearance of the armoire 702 is similar to that of hotel or family room type furniture. The armoire 702 is normally positioned in front of the headwall 726 which has various types of service connectors 754 discussed above. The armoire 702 may be made of wood or have a faux-wood finish or veneer. The armoire 702 may be adorned with trim, artwork, etc. Thus, when the apparatus 20 is incorporated into a patient room, the overall appearance of the room is relaxing, friendly and welcoming for the patient, family members and visitors who may be spending significant amounts of time in the room.

While the disclosure is susceptible to various modifications and alternative forms, specific exemplary embodiments thereof have been shown by way of example in the drawings and have herein been described in detail. It should be understood, however, that there is no intent to limit the disclosure to the particular

forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the disclosure as defined by the appended claims.

There is a plurality of advantages of the present invention arising from the various features of the embodiments described herein. It will be noted that alternative embodiments of the present invention may not include all of the features described yet still benefit from at least some of the advantages of such features. Those of ordinary skill in the art may readily devise their own implementations of a device that incorporates one or more of the features of the present invention and fall within the spirit and scope of the present invention as defined by the appended claims.

CLAIMS:

1. A modular wall system for use in a healthcare facility, the system comprising:

a plurality of frame units, and

a plurality of patient care modules coupled to the frame units to form a wall of a patient room.

2. The system of claim 1, wherein the plurality of frame units form a grid of vertically and laterally spaced apart wall spaces having a predetermined height and a predetermined width, the plurality of patient care modules are configured to be positioned in the wall spaces to form the wall.

3. The system of claim 2, wherein at least some of the plurality of modules have a width substantially equal to a multiple, including one, of the predetermined width of the wall spaces and have a height substantially equal to a multiple, including one, of the predetermined height of the wall spaces.

4. The system of claim 1, wherein each frame unit has a plurality of connection points spaced apart from each other by a predetermined height and a predetermined width to form a grid, the plurality of patient care modules are coupled to the frame units at the connection points to form the wall.

5. The system of claim 4, wherein at least some of the plurality of patient care modules have a width substantially equal to a multiple, including one, of the predetermined width and have a height substantially equal to a multiple, including one, of the predetermined height.

6. The system of claim 4, comprising a plurality of supporting members configured to be detachably coupled to the frame units at the connection points, wherein the supporting members extend generally horizontally away from the frame units in a cantilevered fashion, and the plurality of patient care modules is configured to be coupled to the supporting members to form the wall.

7. The system of claim 6, wherein each patient care module includes at least one pair of oppositely disposed guide tracks sized and positioned to receive an associated pair of oppositely disposed supporting members.

8. The system of claim 1, wherein the patient care modules include any one or more of the following: a vital signs module, a service delivery module, a bed locator module, a monitor module, a sharps-disposal module, a computer module, a tube drop module, a cabinet module, a waste management module, a light module and a clock module.

9. The system of claim 8, wherein the vital signs module comprises a housing, a display panel coupled to the housing, a controller coupled to the housing, and at least one vital sign measuring device coupled to the controller, the display panel being coupled to the controller and configured to display data in response to an output of the at least one vital sign measuring device.

10. The system of claim 9, wherein the at least one vital sign measuring device includes a sensor.

11. The system of claim 10, wherein the sensor is coupled to the controller via a wire.

12. The system of claim 10, wherein the sensor is coupled to the controller via a wireless communication link.

13. The system of claim 9, wherein the vital signs module comprises any one or more of the following: a blood pressure cuff, a thermometer, a pulse oximeter, a cardiac monitor, a respiration rate sensor, storage for leads and sensors, storage for disposable probe covers, and an accessory mounting track.

14. The system of claim 8, wherein the waste management module includes any one or more of the following: a trash bin for collecting trash, a sharps-disposal bin for collecting sharps, a biohazard-disposal bin for collecting biohazard material and a soiled linen bin for soiled linen.

15. The system of claim 14, wherein the waste management module is configured to be accessible from inside the patient room and accessible from outside the patient room.

16. The system of claim 14, comprising a plurality of conveyor tubes coupled to the associated trash bin, sharps-disposal bin, biohazard-disposal bin and soiled linen bin, wherein the conveyor tubes are configured to transport the accumulated trash, sharps, biohazard material and the soiled linen from the respective bins to a pick-up module outside the patient room.

17. The system of claim 16, wherein the trash, sharps and biohazard material are compacted prior to their transfer to the pick-up module via the conveyor tubes.

18. The system of claim 16, wherein the trash, sharps and biohazard material are compacted in their respective bins prior to their transfer to the pick-up module via the conveyor tubes.

19. The system of claim 8, wherein the service delivery module has a plurality of service connectors to provide any one or more of the following services: electrical power outlets, medical gas outlets, vacuum outlets, air outlets, and communication ports.

20. A vital signs module for use in a healthcare facility, the vital sign module comprising:

a housing,

a display panel coupled to the housing,

a controller coupled to the housing, and

at least one vital sign measuring device coupled to the controller, the display panel being coupled to the controller and configured to display data in response to an output of the at least one vital sign measuring device.

21. An apparatus for use in a healthcare facility, the apparatus comprising:

a headwall, and

an armoire movable between a first position blocking access to at least a first portion of the headwall and a second position providing access to the first portion of the headwall, the armoire being coupled to the headwall.

22. The apparatus of claim 21, comprising at least one track to guide the movement of the armoire between the first and second positions.

23. The apparatus of claim 21, wherein the headwall includes a plurality of service connectors.

24. The apparatus of claim 21, wherein the armoire is movable to one side of the headwall.

25. The apparatus of claim 21, wherein the armoire comprises first and second sections, the first section is laterally movable to a first side of the headwall, and the second section is laterally movable to a second side of the headwall.

26. The apparatus of claim 25, wherein the headwall projects outwardly from a wall of the healthcare facility, the first section of the armoire is movable rearwardly toward the wall after it is moved laterally to the first side of the headwall, and the second section of the armoire is movable rearwardly toward the wall after it is moved laterally to the second side of the headwall.

27. The apparatus of claim 26, wherein the armoire first and second sections are movable on tracks coupled to a floor, a ceiling, and/or both the floor and the ceiling.

28. The apparatus of claim 26, comprising a linkage system coupled to the first and second sections to guide the movement of the first and second sections between respective first positions in front of the headwall and second positions alongside the headwall.

29. The apparatus of claim 21, wherein the armoire includes any one or more of the following: a wardrobe, a shelf, a cabinet, a pullout writing surface, a tack surface, and an entertainment center.

