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(54) **FINGER CUFF**

(71) Applicant: **Edwards Lifesciences Corporation**, Irvine, CA (US)

(72) Inventors: **Peiyuan Li**, Amsterdam (NL); **Jeroen Van Goudoever**, Amstelveen (NL)

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A61B 5/00	(2006.01)

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

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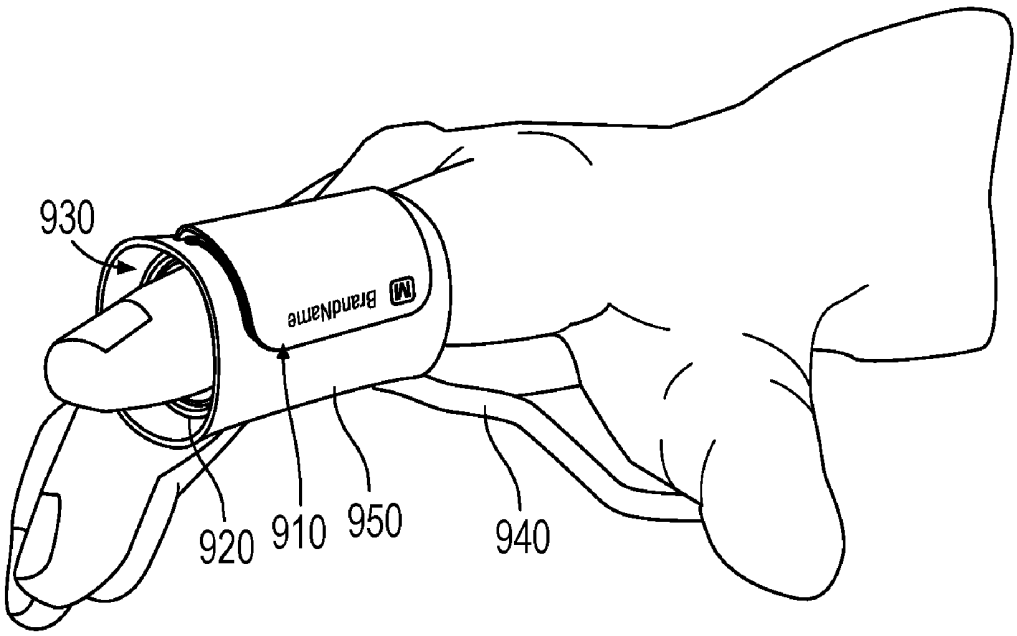
(57) **ABSTRACT**

Disclosed is a finger cuff that is attachable to a patient's finger to be used in measuring the patient's blood pressure. The finger cuff includes a first side and a second side. The first side is removably attached to the second side to wrap the finger cuff around the patient's finger. The finger cuff further includes a signal source and signal detector pair and a bladder. The bladder includes a pair of openings and is mountable within the finger cuff such that the pair of openings surround the signal source and signal detector pair, respectively. The patient's finger surrounded in the finger cuff abuts against the bladder such that the bladder and the signal source and signal detector pair are used in measuring the patient's blood pressure. Further, the bladder and signal source and signal detector pair are coupled to a cable through a connector assembly. The cable provides pneumatic pressure to the bladder and receives electrical signals from the signal source and signal detector pair.



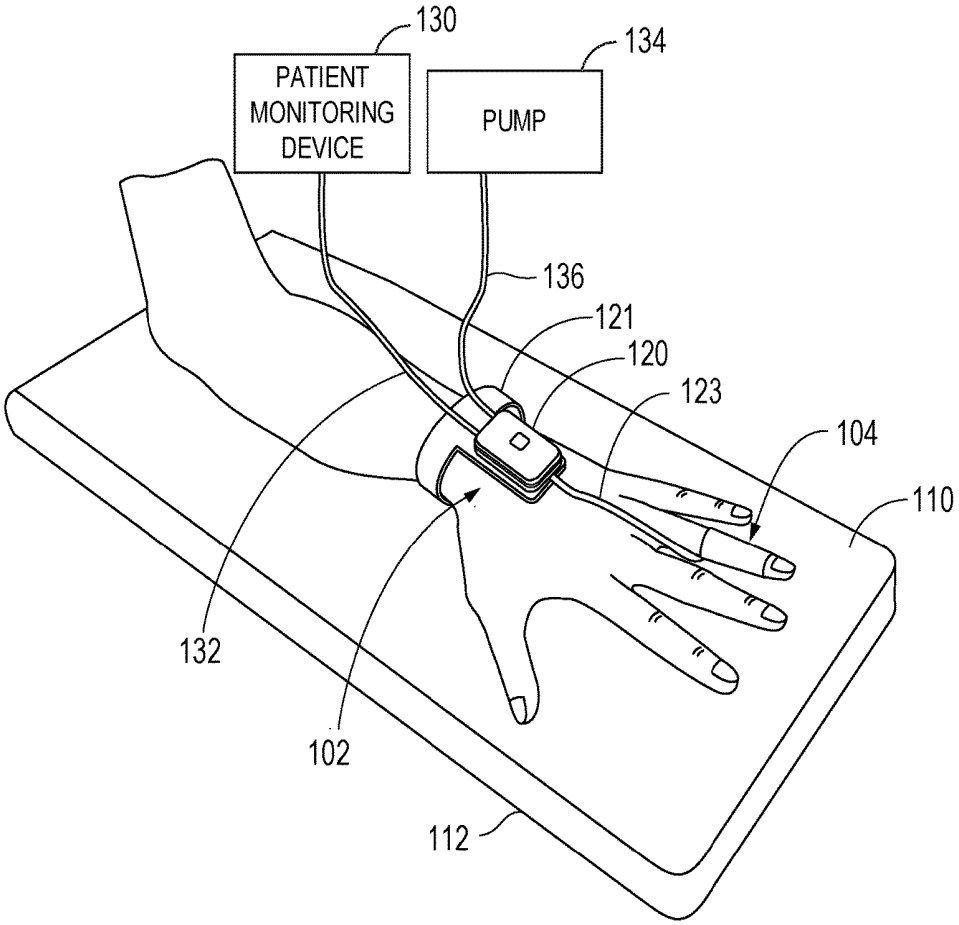

130
PATIENT MONITORING DEVICE
134
PUMP
136
121
120
123
104
110
132
102
112

FIG. 1

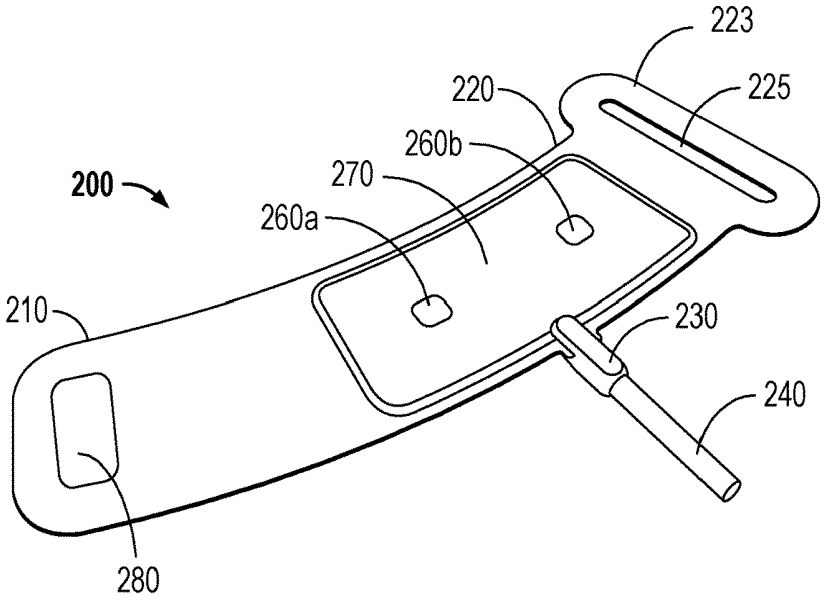


FIG. 2A

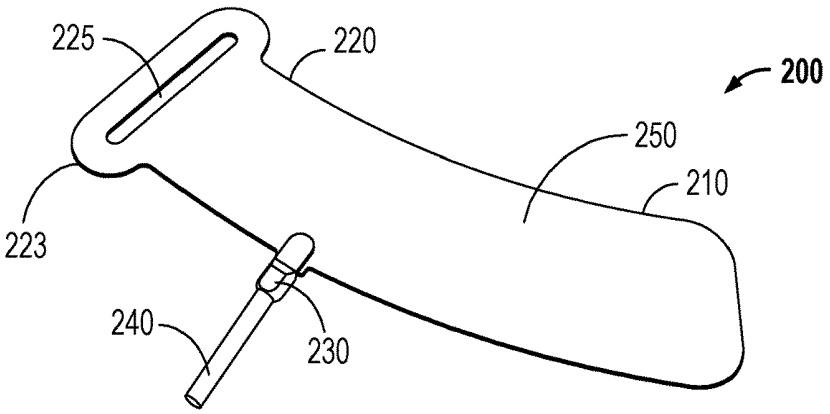


FIG. 2B

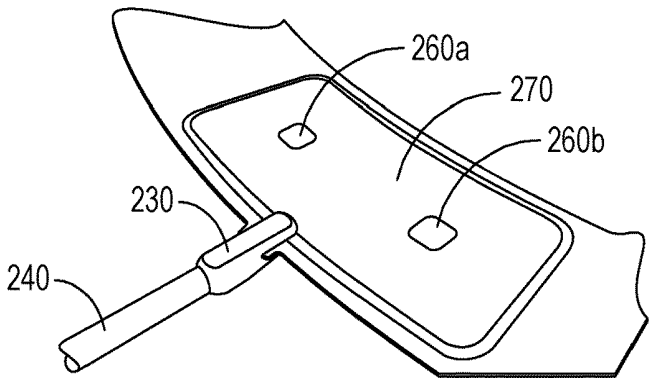
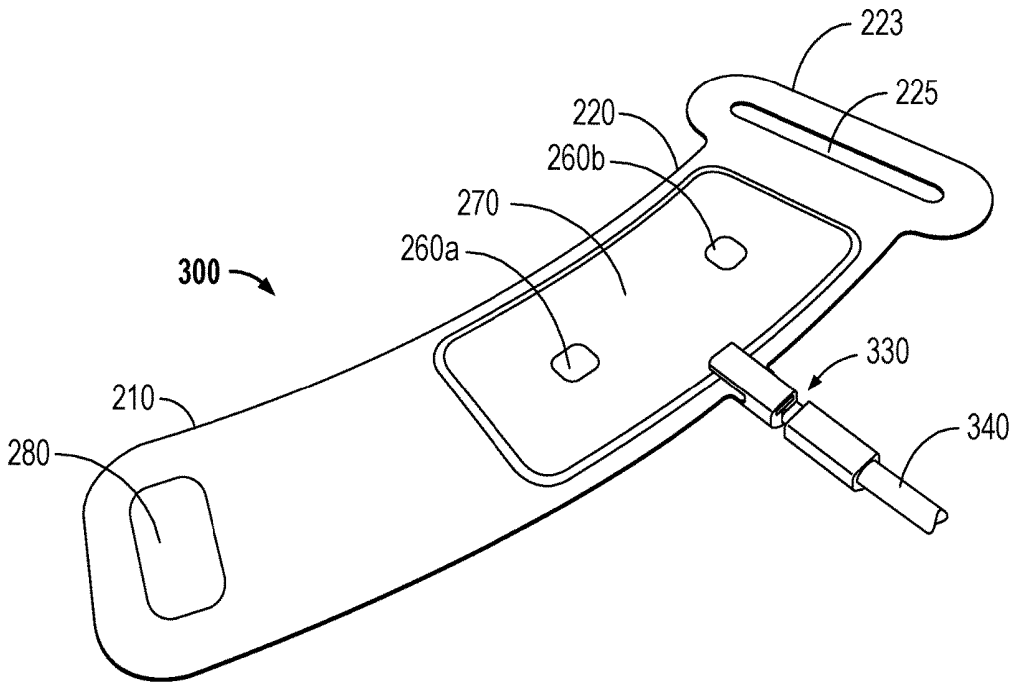