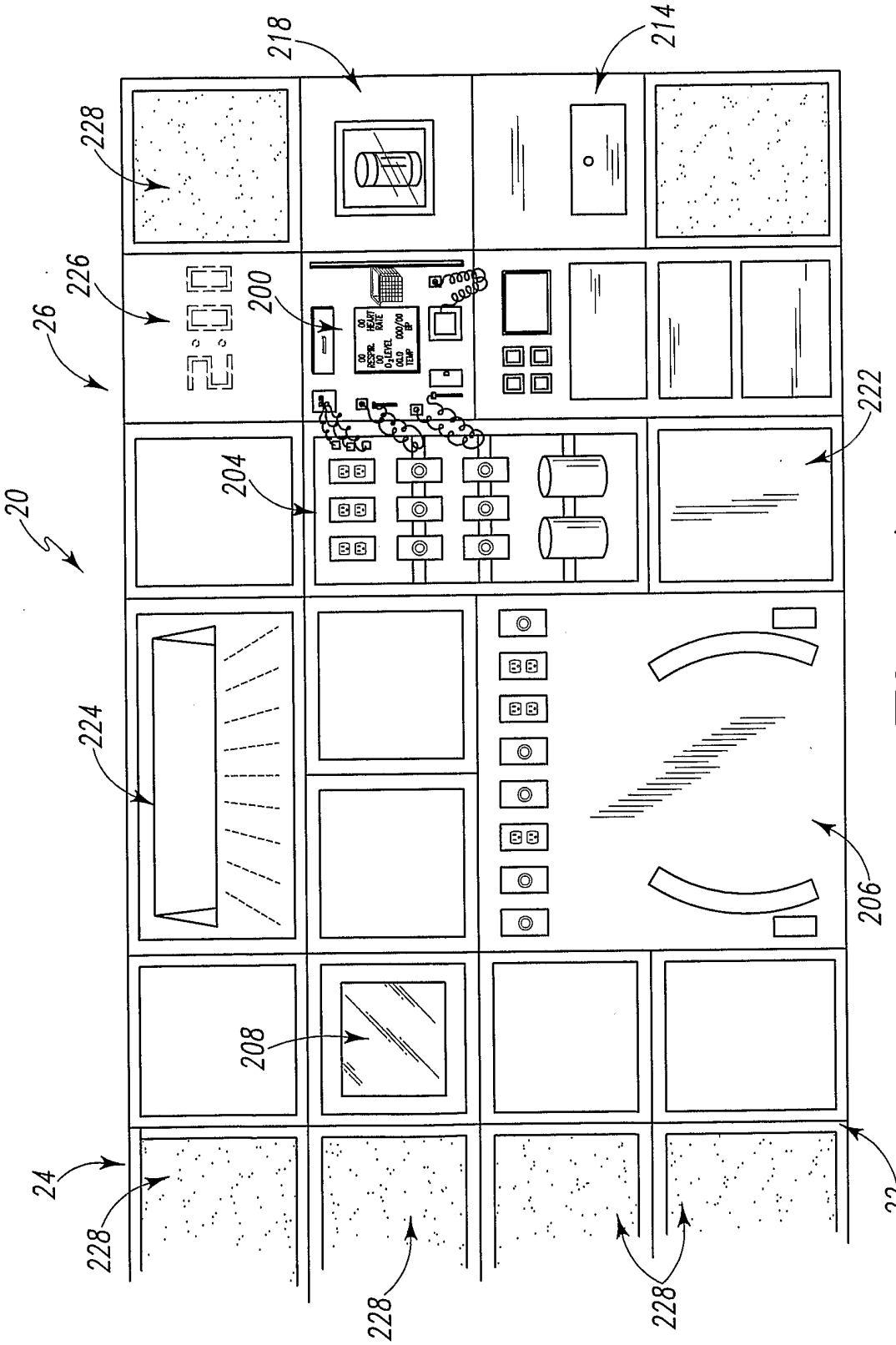

Fig. 1

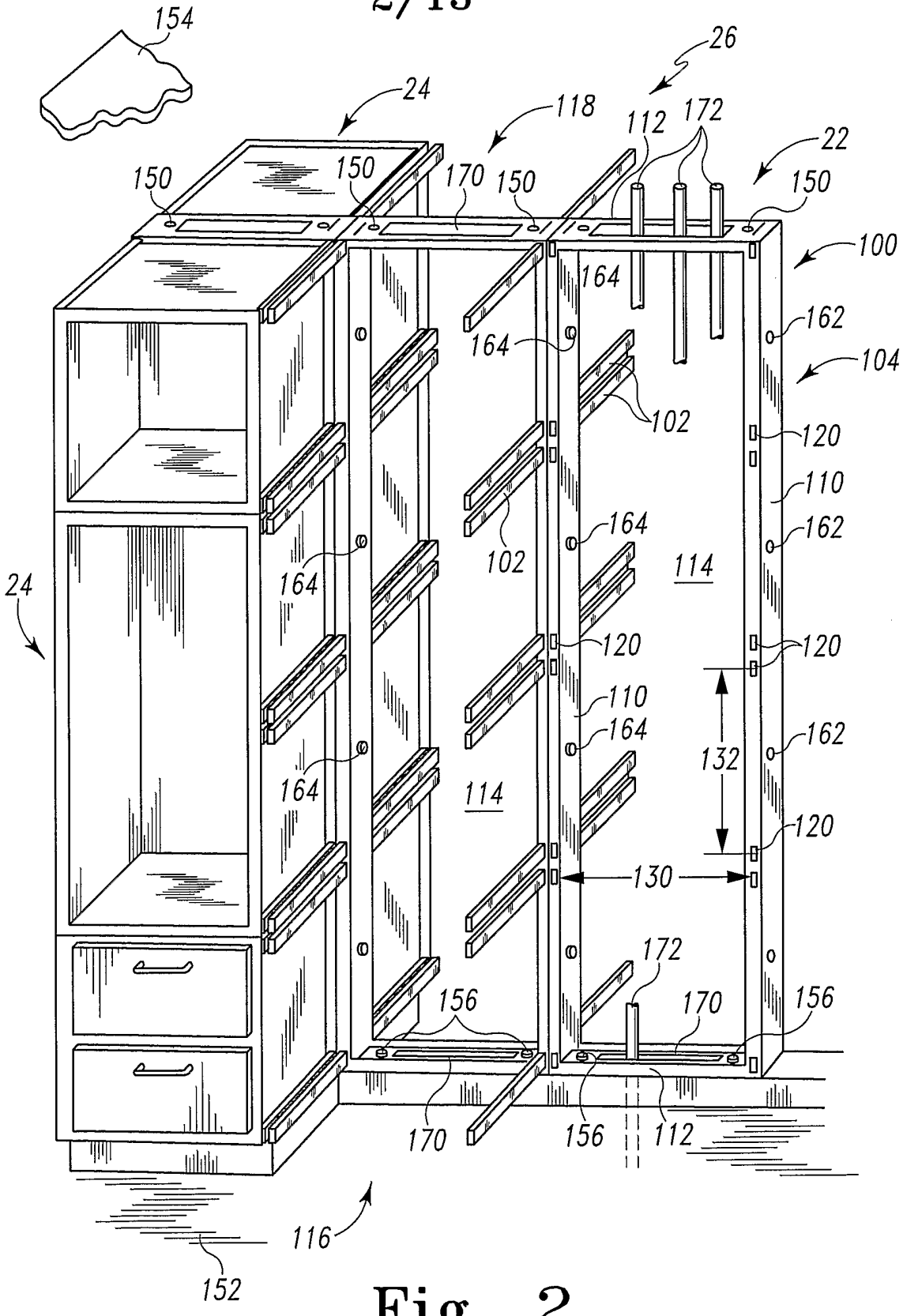
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Fig. 2