FIG. 2C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260b
270
260a
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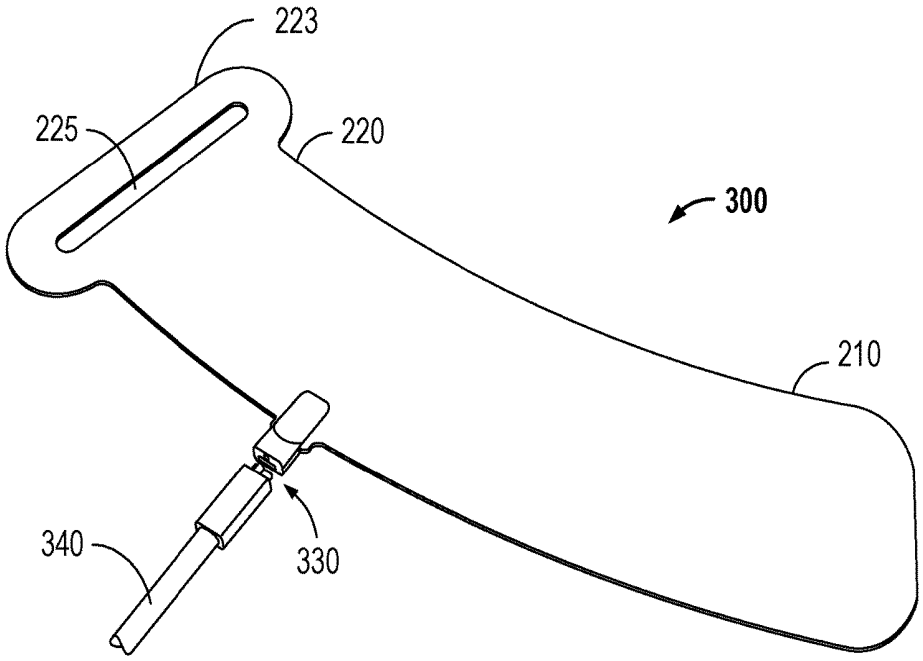
330
210
340
280

FIG. 3A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225
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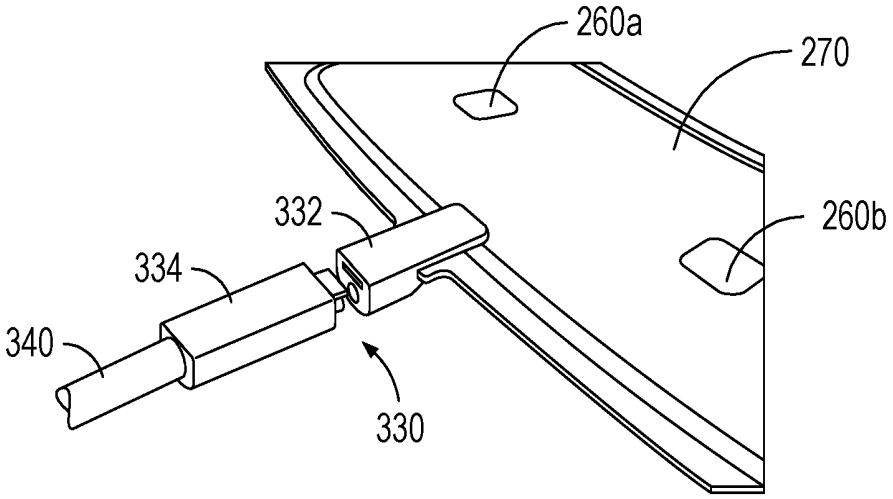
340
330

FIG. 3B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260b
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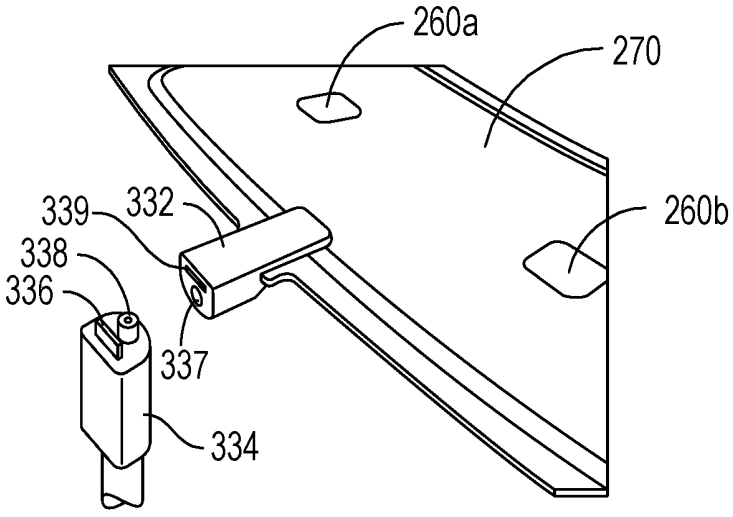
FIG. 3C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260b
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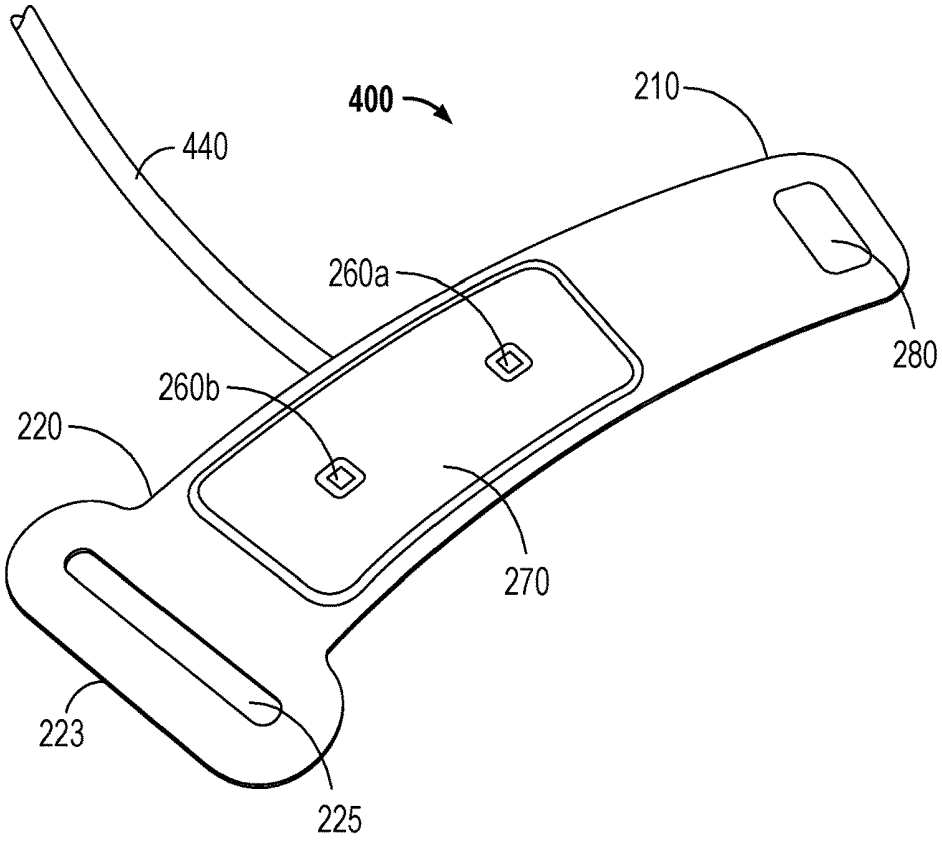
334

FIG. 3D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260b
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225

FIG. 4A

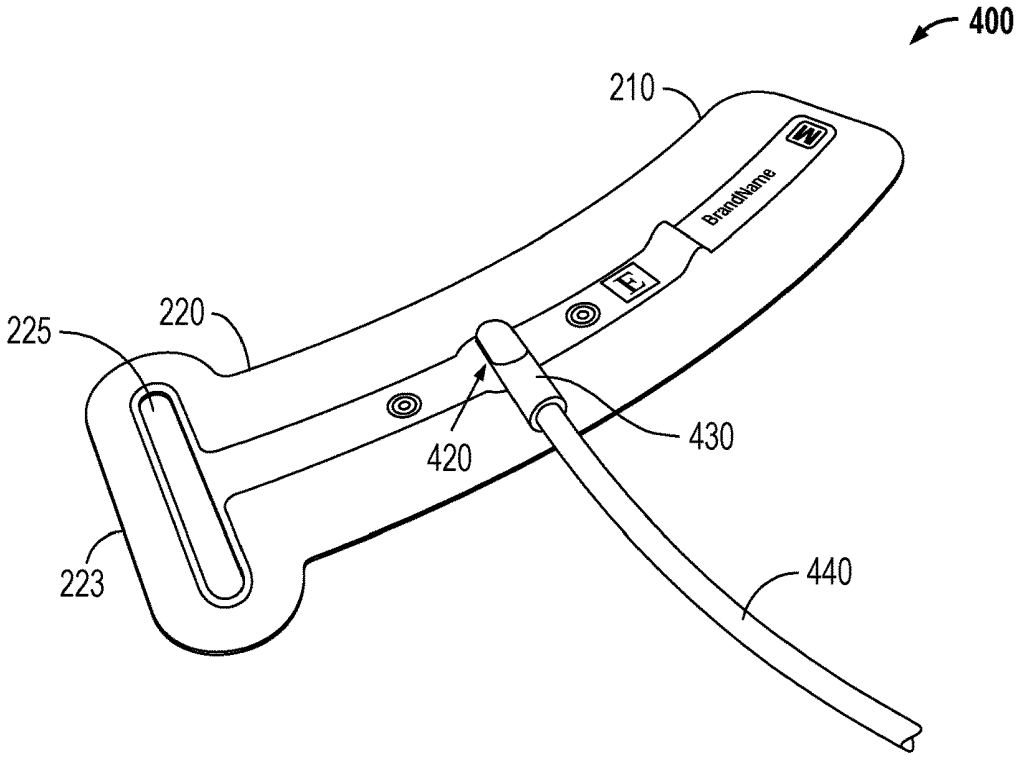
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FIG. 4B