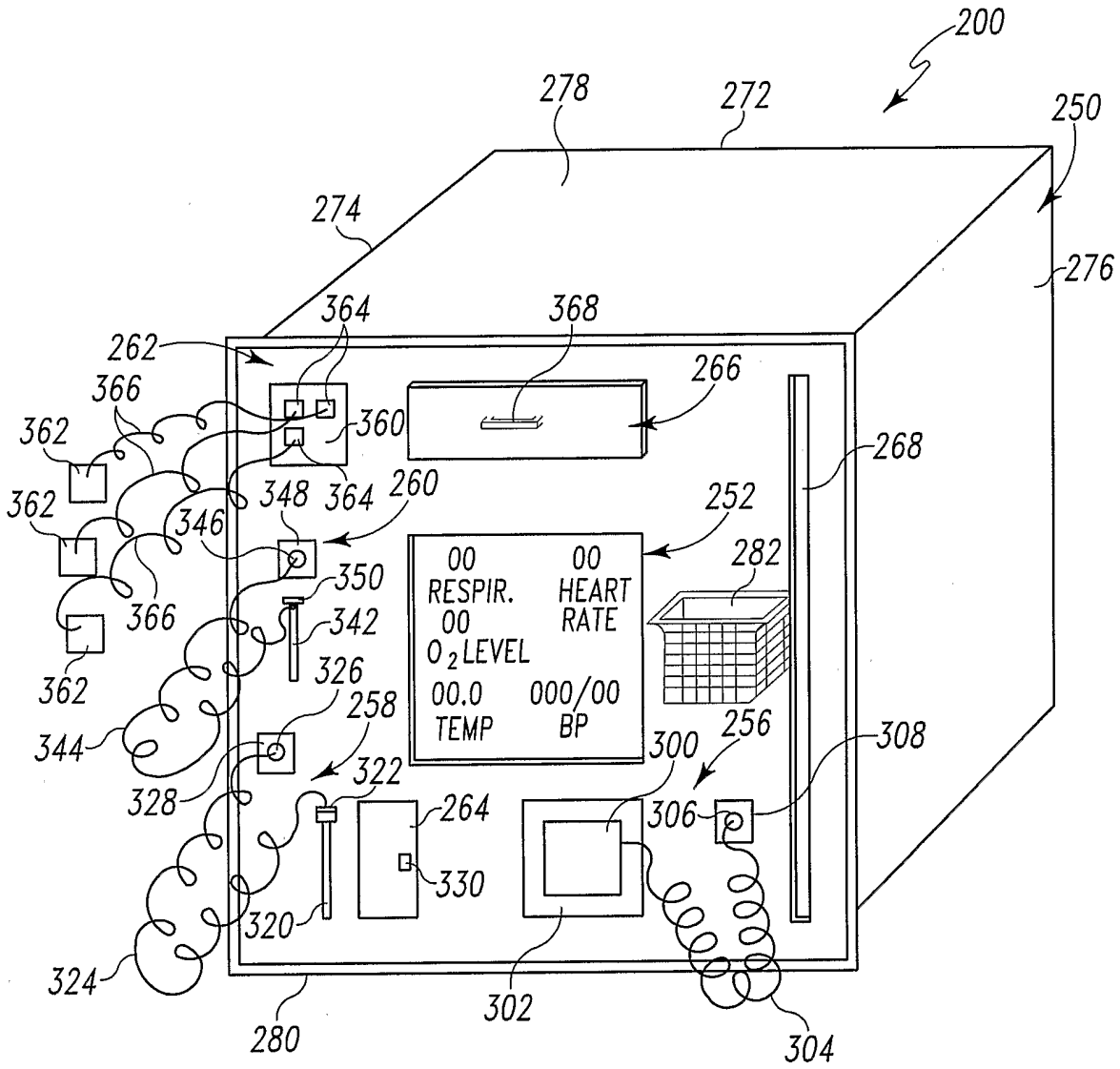
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Fig. 3

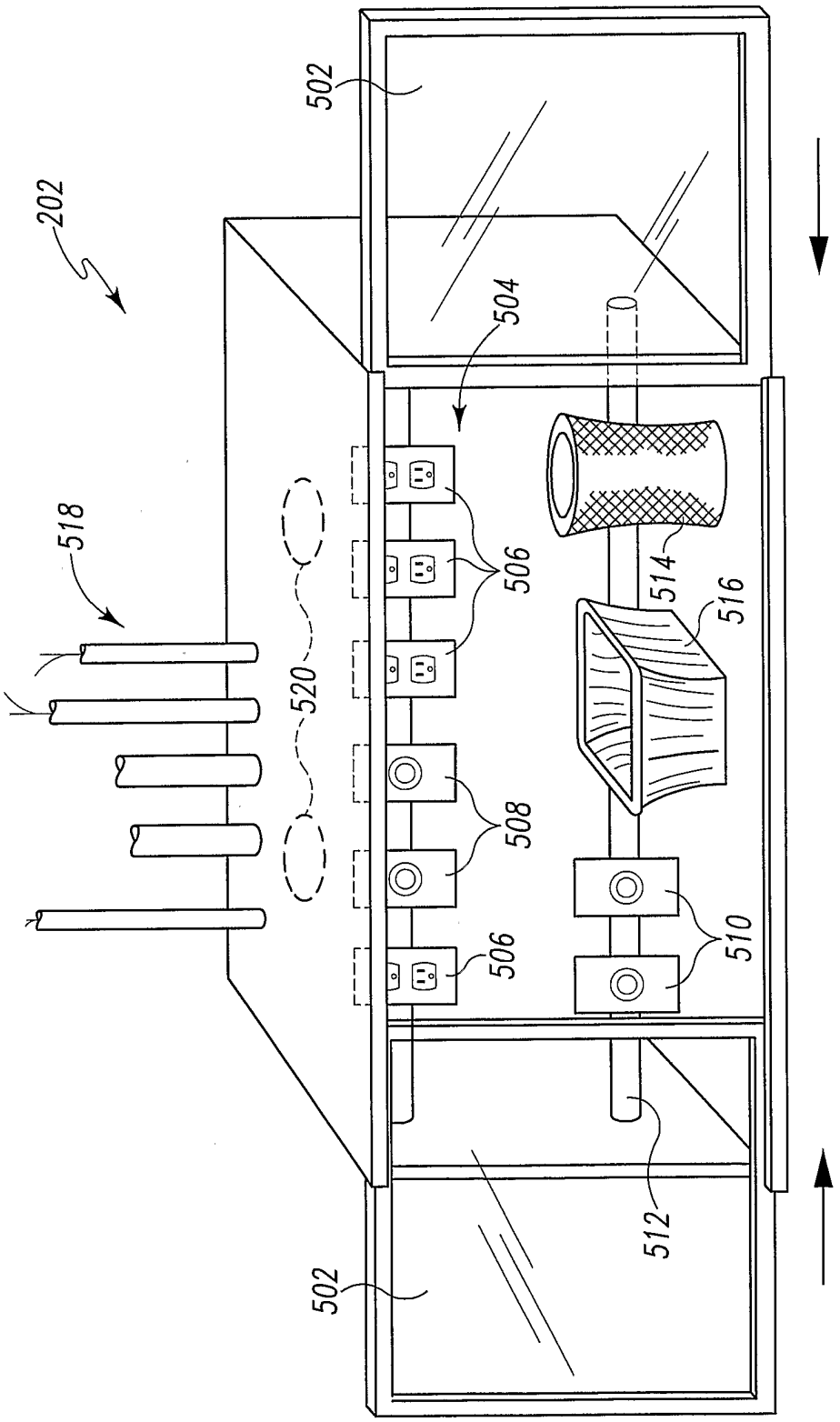

Fig. 4

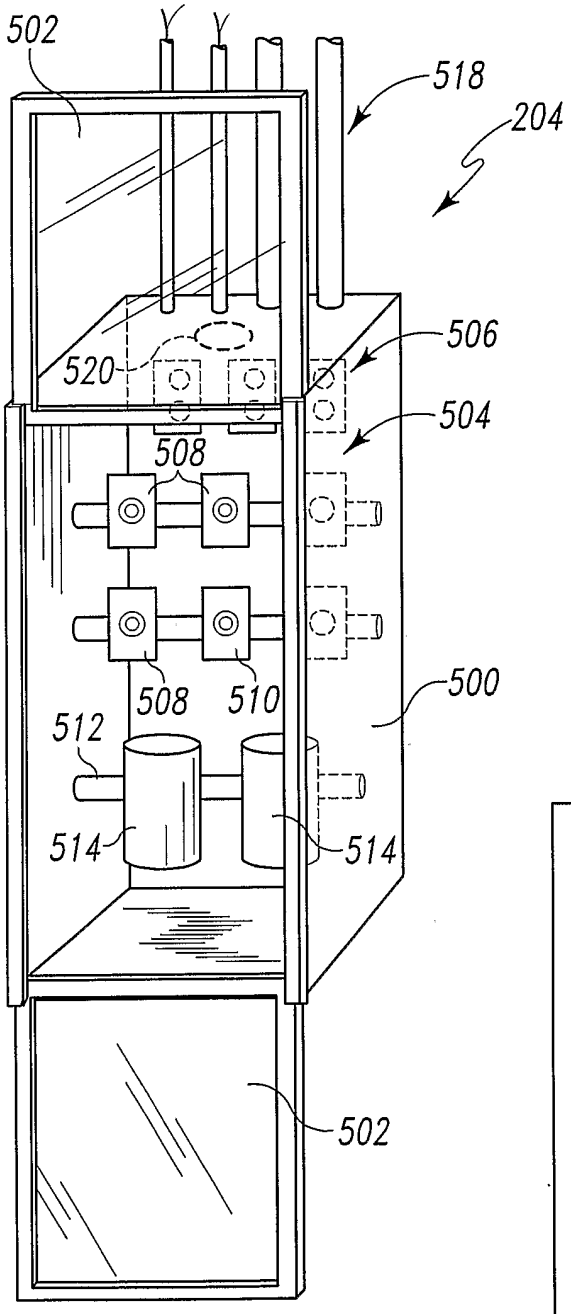
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Fig. 5

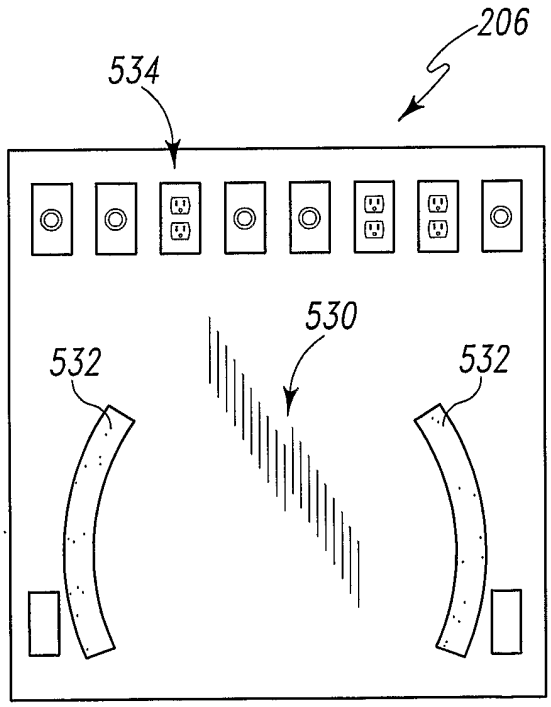
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Fig. 6