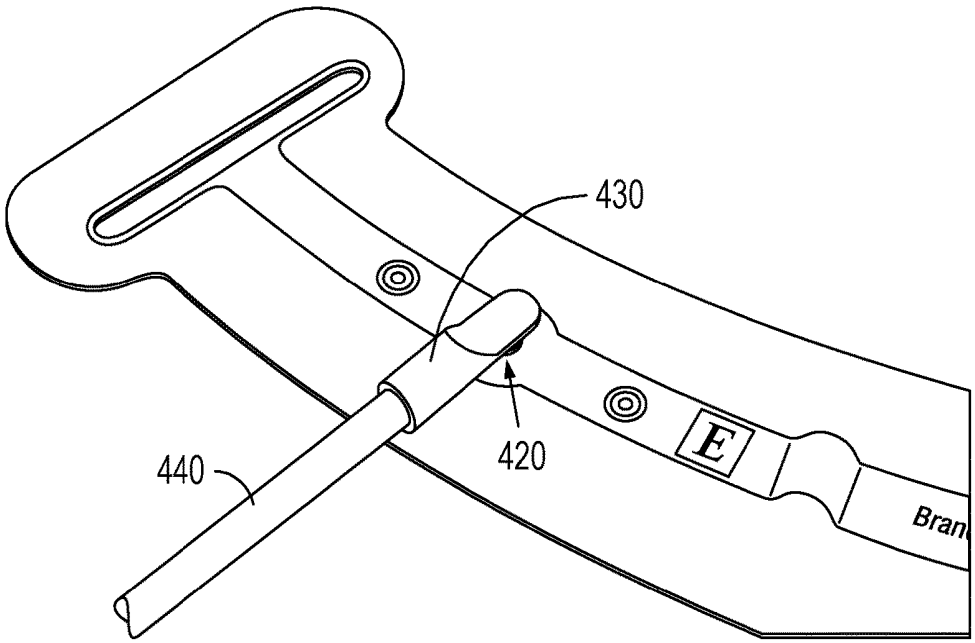


FIG. 4C

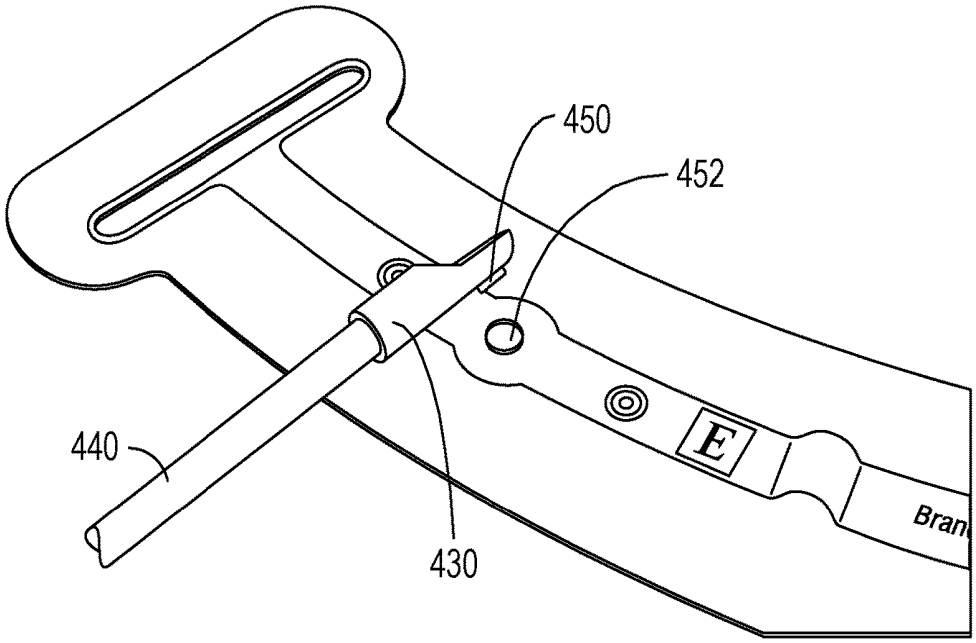
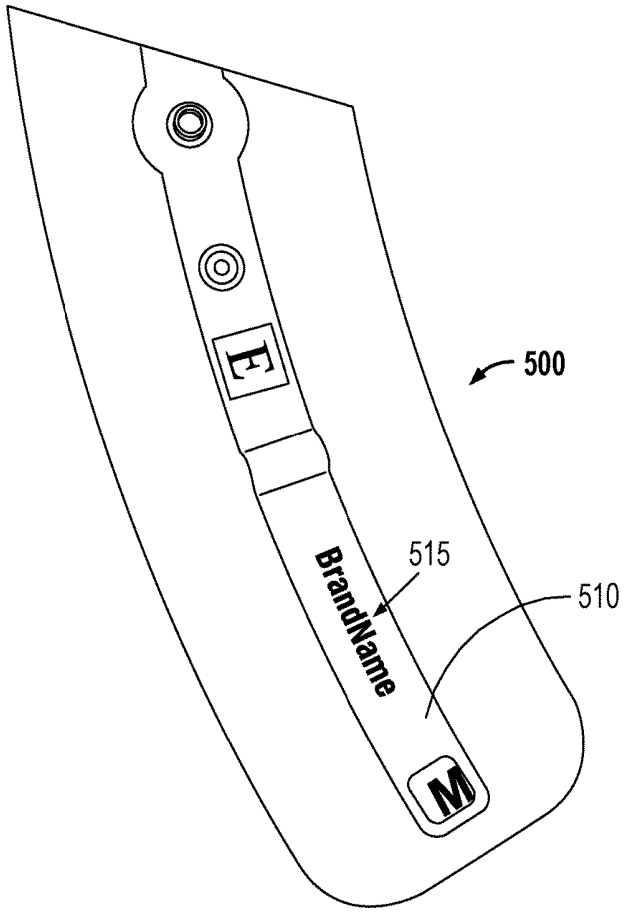


FIG. 4D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E
BrandName
515
510
M

FIG. 5A

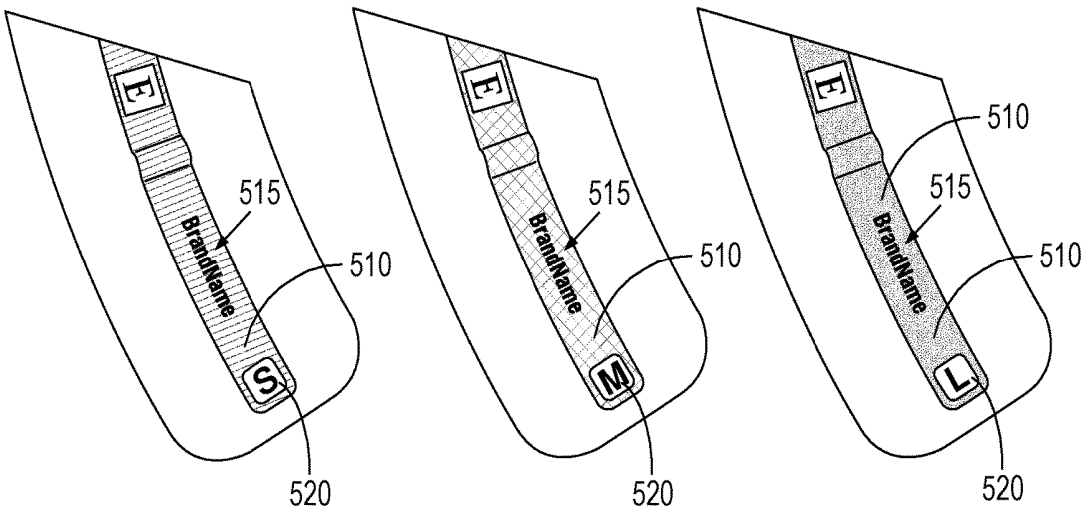
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FIG. 5B