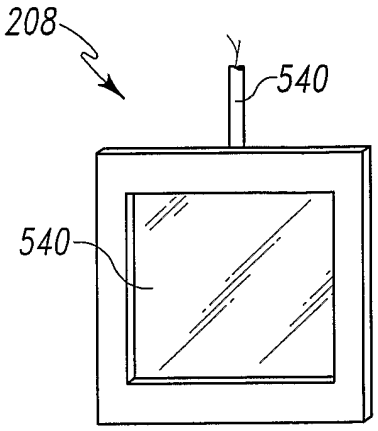


Fig. 7

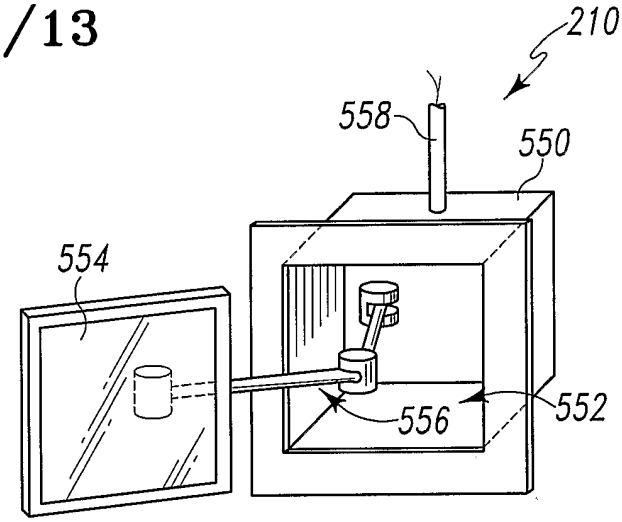


Fig. 8

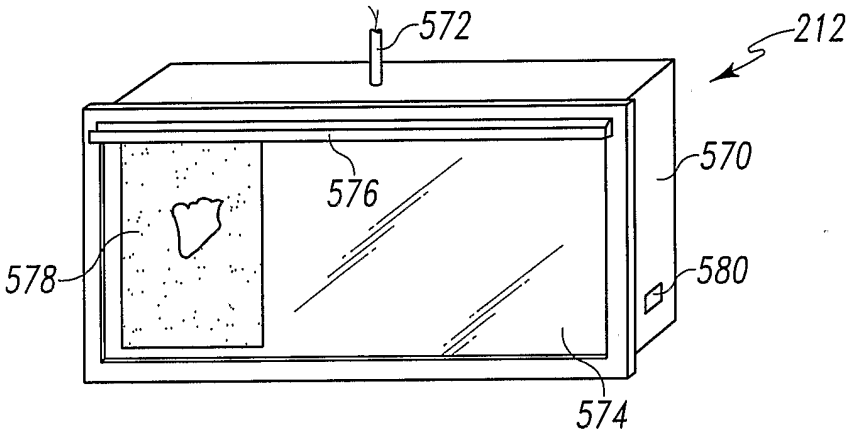


Fig. 9

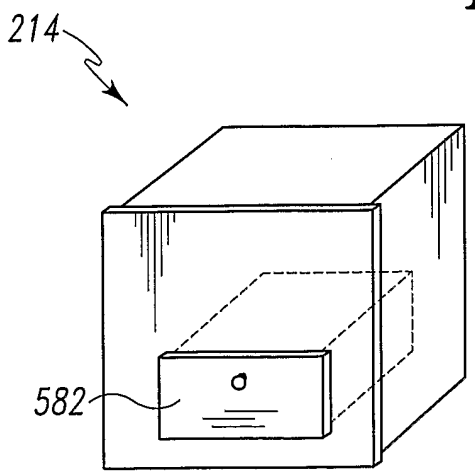


Fig. 10

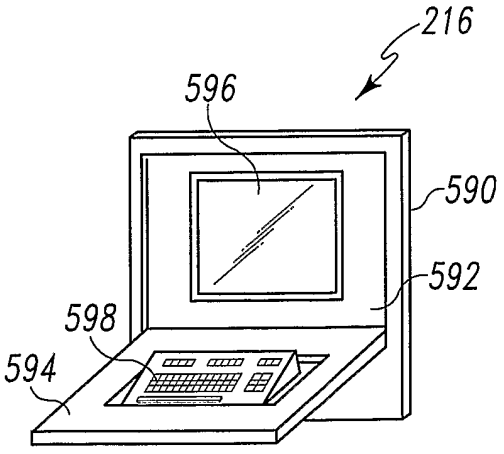


Fig. 11

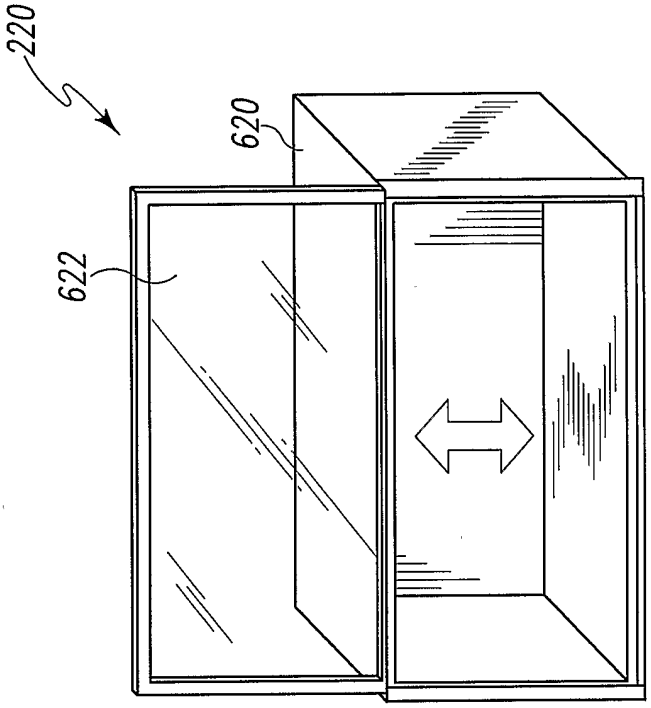
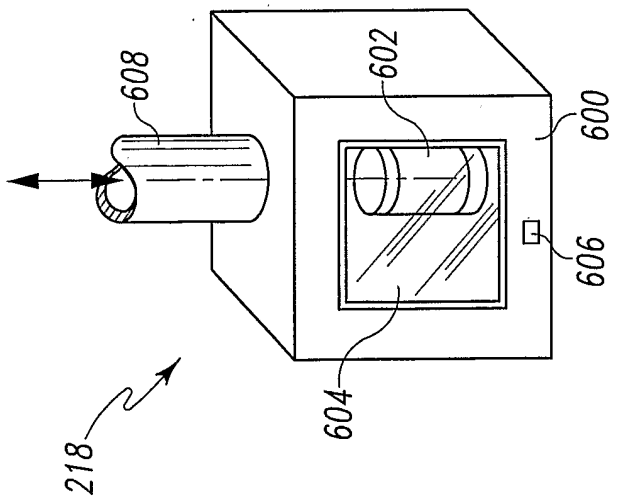


Fig. 13



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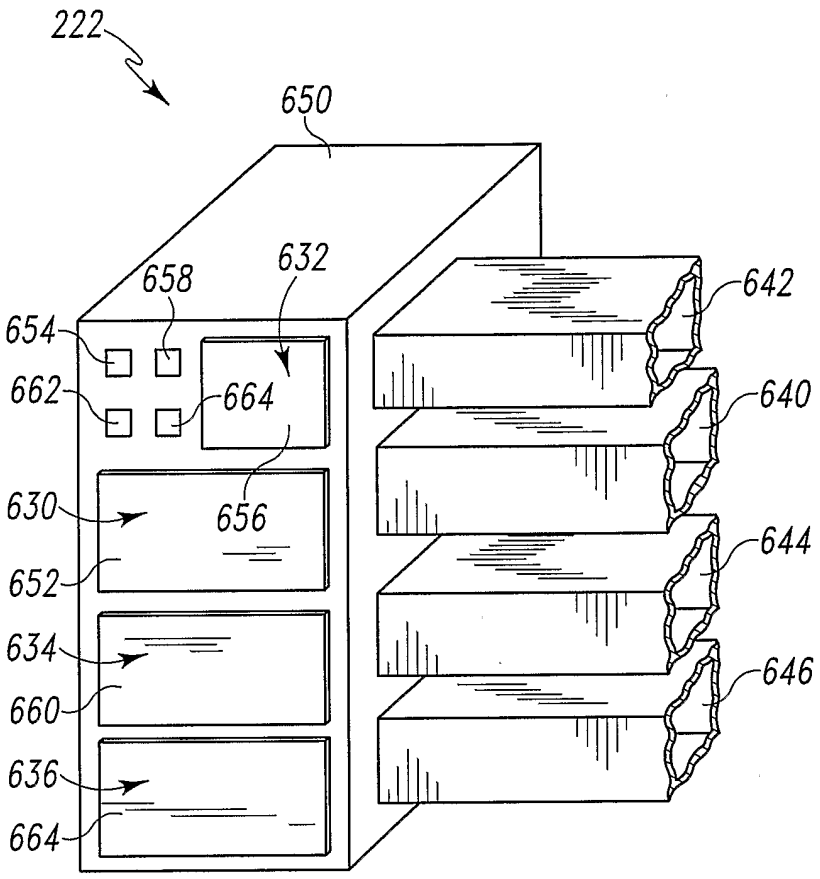
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Fig. 14