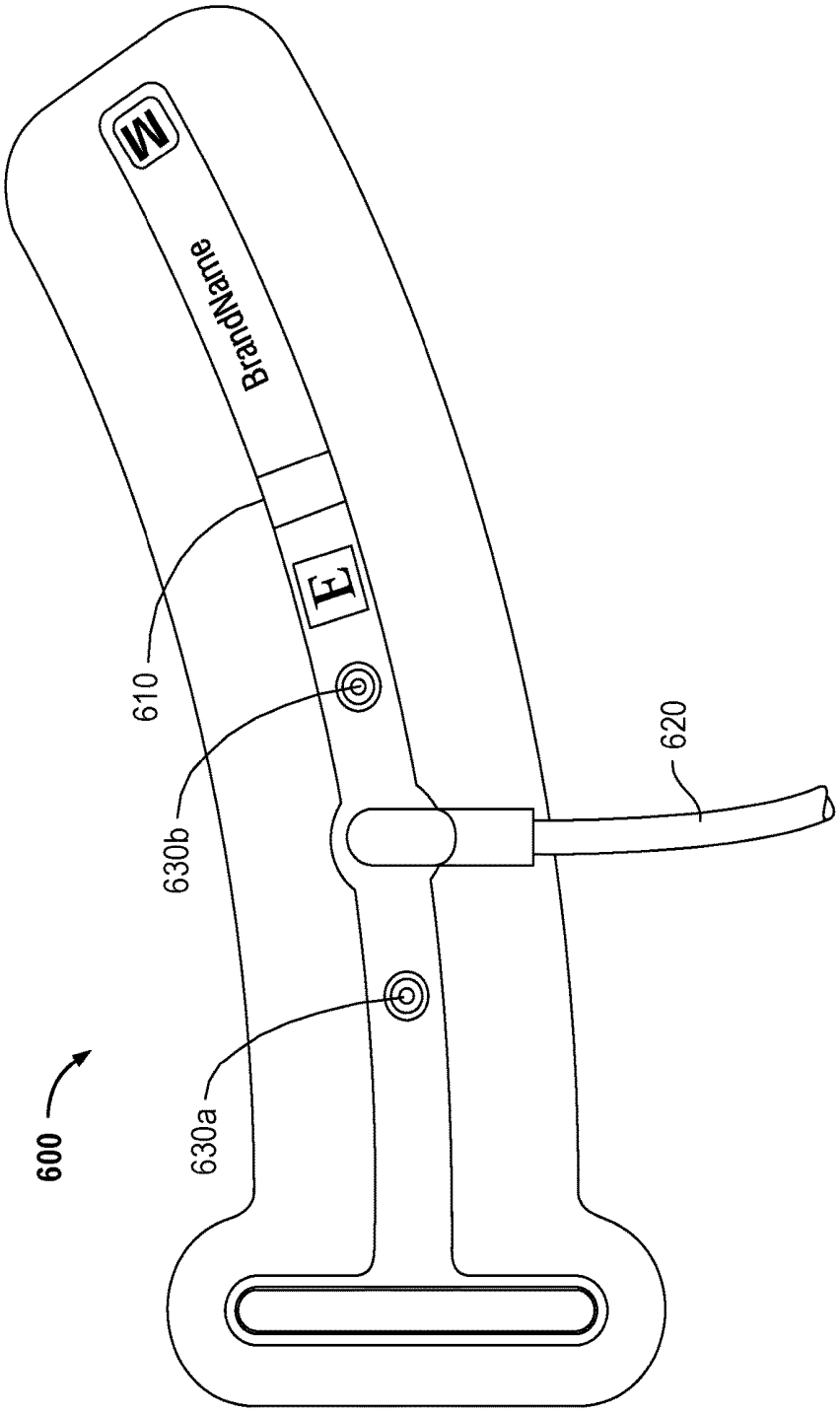

FIG. 6

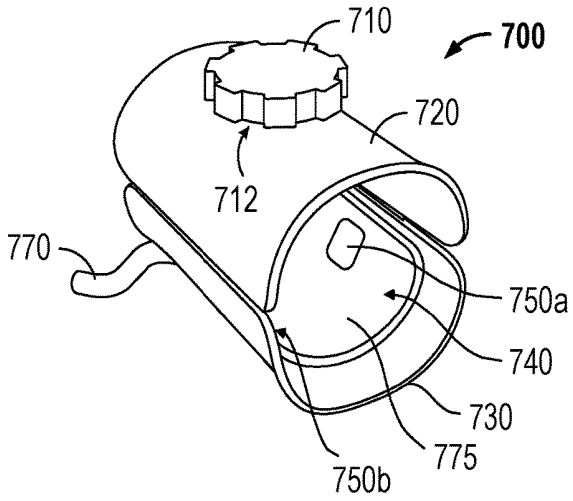

FIG. 7A

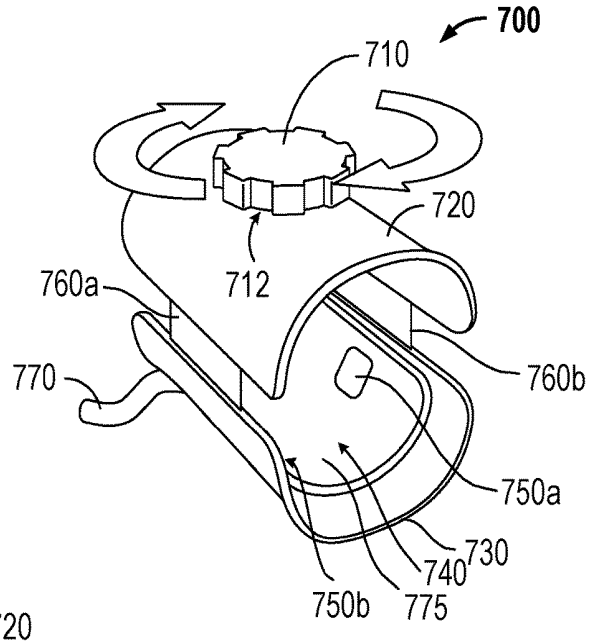

FIG. 7B

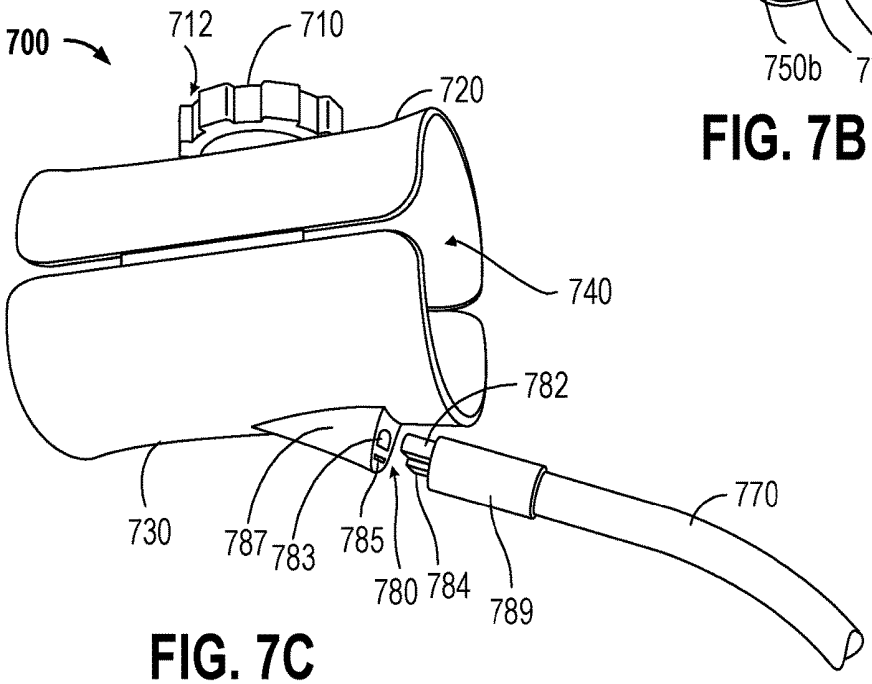

FIG. 7C

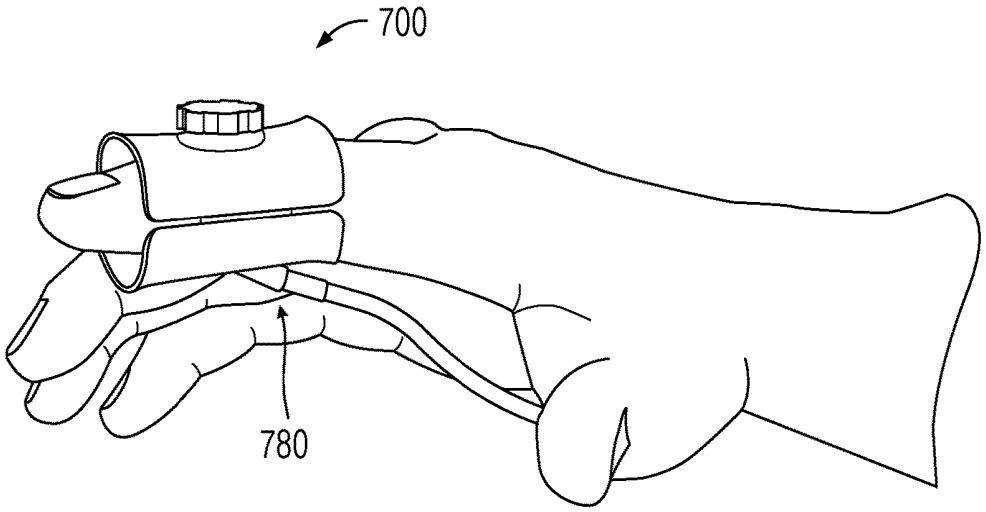

FIG. 7D

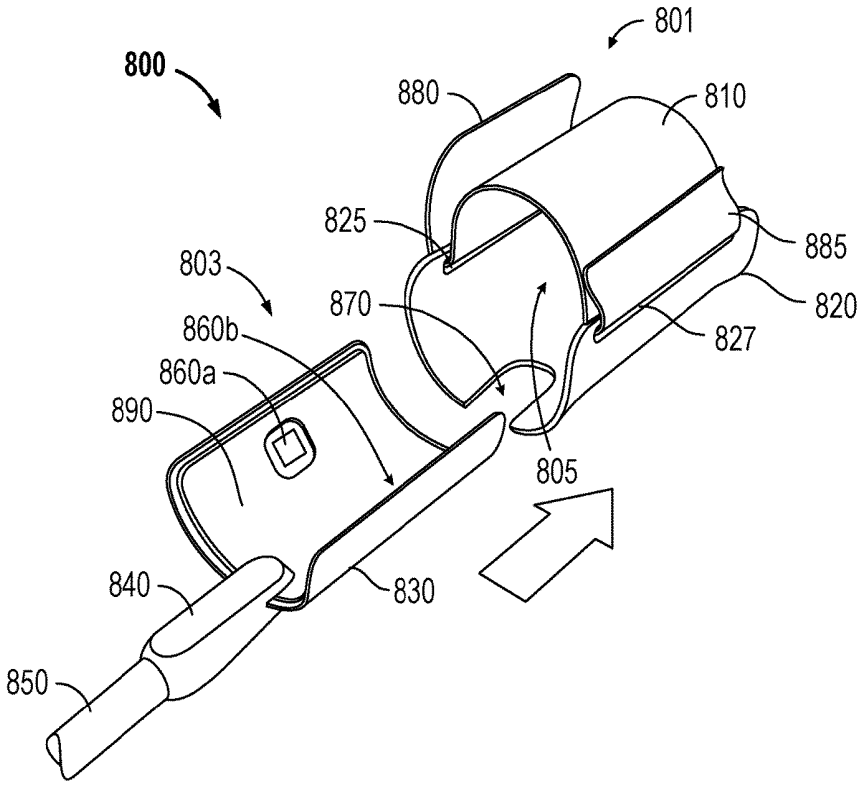
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FIG. 8A

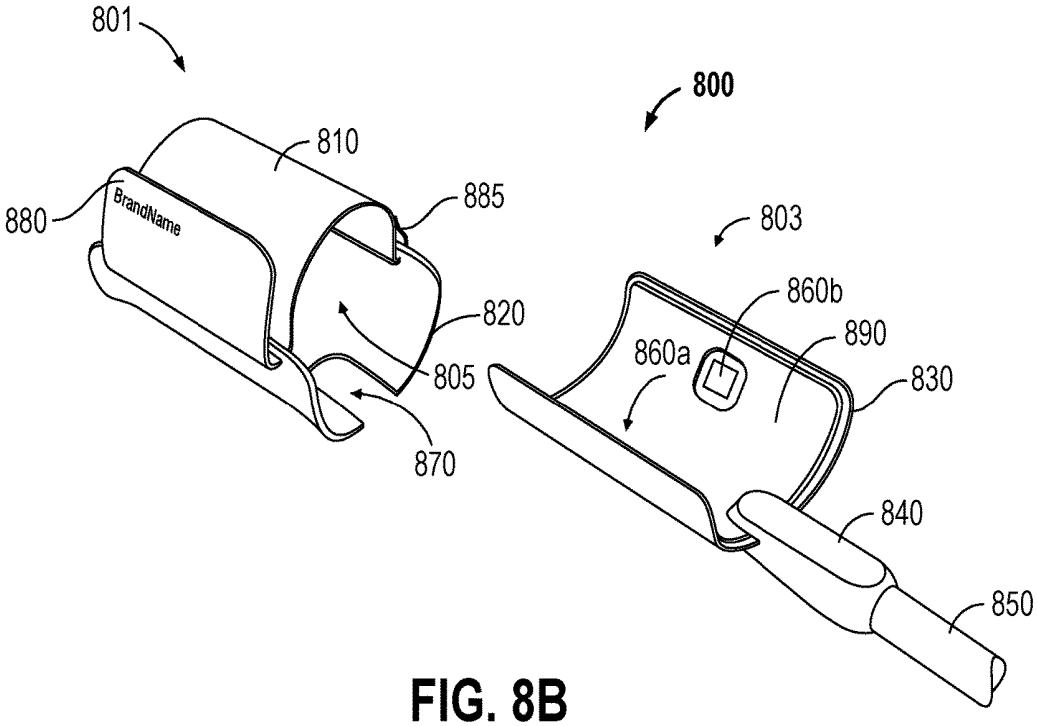
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FIG. 8B

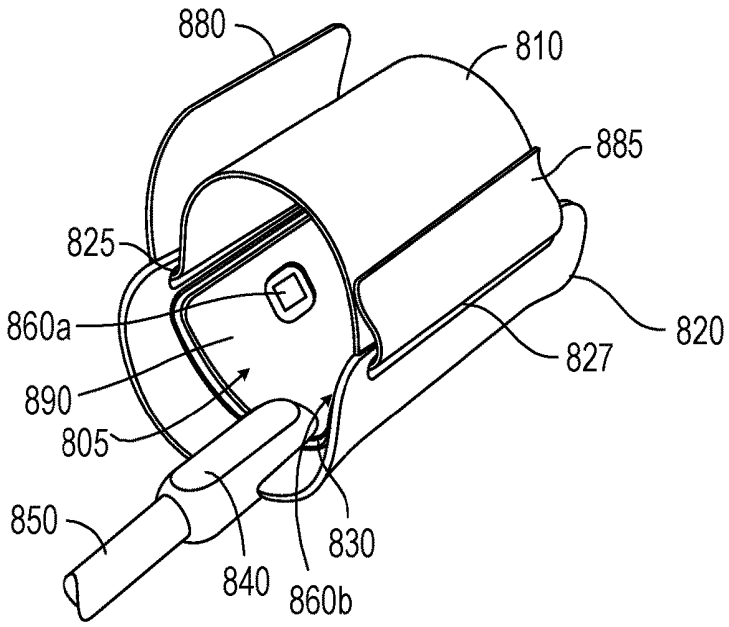
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FIG. 8C

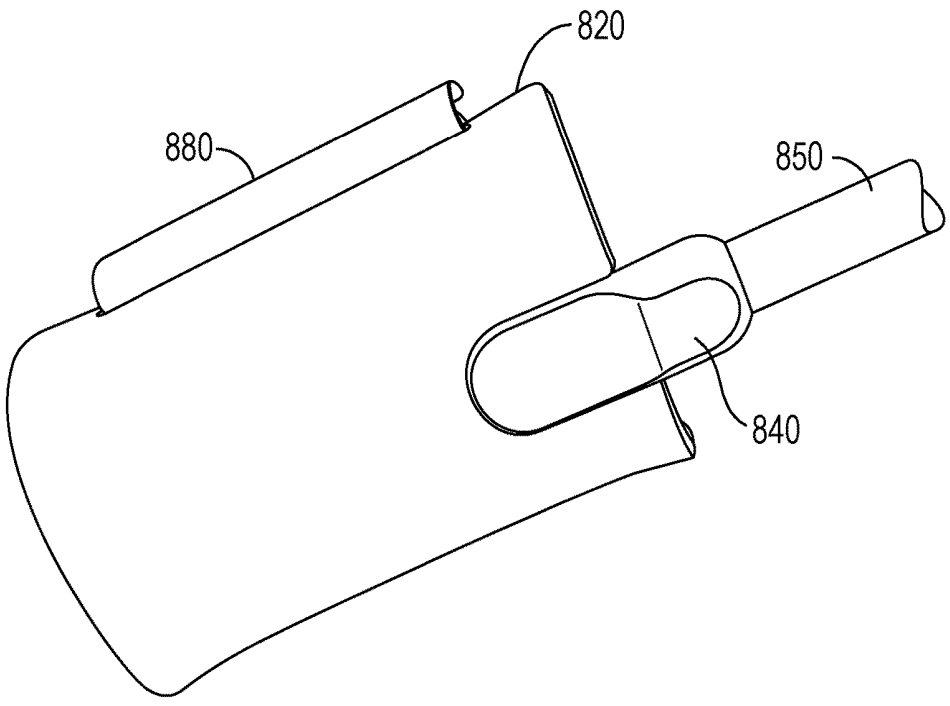
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FIG. 8D

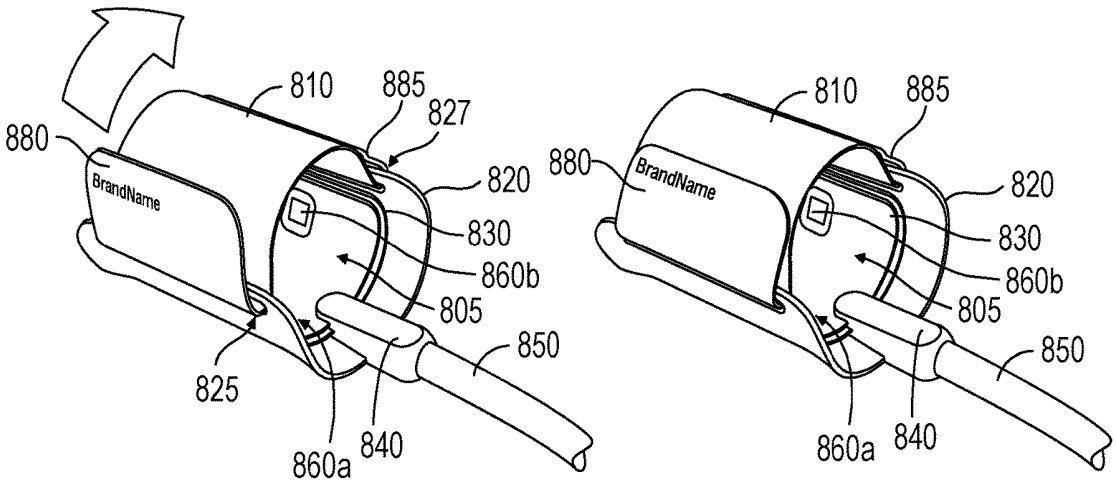
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FIG. 8E

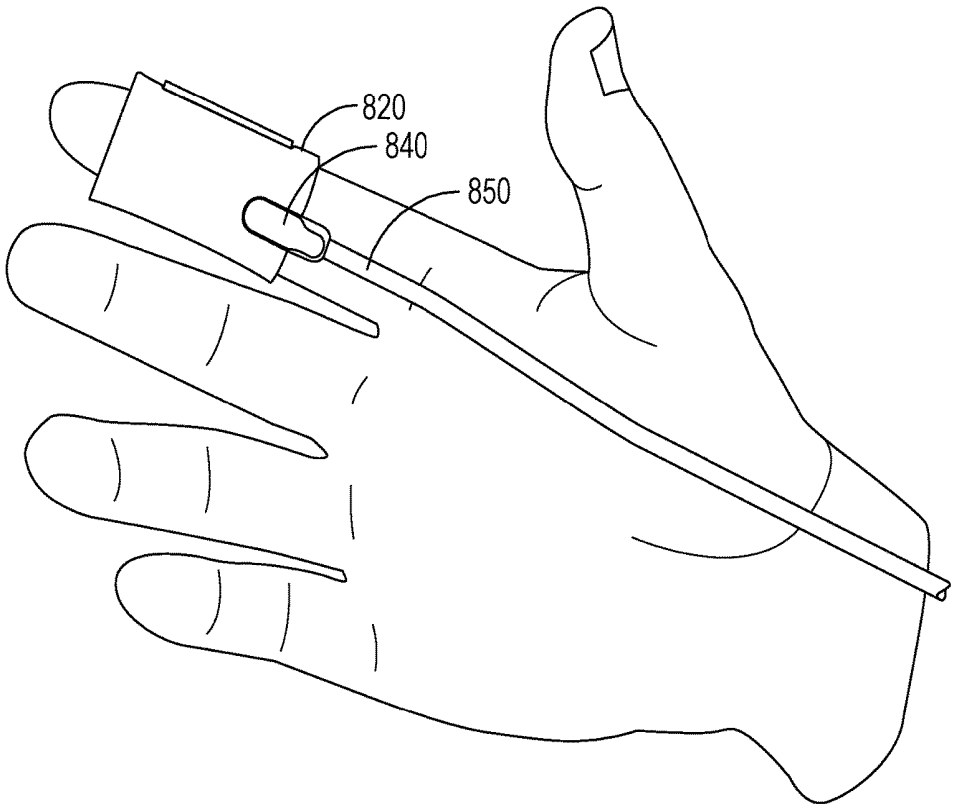
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FIG. 8F

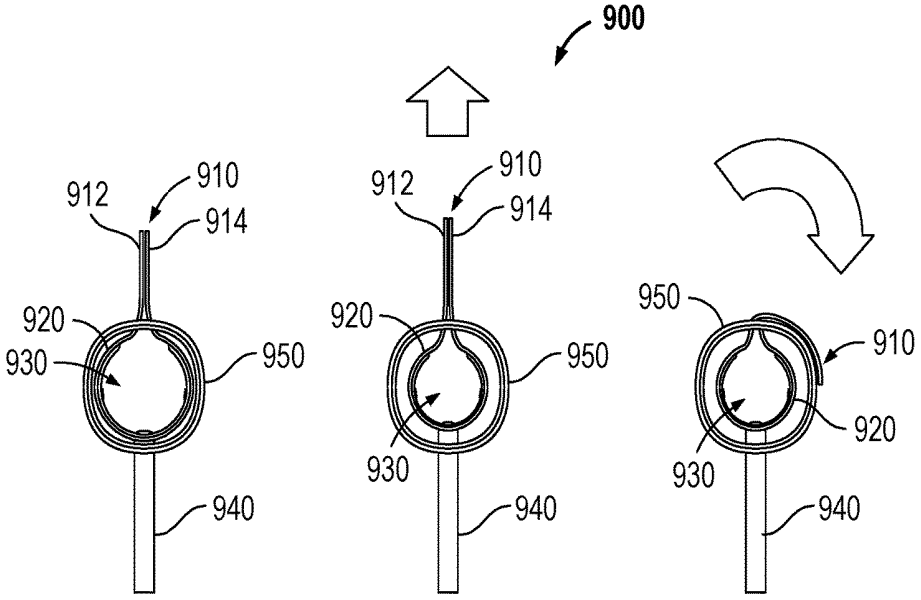
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FIG. 9A

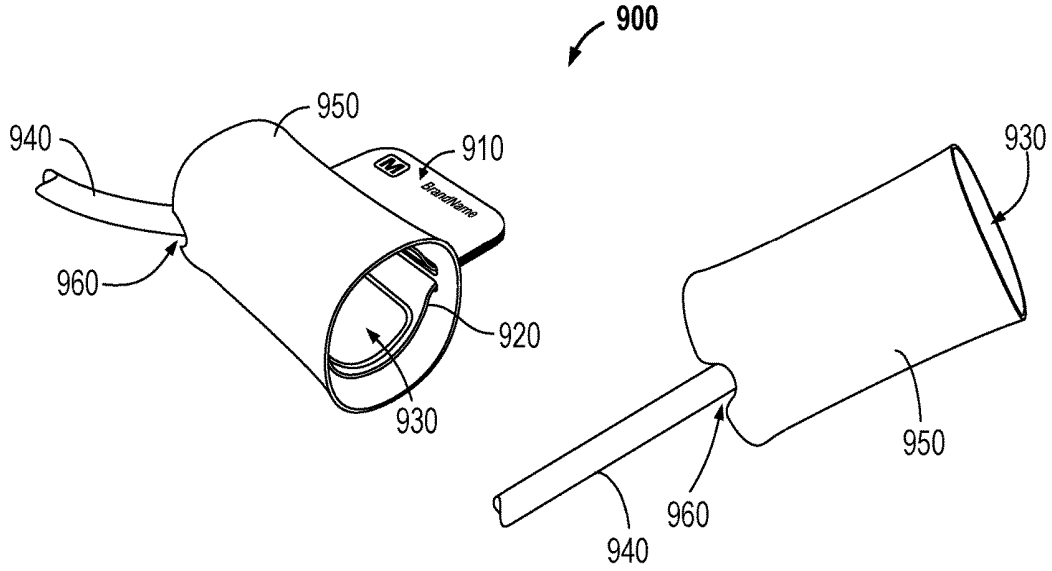
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FIG. 9B

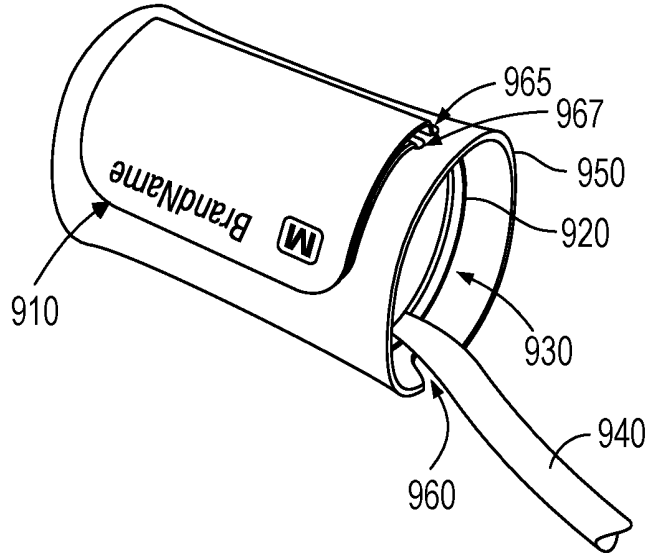
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FIG. 9C

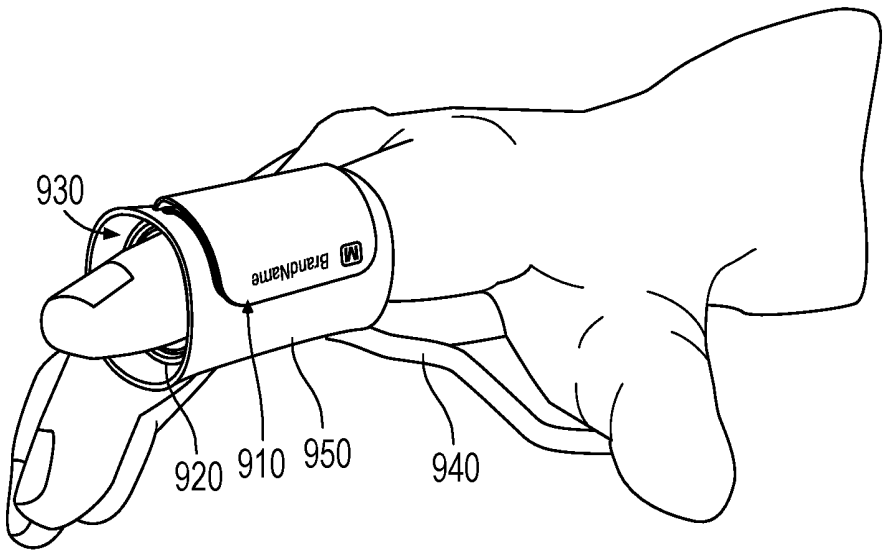
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FIG. 9D

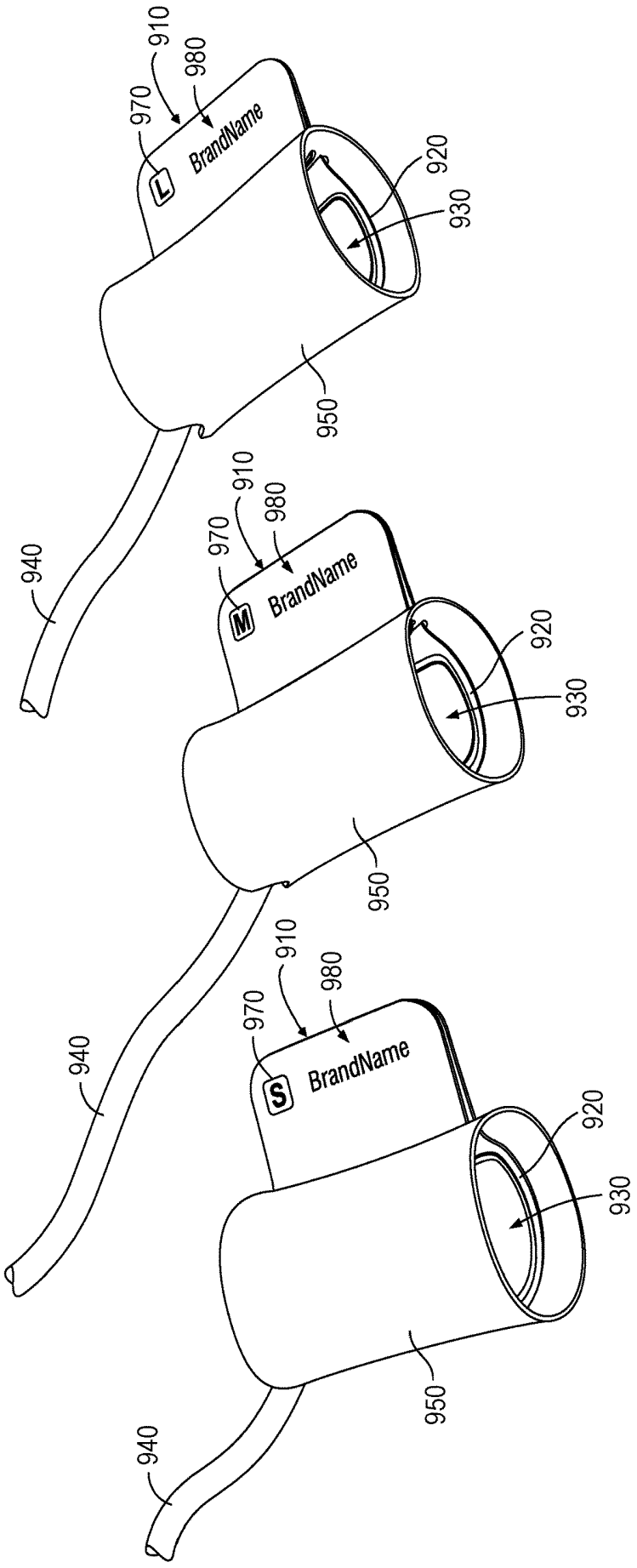
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FIG. 9E

FINGER CUFF

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 62/539,317, filed Jul. 31, 2017, which is incorporated herein by reference.