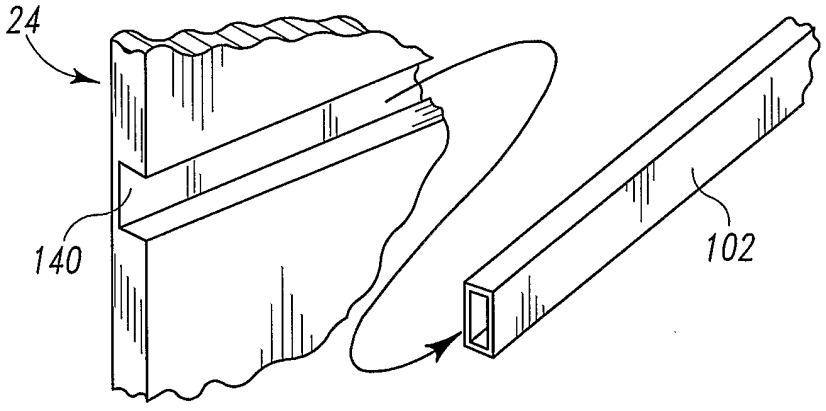
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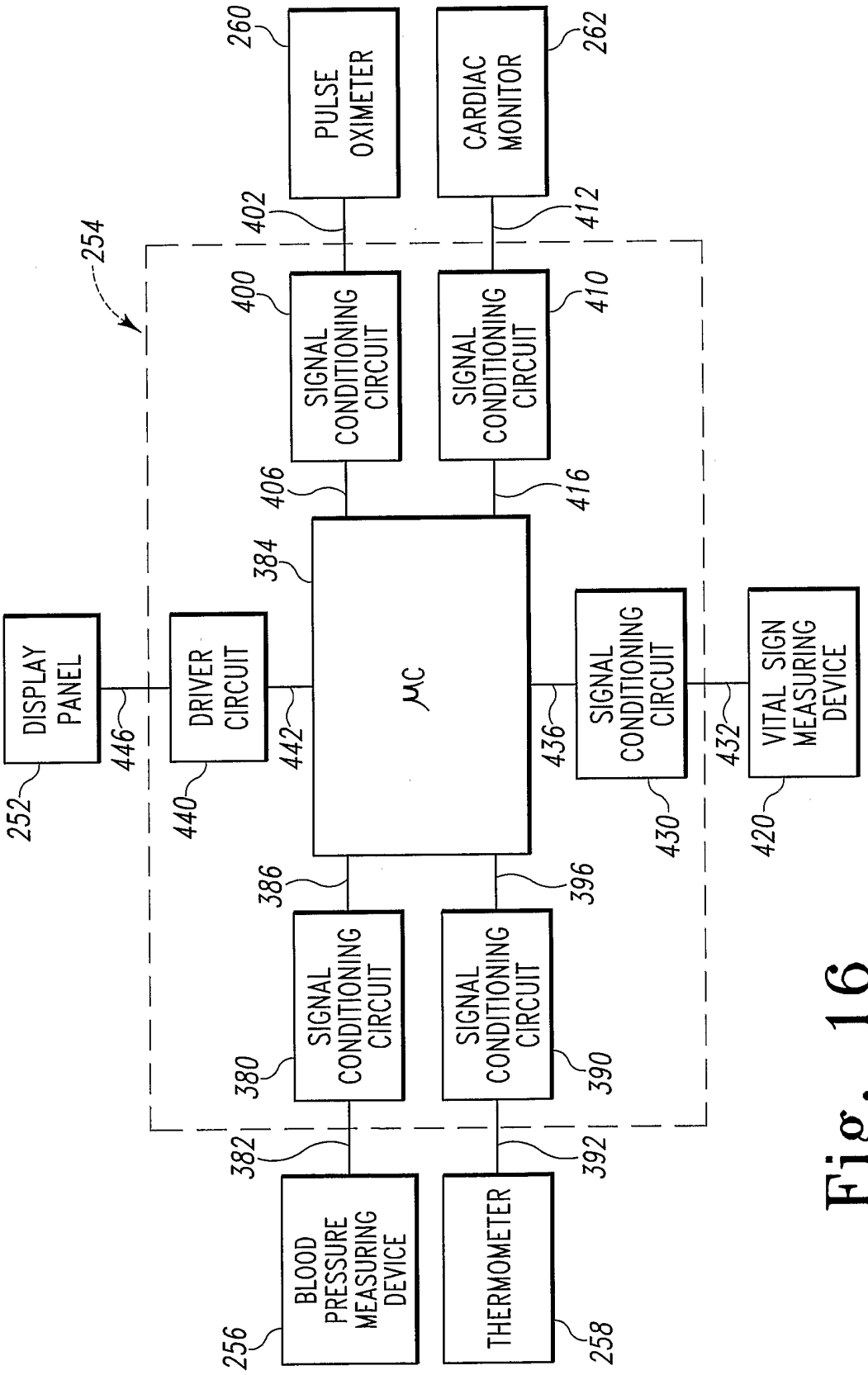
Fig. 15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PULSE OXIMETER
260
CARDIAC MONITOR
262
402
412
SIGNAL CONDITIONING CIRCUIT
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SIGNAL CONDITIONING CIRCUIT
410
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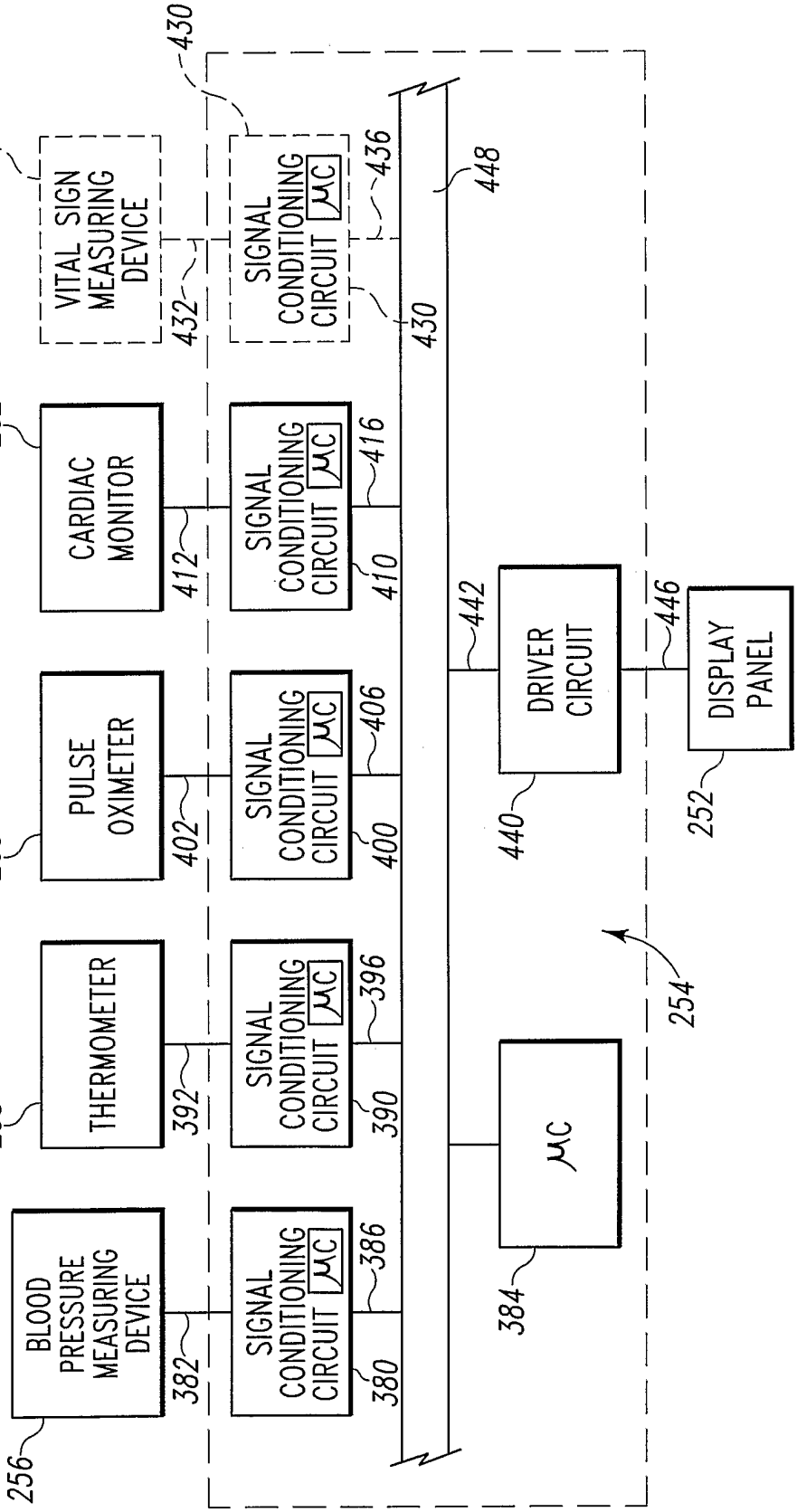
416
384
μC
DISPLAY PANEL
252
446
DRIVER CIRCUIT
440
442
436
SIGNAL CONDITIONING CIRCUIT
430
432
VITAL SIGN MEASURING DEVICE
420
386
396
SIGNAL CONDITIONING CIRCUIT
380
SIGNAL CONDITIONING CIRCUIT
390
382
392
BLOOD PRESSURE MEASURING DEVICE
256
THERMOMETER
258