BACKGROUND

Field

[0002] Embodiments of the invention relate generally to finger cuffs.

Relevant Background

[0003] Volume clamping is a technique for non-invasively measuring blood pressure in which pressure is applied to a patient's finger in such a manner that arterial pressure may be balanced by a time varying pressure to maintain a constant arterial volume. In a properly fitted and calibrated system, the applied time varying pressure is equal to the arterial blood pressure in the finger. The applied time varying pressure may be measured to provide a reading of the patient's arterial blood pressure.

[0004] This may be accomplished by a finger cuff that is arranged around a finger of a patient. The finger cuff may include an infrared light source, an infrared sensor, and an inflatable bladder. The infrared light may be sent through the finger in which a finger artery is present. The infrared sensor picks up the infrared light and the amount of infrared light registered by the sensor may be inversely proportional to the artery diameter and indicative of the pressure in the artery.

[0005] In the finger cuff implementation, by inflating the bladder in the finger cuff, a pressure is exerted on the finger artery. If the pressure is high enough, it will compress the artery and the amount of light registered by the sensor will increase. The amount of pressure necessary in the inflatable bladder to compress the artery is dependent on the blood pressure. By controlling the pressure of the inflatable bladder such that the diameter of the finger artery is kept constant, the blood pressure may be monitored in very precise detail as the pressure in the inflatable bladder is directly linked to the blood pressure. In a typical present day finger cuff implementation, a volume clamp system is used with the finger cuff. The volume clamp system typically includes a pressure generating system and a regulating system that includes: a pump, a valve, and a pressure sensor in a closed loop feedback system that are used in the measurement of the arterial volume. To accurately measure blood pressure, the feedback loop provides sufficient pressure generating and releasing capabilities to match the pressure oscillations of the patient's blood pressure.

[0006] For a proper functioning of the volume clamp based blood pressure measurement, the design and application of the finger sensor are critical. The bladder inside the sensor should be small enough not to influence the quick pressure changes that are needed for optimal control of the arterial volume, and the bladder should be large enough to properly transfer the cuff pressure to the underlying artery. Due to the use of a photo-plethysmograph, the cuff orientation is also important to warrant that the arterial diameter changes under the cuff are effectively measured. Compared to the presently used wrap-around and ring type of sensors, the embodiments disclosed here focus on easy and robust application, which are less sensitive to cuff application errors and motion.

SUMMARY

[0007] Embodiments of the invention may relate to a finger cuff that is attachable to a patient's finger to be used in measuring the patient's blood pressure by a blood pressure measurement system. The finger cuff includes a first side and a second side. The first side is removably attached to the second side to wrap the finger cuff around the patient's finger. The finger cuff further includes a signal source and signal detector pair and a bladder. The bladder includes a pair of openings and is mountable within the finger cuff such that the pair of openings surround the signal source and signal detector pair, respectively. The patient's finger surrounded in the finger cuff abuts against the bladder such that the bladder and the signal source and signal detector pair are used in measuring the patient's blood pressure by the blood pressure measurement system. Further, the bladder and signal source and signal detector pair are coupled to a cable through a connector assembly. The cable provides pneumatic pressure to the bladder and receives electrical signals from the signal source and signal detector pair.

[0008] In one embodiment, a finger cuff may be connectable to a patient's finger to be used in measuring the patient's blood pressure by a blood pressure measurement system, in which the finger cuff comprises: a top shell portion and a bottom shell portion forming a finger cavity of the finger cuff to be placed around the patient's finger, the bottom shell portion including a signal source and signal detector pair and a bladder. The bladder may include a pair of openings, in which the bladder is mountable within the bottom shell portion such that the pair of openings surround the signal source and signal detector pair, respectively, wherein the patient's finger received and surrounded in the finger cavity abuts against the bladder such that the bladder and the signal source and signal detector pair are used in measuring the patient's blood pressure by the blood pressure measurement system.

[0009] In one embodiment, a finger cuff is connectable to a patient's finger to be used in measuring the patient's blood pressure by a blood pressure measurement system. The finger cuff may comprise: a shell having a first slot and a second slot on first and second opposing ends of the shell, the shell forming a finger cavity to be placed around the patient's finger; a flexible material having a first side and a second side, wherein the first side and the second side are respectively inserted through the first slot and the second slot; and a bladder assembly insertable into the shell. The bladder assembly may comprise a shell portion having a signal source and signal detector pair and a bladder including a pair of openings. The bladder may be mountable within the shell portion such that the pair of openings surround the signal source and signal detector pair, respectively, wherein the patient's finger received and surrounded in the finger cavity abuts against the bladder such that the bladder and the signal source and signal detector pair are used in measuring the patient's blood pressure by the blood pressure measurement system.

[0010] In one embodiment, a finger cuff is connectable to a patient's finger to be used in measuring the patient's blood

pressure by a blood pressure measurement system. The finger cuff may comprise: a fixed shell including a first slot and a second slot; and

[0011] a wrapping portion within the fixed shell. The wrapping portion may include: a first side and a second side respectively inserted through the first slot and the second slot forming a finger cavity of the wrapping portion to be placed around the patient's finger; a signal source and signal detector pair; and a bladder including a pair of openings. The bladder is mountable within the wrapping portion such that the pair of openings surround the signal source and signal detector pair, respectively, wherein, the patient's finger surrounded in the finger cavity abuts against the bladder such that the bladder and the signal source and signal detector pair are used in measuring the patient's blood pressure by the blood pressure measurement system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** is a diagram of an example of a blood pressure measurement system according to one embodiment.

[0013] FIGS. **2**A-**2**C are views of a finger cuff according to embodiments of the invention.

[0014] FIGS. **3**A-**3**D are views of a finger cuff and a connector assembly according to embodiments of the invention.

[0015] FIGS. **4**A-**4**D are views of a finger and a snap connector assembly according to embodiments of the invention.

[0016] FIGS. **5**A-**5**B illustrate a label of a finger cuff according to embodiments of the invention.

[0017] FIG. **6** illustrates several features associated with a finger cuff according to embodiments of the invention.

[0018] FIGS. **7**A-**7**D are views of a shell finger cuff with a rotatable knob according to embodiments of the invention.

[0019] FIGS. **8**A-**8**F are views of a finger cuff with a bladder assembly according to embodiments of the invention.

[0020] FIGS. **9**A-**9**E are views of a finger cuff with a pull member according to embodiments of the invention.

DETAILED DESCRIPTION

[0021] With reference to FIG. **1**, which illustrates an example of a blood pressure measurement system according to one embodiment, a blood pressure measurement system **102** that includes a finger cuff **104** that may be attached to a patient's finger and a blood pressure measurement controller **120**, which may be attached to the patient's body (e.g., a patient's wrist or hand) is shown. The blood pressure measurement system **102** may further be connected to a patient monitoring device **130**, and, in some embodiments, a pump **134**. Further, finger cuff **104** may include a bladder (not shown) and an LED-PD pair (not shown), which are conventional for finger cuffs.

[0022] In one embodiment, the blood pressure measurement system **102** may include a pressure measurement controller **120** that includes: a small internal pump, a small internal valve, a pressure sensor, and control circuity. In this embodiment, the control circuitry may be configured to: control the pneumatic pressure applied by the internal pump to the bladder of the finger cuff **104** to replicate the patient's blood pressure based upon measuring the pleth signal received from the LED-PD pair of the finger cuff **104**. Further, the control circuitry may be configured to: control the opening of the internal valve to release pneumatic pressure from the bladder; or the internal valve may simply be an orifice that is not controlled. Additionally, the control circuitry may be configured to: measure the patient's blood pressure by monitoring the pressure of the bladder based upon the input from a pressure senor, which should be the same as patient's blood pressure, and may display the patient's blood pressure on the patient monitoring device **130**.

[0023] In another embodiment, a conventional pressure generating and regulating system may be utilized, in which, a pump **134** is located remotely from the body of the patient. In this embodiment, the blood pressure measurement controller **120** receives pneumatic pressure from remote pump **134** through tube **136** and passes on the pneumatic pressure through tube **123** to the bladder of finger cuff **104**. Blood pressure measurement device controller **120** may also control the pneumatic pressure (e.g., utilizing a controllable valve) applied to the finger cuff **104** as well as other functions. In this example, the pneumatic pressure applied by the pump **134** to the bladder of finger cuff **104** to replicate the patient's blood pressure based upon measuring the pleth signal received from the LED-PD pair of the finger cuff **104** and measuring the patient's blood pressure by monitoring the pressure of the bladder may be controlled by the blood pressure measurement controller **120** and/or a remote computing device and/or the pump **134** and/or the patient monitoring device **130** to implement the volume clamping method. In some embodiments, a blood pressure measurement controller **120** is not used at all and there is simply a connection from tube **136** from a remote pump **134** including a remote pressure regulatory system to finger cuff **104**, and all processing for the pressure generating and regulatory system, data processing, and display is performed by a remote computing device.

[0024] Continuing with this example, as shown in FIG. **1**, a patient's hand may be placed on the face **110** of an arm rest **112** for measuring a patient's blood pressure with the blood pressure measurement system **102**. The blood pressure measurement controller **120** of the blood pressure measurement system **102** may be coupled to a bladder of the finger cuff **104** in order to provide pneumatic pressure to the bladder for use in blood pressure measurement. Blood pressure measurement controller **120** may be coupled to the patient monitoring device **130** through a power/data cable **132**. Also, in one embodiment, as previously described, in a remote implementation, blood pressure measurement controller **120** may be coupled to a remote pump **134** through tube **136** to receive pneumatic pressure for the bladder of the finger cuff **104**. The patient monitoring device **130** may be any type of medical electronic device that may read, collect, process, display, etc., physiological readings/data of a patient including blood pressure, as well as any other suitable physiological patient readings. Accordingly, power/data cable **132** may transmit data to and from patient monitoring device **130** and also may provide power from the patient monitoring device **130** to the blood pressure measurement controller **120** and finger cuff **104**.

[0025] As can be seen in FIG. **1**, in one example, the finger cuff **104** may be attached to a patient's finger and the blood pressure measurement controller **120** may be attached on the patient's hand or wrist with an attachment bracelet **121** that wraps around the patient's wrist or hand. The attachment

bracelet **121** may be metal, plastic, Velcro, etc. It should be appreciated that this is just one example of attaching a blood pressure measurement controller **120** and that any suitable way of attaching a blood pressure measurement controller to a patient's body or in close proximity to a patient's body may be utilized and that, in some embodiments, a blood pressure measurement controller **120** may not be used at all. It should further be appreciated that the finger cuff **104** may be connected to a blood pressure measurement controller described herein, or a pressure generating and regulating system of any other kind, such as a conventional pressure generating and regulating system that is located remotely from the body of the patient (e.g., a pump **134** located remotely from a patient). Any kind of pressure generating and regulating system can be used, including but not limited to the blood pressure measurement controller, and may be described simply as a pressure generating and regulating system that may be used with a finger cuff **104** including an LED-PD pair and a bladder to implement the volume clamping method. Further, any sort of suitable finger cuff **104** including an LED-PD pair and a bladder may be utilized to implement the volume clamping method. For example, finger cuff **104** may include a suitable wrapping portion that wraps around the patient's finger (e.g., being of flexible material with a Velcro clamping system) that can be connected around the patient's finger and that includes an LED-PD pair and a bladder to aid in measuring the patient's blood pressure by the blood pressure measurement system utilizing the volume clamping method. It should be appreciated that the finger cuffs to be hereafter described may be utilized to measure blood pressure utilizing a blood pressure measurement system utilizing the volume clamp method (as well as other physiological factors). It should be appreciated that the finger cuffs to be hereafter described may also be utilized to measure other physiological and hemodynamic parameters, such as: stroke volume; stroke volume variation; cardiac output; systemic vascular resistance; as well as various types of other parameters.

[0026] With reference to FIGS. **2**A-**2**C, embodiments of the invention related to a finger cuff **200** will be particularly described. In some embodiments, the finger cuff **200** may be the finger cuff **104**, as previously described in FIG. **1**. As shown, finger cuff **200** may wrap around a patient's finger. The finger cuff **200** may be formed from a flexible material with a suitable clamping system (e.g., a Velcro system or any suitable releasable adhesive). As further shown in FIGS. **2**A-**2**C, the finger cuff **200** may include a first side **210** and a second side **220**. In one embodiment, the second side **220** may include an elongated portion **223** having a slot **225**. For attachment purposes to the patient's finger, the first side **210** may be pulled towards the second side **220**, for example by a healthcare provider, and inserted through the slot **225**, in order to wrap the finger cuff **200** around the patient's finger. As shown in FIG. **2**A, in one embodiment, the first side **210** on the interior may include a first connecting portion **280** (e.g., a Velcro type portion) that connects with a second connecting portion (not shown), e.g., a Velcro type portion, on the exterior of the second side **220** of the finger cuff **200**. In another embodiment, the first connecting portion **280** may include removable or reusable adhesive material that can be removably attached to the exterior surface of the second side **220** of the finger cuff **200**. It should be appreciated that these are just some examples of an attachment mechanism and that any suitable attachment mechanism may be utilized. Further, finger cuff **200** may include a bladder **270** and a signal source and signal detector pair **260***a-b* mounted on the interior of the finger cuff **200**. It should be appreciated the signal source and signal detector pair **260***a-b* may be an LED-PD pair **260***a-b,* as is commonly utilized, but may be any suitable signal source and signal detector pair that can be utilized to achieve the intended functions. For ease of reference, an LED-PD pair will be hereafter referred to in all embodiments, but it should be appreciated that any suitable signal source and signal detector pair may be utilized. In one embodiment, the bladder **270** may include a pair of openings that surround the LED-PD pair **260***a-b.* The bladder **270** and LED-PD pair **260***a-b* may couple to tube or cable **240** through a fixed connector **230**, which may be attached to finger cuff **200**, to provide pneumatic pressure to the bladder **270**, and to provide power to and receive electrical signals/data from the LED-PD pair **260***a-b.* It should be appreciated that the bladder **270** and the LED-PD pair **260***a-b* may be used in measuring the patient's blood pressure by the blood pressure measurement system utilizing the volume clamping method.

[0027] With additional reference to FIGS. **3**A-**3**D, embodiments of the invention related to a finger cuff **300** will be particularly described. In some embodiments, the finger cuff **300** may be the finger cuff **104**, as previously described in FIG. **1**. The finger cuff **300** may include components that are similar or same as components previously described with respect to finger cuff **200** of FIGS. **2**A-**2**C, such as first side **210**, second side **220** that includes elongated portion **223** having slot **225**, first connecting portion **280**, bladder **270**, and LED-PD pair **260***a-b.* Therefore, the same attachment procedure to the patient's finger will not be repeated.

[0028] Further, in FIGS. **3**A-**3**D, the bladder **270** and LED-PD pair **260***a-b* are coupled to tube or cable **340** through a connector assembly **330**. Referring to FIGS. **3**C-**3**D, the connector assembly **330** may include a plug connector **334** and a receptacle connector **332** that are shown in a non-plugged state. The receptacle connector **332**, which may have one end attached to finger cuff **300**, may be connected or coupled to bladder **270** and LED-PD pair **260***a-b,* while the plug connector **334** may have one end connected to tube **340**. As further shown in FIGS. **3**C-**3**D, the plug connector **334** may include another end having a first plugging member **336** and a second plugging member **338**. The first plugging member **336** may include a group of electrical contacts (not shown) and the second plugging member **338** may include a cavity to pass pneumatic pressure to bladder **270**. Still referring to FIGS. **3**C-**3**D, the receptacle connector **332** may include another end having a first socket **337** and a second socket **339**. By inserting the plug connector **334** into the receptacle connector **332**, the group of electrical contacts on the first plugging member **336** may engage a corresponding group of electrical contacts within the second socket **339** such that power may be provided to the LED-PD pair **260***a-b* and electrical signals (e.g., pleth signal) may be received from the LED-PD pair **260***a-b.* Further, by inserting the plug connector **334** into the receptacle connector **332**, the second plugging member **338** (which may be of cylindrical shape) may be inserted into the first socket **337** such that pneumatic pressure may pass through tube **340** and connector assembly **330** to bladder **270**.

[0029] With additional reference to FIGS. **4**A-**4**D, embodiments of the invention related to finger cuff **400** will be particularly described. In some embodiments, the finger cuff **400** may be the finger cuff **104**, as previously described in FIG. **1**. As with finger cuff **300** of FIGS. **3**A-**3**D, the finger cuff **400** may include components that are similar or same as components previously described with respect to finger cuff **200** of FIGS. **2**A-**2**C, such as first side **210**, second side **220** that includes elongated portion **223** having slot **225**, first connecting portion **280**, bladder **270**, and LED-PD pair **260***a-b*. Therefore, the same attachment procedure to the patient's finger will not be repeated.

[0030] Further, in FIGS. **4**A-**4**D, the bladder **270** and LED-PD pair **260***a-b* are coupled to tube or cable **440** through a snap connector assembly **420**. The snap connector assembly **420** may include a snap member **430** connected to tube **440** and having a loop **450** extending from a surface of the snap member **430** and a mating loop **452** attached to the exterior of finger cuff **400**. As shown in FIG. **4**D, the loop **450** and mating loop **452** are in a disconnected state. By snapping the snapping member **430** into the mating loop **452** (as shown in FIGS. **4**B-**4**C), the loop **450** may be secured to the mating loop **452**. Accordingly, pneumatic pressure may be provided to bladder **270** through tube **440** and snap connector assembly **420**. Further, power may be provided to the LED-PD pair **260***a-b* and electrical signals (e.g., pleth signal) may be received from the LED-PD pair **260***a-b* through tube **440** and snap connector assembly **420**. It should be appreciated that the bladder and the LED-PD pair of finger cuffs **104**, **200**, **300**, and **400**, may be used in measuring the patient's blood pressure by the blood pressure measurement system utilizing the volume clamping method.

[0031] With additional reference to FIGS. **5**A-**5**B, embodiments of the invention related to a label **510** of a finger cuff **500** will be particularly described. In some embodiments, finger cuff **500** may be any of finger cuffs **104**, **200**, **300** and **400** as previously described. Referring to FIGS. **5**A-**5**B, the exterior of finger cuff **500** may include the label **510** (e.g., a printed label) that displays information pertaining to the finger cuff **500**. The label **510** may include a name brand **515**, such as CLEARSIGHT from Edwards Lifesciences Corporation, and a letter or character or symbol portion **520** indicating the size of finger cuff **500**. For example, the character portion **520** may include a letter "S" indicating a small-sized finger cuff **500**, a letter "M" indicating a medium-sized finger cuff **500**, and a letter "L" indicating a large-sized finger cuff **500**. Other examples may include "XS" indicating extra small or "XL" indicating extra-large. Further, the label **510** and the letter may be of different colors (e.g., green, blue, and orange) to also indicate the size of finger cuff **500**. For instance, a green color label **510** and green color letter may correlate to a small-sized finger cuff **500**, a blue color label **510** and blue color letter may correlate to a medium-sized finger cuff **500**, and an orange color label **510** and orange color letter may correlate to a large-sized finger cuff **500**.

[0032] With additional reference to FIG. **6**, various features associated with finger cuff **600** will be particularly described. In some embodiments, finger cuff **600** may be any of finger cuffs **104**, **200**, **300** and **400** as previously described. In FIG. **6**, the exterior of the finger cuff **600** may include a loop **610** for attaching a sensor, such as, a heart reference sensor (HRS), to the finger cuff **600**. The exterior of the finger cuff **600** may further include sensor symbols **630***a-b* (which may resemble a shooting target) indicating the positioning of an LED-PD pair (e.g., LED-PD pair **260***a-b* as previously described) on the interior of the finger cuff **600**. That is, the positioning of the sensor symbols **630***a-b* on the exterior of the finger cuff **600** may correspond to the positioning of the LED-PD pair on the interior of the finger cuff **600**. Still referring to FIG. **6**, tube or cable **620** (which may be any of tubes/cables **123**, **240**, **340**, **440** as previously described) connected or coupled to the exterior of the finger cuff **600** may be of a particular color such that tube **620** would stand out against cabling associated with various devices.

[0033] With additional reference to FIGS. **7**A-**7**D, embodiments of the invention related to a shell finger cuff **700** to reduce finger movement will be described. In some embodiments, the finger cuff **700** may be the finger cuff **104**, as previously described in FIG. **1**. As described with respect to finger cuff **104**, finger cuff **700** may be connectable to a patient's finger to be used in measuring the patient's blood pressure by the previously described blood pressure measurement system **102** utilizing the volume clamping method. As can be seen in FIGS. **7**A-**7**D, finger cuff **700** may include a top shell portion **720**, a bottom shell portion **730**, and opposing adjustable sidewalls **760***a-b* that extend from the top shell portion **720** to the bottom shell portion **730**.

[0034] In one embodiment, sidewall **760***a* may extend from a first end of top shell portion **720** to a first end of bottom shell portion **730**. Similarly, sidewall **760***b* may extend from a second end of top shell portion **720** to a second end of bottom shell portion **730**. In one embodiment, the top shell portion **720** and bottom shell portion **730** may be convex in shape and of extended length. In one embodiment, the sidewalls **760***a-b* may be of flexible material to provide some flexibility in addition to the rigidity of the top shell portion **720** and bottom shell portion **730**. Together, top shell portion **720**, bottom shell portion **730**, and sidewalls **760***a-b* may form the shell finger cuff **700** that may be approximately cylindrically-shaped and may have an adjustable finger cavity **740** that is approximately oval-shaped for insertion of the patient's finger into the finger cuff **700**, for example by the healthcare provider. As can be seen in FIG. **7**D, the interior of top shell portion **720** abuts against the topside of the patient's finger, while the bladder **775** on the interior of bottom shell portion **730** abuts against the underside of the patient's finger. It should be appreciated that the top shell portion **720** and bottom shell portion **730** may be formed by any suitable sort of material: plastic, polyvinyl chloride (PVC), metallic material, etc., or combinations thereof, to provide suitable rigidity as well as desired flexibility.

[0035] Referring to FIGS. **7**A-**7**B, an LED-PD pair **750***a-b* and bladder **775** may be mounted on the interior of bottom shell portion **730** and within the finger cavity **740**. In one embodiment, the bladder **775** may include a pair of openings that surround the LED-PD pair **750***a-b*. The exterior of the top shell portion **720** may be coupled or connected to a rotatable knob **710** that adjusts the length of the adjustable sidewalls **760***a-b* to effectively fit the patient's finger into the finger cuff **700**. For example, in one embodiment, the healthcare provider may turn the rotatable knob **710** counterclockwise to lengthen the sidewalls **760***a-b*, thereby pushing the bottom shell portion **730** away from the top shell portion **720** in order to create a suitable finger cavity **740** for guidance of the patient's finger into the finger cavity **740**.