Fig. 16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THERMOMETER
SIGNAL CONDITIONING CIRCUIT μC
BLOOD PRESSURE MEASURING DEVICE
SIGNAL CONDITIONING CIRCUIT μC
μC
DRIVER CIRCUIT
DISPLAY PANEL
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Fig. 17

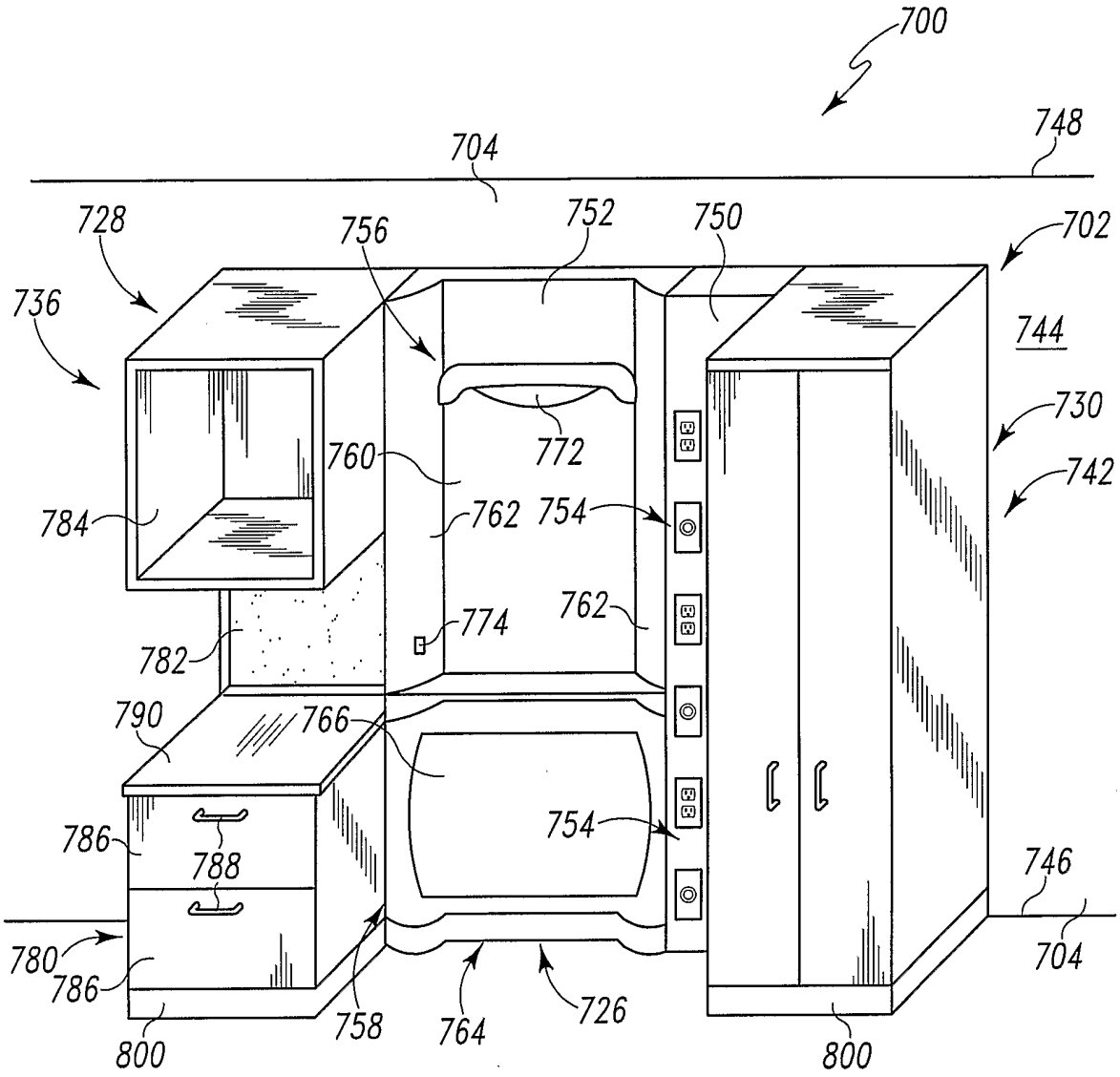
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Fig. 18

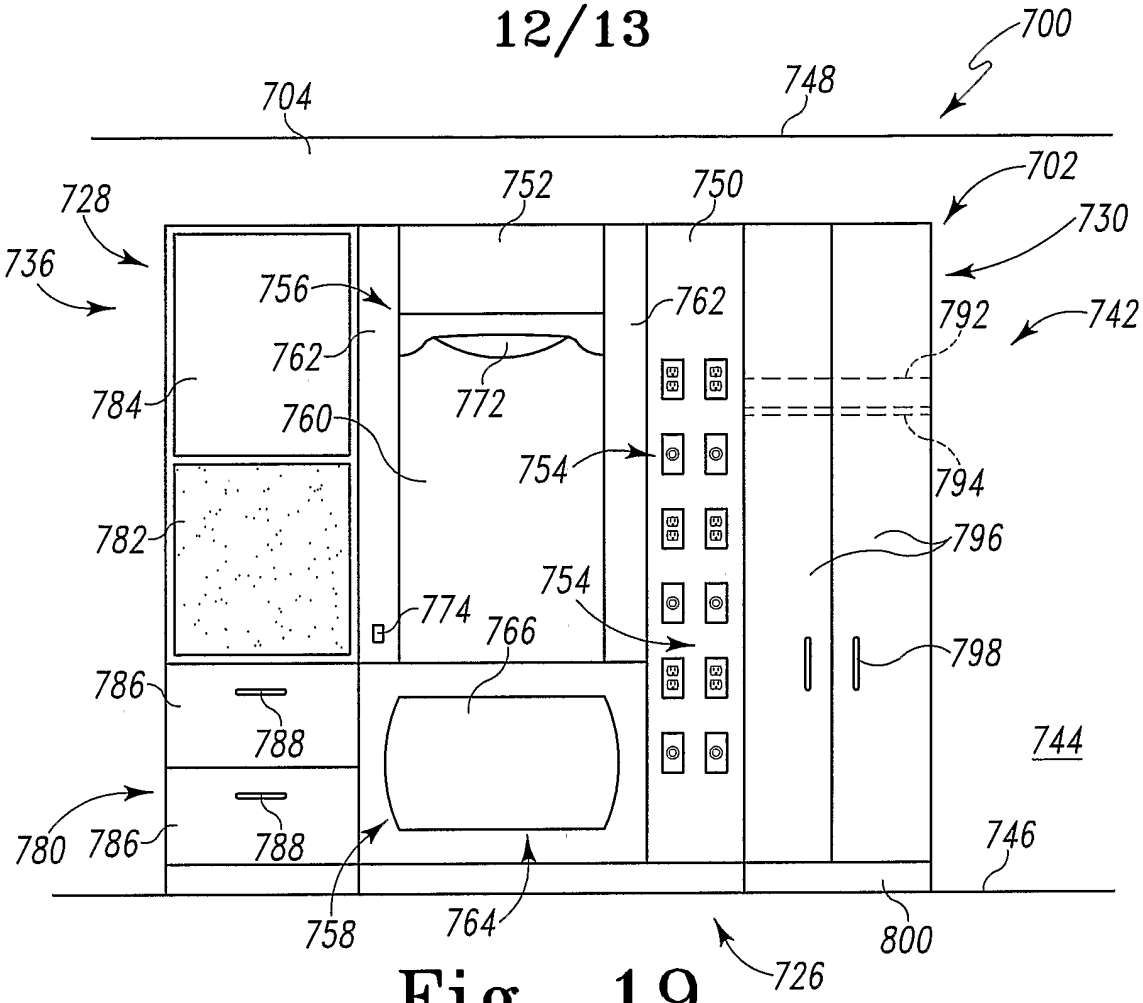
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Fig. 19

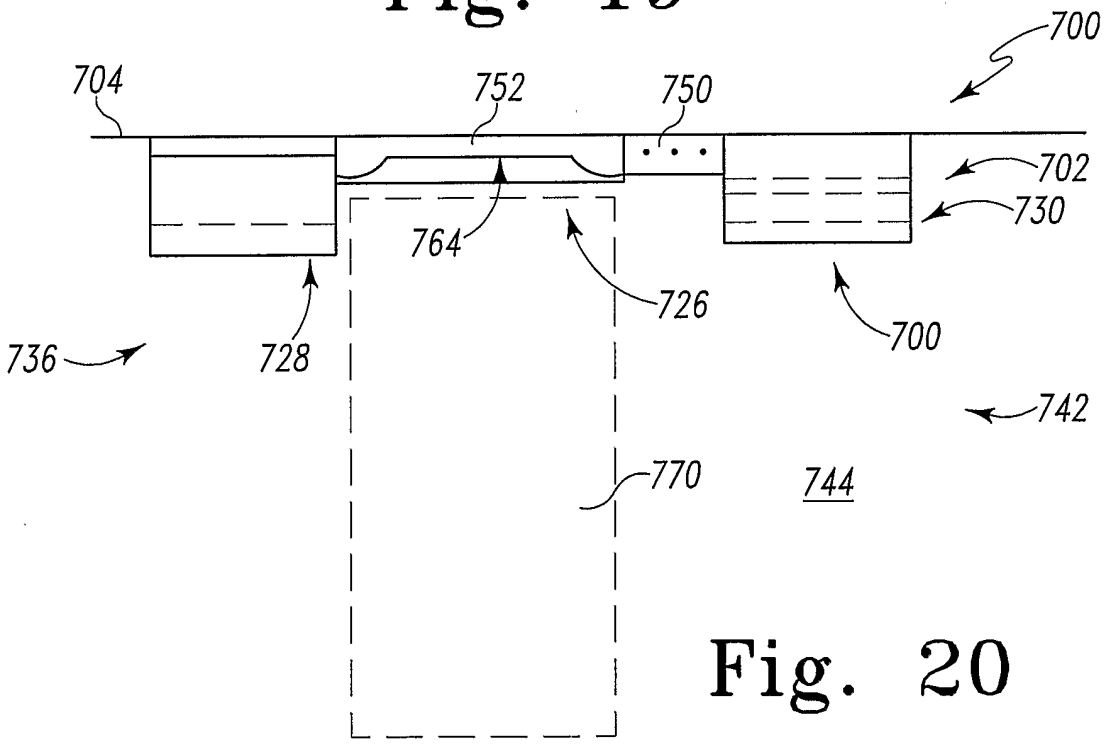
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Fig. 20

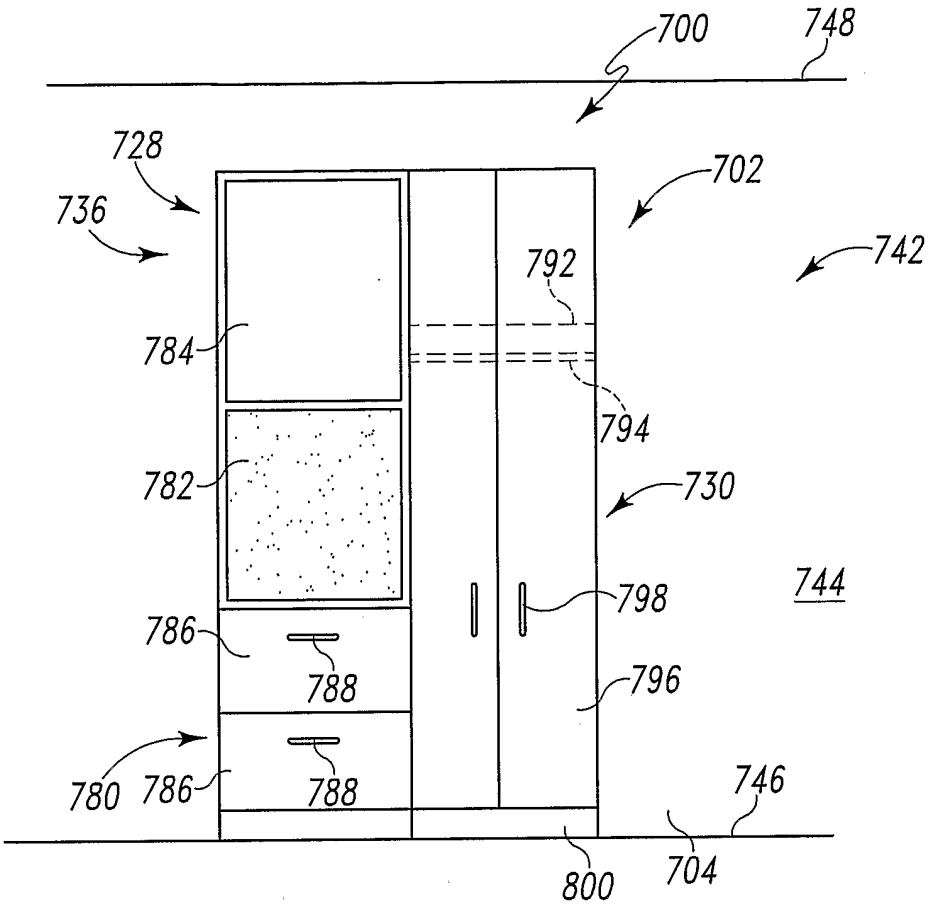
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Fig. 21

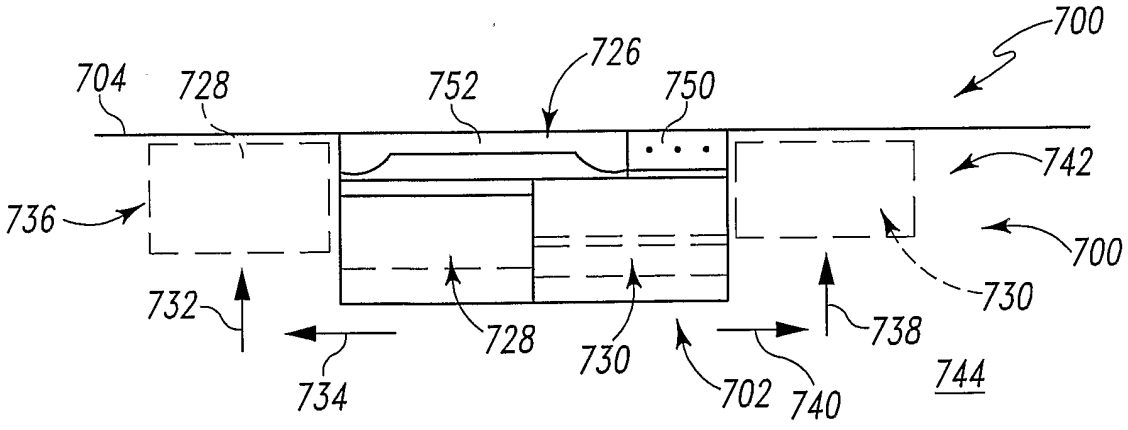
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Fig. 22