After the patient's finger is inserted, the healthcare provider may turn the rotatable knob **710** clockwise to shorten the sidewalls **760***a-b*, thereby pulling the bottom shell portion **730** towards the top shell portion **720** in order to tighten the finger cuff **700** around the patient's finger. This would decrease the size of finger cavity **740** to effectively fit the finger cuff **700** around the patient's finger. In another embodiment, the turn direction of the rotatable knob **710** may operate in the reverse such that turning the rotatable knob **710** clockwise would cause the bottom shell portion **730** to move away from the top shell portion **720**, and turning the rotatable knob **710** counter-clockwise would pull the bottom shell portion **730** towards the top shell portion **720** in order to tighten the finger cuff **700** around the patient's finger. Accordingly, due to the solid nature of the finger cuff **700**, the patient's possible finger movement is significantly reduced thereby reducing noise and increasing the accuracy of the blood pressure measurement (utilizing the volume clamping method). In one embodiment, the rotatable knob **710** may include several grooves, such as groove **712**, around the rotatable knob **710** to facilitate the gripping of the rotatable knob **710** by a user (e.g., a healthcare provider). Also, in one embodiment, features may be included to prevent over-tightening by the rotatable knob **710**, so the cuff will be applied with the right snugness

[0036] Still referring to FIGS. **7**A-**7**D, finger cuff **700** (the bottom shell portion **730** in particular) may be coupled to tube or cable **770** through a connector assembly **780**. In one embodiment, the connector assembly **780** may be similar or the same as connector assembly **330** of FIG. **3**. Accordingly, as shown in FIGS. **7**A-**7**D, the connector assembly **780** may include a plug connector **789** and a receptacle connector **787** that are represented in a non-plugged state. The receptacle connector **787**, which may be attached to the exterior of bottom shell portion **730**, may be connected or coupled to bladder **775** and LED-PD pair **750***a-b*, while the plug connector **789** may be connected to tube **770**. As further shown in FIGS. **7**C-**7**D, the plug connector **789** may include a first plugging member **784** and a second plugging member **782**. The first plugging member **784** may include a group of electrical contacts (not shown) and the second plugging member **782** may include a cavity to pass pneumatic pressure to bladder **775**. Still referring to FIGS. **7**C-**7**D, the receptacle connector **787** may include a first socket **783** and a second socket **785**. By inserting the plug connector **789** into the receptacle connector **787**, the group of electrical contacts on the first plugging member **784** may engage a corresponding group of electrical contacts within the second socket **785** such that power may be provided to the LED-PD pair **750***a-b* and electrical signals (e.g., pleth signal) may be received from the LED-PD pair **750***a-b*. Further, by inserting the plug connector **789** into the receptacle connector **787**, the second plugging member **782** (which may be of cylindrical shape) may be inserted into the first socket **783** such that pneumatic pressure may pass through tube **770** and connector assembly **780** to bladder **775**.

[0037] In some embodiments, the finger cuff **700** is useable with patients who are awake (e.g., not sedated) in a wide variety of different areas (e.g., in the emergency room, a standard hospital, etc.). Also, by utilizing the shell finger cuff **700** with finger cavity **740** that completely surrounds the patient's finger and guides the finger into the finger cuff **700**, the patient's finger may be secured with a snug fit such that orientation and rotation errors due to the movement of the finger are avoided, and more accurate blood pressure measurements can be taken by the volume clamp method of the blood pressure measurement system **102**. In particular, with the patient's finger received in the finger cavity **740** of the shell finger cuff **700** abutting against the bladder **775**, the bladder **775** (being provided pneumatic pressure through the tube **770**) and the LED-PD pair **750***a-b* may be more accurately utilized in measuring the patient's blood pressure by the volume clamp method of the blood pressure measurement system **102**.

[0038] With additional reference to FIGS. **8**A-**8**F, embodiments of the invention related to finger cuff **800** will be particularly described. In some embodiments, the finger cuff **800** may be the finger cuff **104**, as previously described in FIG. **1**. As shown, finger cuff **800** may include a finger cuff assembly **801** and a bladder assembly **803**. The finger cuff assembly **801** may include a flexible material **810** having a first side **880** and a second side **885**, and a shell **820** having first slot **825** and second slot **827** on opposing ends of the shell **820**, respectively. The shell **820** may be convex in shape and may from a finger cavity **805** and may further include a shell cavity **870** that is located at a convex edge of the shell **820**. For attachment purposes to the patient's finger, the first side **880** may be inserted through the first slot **825** and the second side **885** may be inserted through the second slot **827** in order to aid in forming the finger cavity **805** (which may be approximately oval shaped) that helps to guide the patient's finger in, with the flexible material **810** wrapping around the patient's finger. Subsequently, in one embodiment, the first side **880** on the interior may be removably attached to a first outward-facing surface of the flexible material **810** (e.g., using a Velcro clamping system), while the second side **885** on the interior may be permanently fixed to a second outward-facing surface of the flexible material **810**. In another embodiment, the second side **885** on the interior may be removably attached to the second outward-facing surface of the flexible material **810** (e.g., using a Velcro clamping system).

[0039] With reference to FIGS. **8**A-**8**B, the bladder assembly **803** may include a shell portion **830** (which may be convex in shape), a fixed connector **840**, and a tube or cable **850**. The shell portion **830** may be coupled to the tube **850** through fixed connector **840**, with the fixed connector **840** connecting to both the shell portion **830** and tube **850**. Looking at FIGS. **8**A-**8**B, a bladder **890** and a LED-PD pair **860***a-b* may be mounted on the interior of the shell portion **830**. In one embodiment, the bladder **890** may include a pair of openings that surround the LED-PD pair **860***a-b*. The bladder **890** and LED-PD pair **860***a-b* may be coupled to tube **850** through the fixed connector **840** to provide pneumatic pressure to bladder **890** and provide power to and receive electrical signals (e.g., pleth signal) from the LED-PD pair **860***a-b*. It should be appreciated that the fixed connector **840** is just one example of coupling the bladder **890** and LED-PD pair **860***a-b* to tube **850**, and that any suitable connectors or connecting system may be utilized, such as the connector assembly **330** and snap connector assembly **420** as previously described.

[0040] As shown in FIGS. **8**A-**8**F, the bladder assembly **803** may be inserted into the finger cuff assembly **801** to form the finger cuff **800**, and to cause the bladder **890** and LED-PD pair **860***a-b* to be positioned within finger cavity **805**. In particular, the shell portion **830** (along with the fixed connector **840**) may be inserted into the shell **820** until a

portion of the fixed connector **840** is fixed or secured into the shell cavity **870**. In one embodiment, the exterior of the shell portion **830** may abut the interior of the shell **820**. In another embodiment, the exterior of the shell portion **830** may not abut the interior of the shell **820**, thereby creating a gap between the exterior of the shell portion **830** and the interior of the shell **820**. It should be appreciated that the shell **820** and shell portion **830** of finger cuff **800** may be formed by any suitable sort of material: plastic, polyvinyl chloride (PVC), metallic material, etc., or combinations thereof, to provide suitable rigidity as well as desired flexibility.

[0041] In operation, in one embodiment, the healthcare provider may insert the bladder assembly **803** into the finger cuff assembly **801** to form the finger cuff **800**. Subsequently, the healthcare provide may guide the patient's finger through the finger cavity **805** such that the bladder **890** would abut the underside of the patient's finger. In another embodiment, the healthcare provider may instead guide the patient's finger through the finger cavity **805** and subsequently, insert the bladder assembly **803** underneath the patient's finger and into the finger cuff assembly **801** such that the bladder **890** would abut the underside of the patient's finger. Subsequently, in one embodiment, the healthcare provider may pull the first side **880** outward, while the second side **885** being fixed to the second outward-facing surface of the flexible material **810**, and secure the first side **880** to the first outward-facing surface of the flexible material **810** in order to tighten the flexible material **810**, and ultimately the finger cuff **800**, around the patient's finger. In another embodiment, the healthcare provider may pull both the first side **880** and the second side **885** outward, and secure the first side **880** to the first outward-facing surface of the flexible material **810** and the second side **885** to the second outward-facing surface of the flexible material **810**. It should be appreciated that the bladder **890** and the LED-PD pair **860***a-b* may be used in measuring the patient's blood pressure by the blood pressure measurement system utilizing the volume clamping method.

[0042] With additional reference to FIGS. **9**A-**9**E, embodiments of the invention related to finger cuff **900** will be particularly described. In some embodiments, the finger cuff **900** may be the finger cuff **104**, as previously described in FIG. **1**. As shown, finger cuff **900** may include a fixed shell **950** and a wrapping portion **920** within the fixed shell **950**. The fixed shell **950** may be of extended length and may be approximately cylindrically-shaped. It should be appreciated that the fixed shell **950** of the finger cuff **900** may be formed by any suitable sort of material: plastic, polyvinyl chloride (PVC), metallic material, etc., or combinations thereof, to provide suitable rigidity as well as desired flexibility.

[0043] Looking particularly at FIG. **9**C, the top portion of the fixed shell **950** may include a first slot **965** and a second slot **967**. Referring to FIGS. **9**A-**9**D, for example, a first side **912** and second side **914** of the wrapping portion **920** may be inserted through first slot **965** and second slot **967**, respectively, to form finger cavity **930** that is approximately oval shaped, and subsequently be fixed together on the interior to form a pull member **910**. In one embodiment, the first side **912** and second side **914** may be permanently fixed together such that the wrapping portion **920** may not be removed from the fixed shell **950**. In another embodiment, the first side **912** and second side **914** may be removably attached (e.g., using a Velcro clamping system) to each other such that the wrapping portion **920** may be removed from the fixed shell **950** and the wrapping portion **920** may particularly size the size of the finger cavity **930**.

[0044] With continued reference to FIGS. **9**A-**9**D, the pull member **910** may be pulled outward to tighten the wrapping portion **920** around the patient's finger. While applying the pull force on pull member **910**, the pull member **910** may be turned clockwise (or counter-clockwise) to fix or secure to the exterior of the fixed shell **950**. In one embodiment, the first side **912** or the second side **914** on the exterior may include a connecting portion (not shown), e.g., a velcro type portion, that connects with another connecting portion (also not shown), e.g., a velcro type portion, on the exterior of the fixed shell **950**. In another embodiment, the exterior of the first side **912** or the second side **914** may include removable or reusable adhesive material that can be removably attached to the exterior of the fixed shell **950**. It should be appreciated that these are just some examples of an attachment mechanism and that any suitable type may be utilized.

[0045] Looking at FIG. **9**E in particular, the exterior of the first side **912** and/or the second side **914** may include a label **970** (e.g., a printed label) that displays information pertaining to the finger cuff **900**. The label **970** may include a name brand **980**, such as CLEARSIGHT from Edwards Lifesciences Corporation, and a letter or character or symbol portion **970** indicating the size of finger cuff **500**. For example, the character portion **970** (which may be approximately square shaped) may include a letter "S" indicating a small-sized finger cuff **900**, a letter "M" indicating a medium-sized finger cuff **900**, and a letter "L" indicating a large-sized finger cuff **900**. Other examples may include "XS" indicating extra small or "XL" indicating extra-large. Further, the character portion **970** may include different background colors (e.g., green, blue, and orange) to also indicate the size of finger cuff **900**. For instance, a green background color may correlate to a small-sized finger cuff **900**, a blue background color may correlate to a medium-sized finger cuff **900**, and an orange background color may correlate to a large-sized finger cuff **900**.

[0046] Although not explicitly shown in FIGS. **9**A-**9**E, similar to the previously described embodiment, a bladder and an LED-PD pair (as previously described) may be mounted on the interior of the wrapping portion **920** (within the fixed shell **950**) and within finger cavity **930**. Further, the bladder and LED-PD pair may be coupled to tube or cable **940** through a connector (which may be any of connector and connector assembly as previously described, such as fixed connector **230**, connector assembly **330**, and snap connector assembly **420**), with the tube **940** being guided through the fixed shell **950** via a shell cavity **960** (as shown in FIGS. **9**B-**9**C) that receives the tube **940** at an edge of fixed shell **950**. It should be appreciated that the bladder and the LED-PD pair may be used in measuring the patient's blood pressure by the blood pressure measurement system utilizing the volume clamping method.

[0047] It should be appreciated that aspects of the invention previously described may be implemented in conjunction with the execution of instructions by processors, circuitry, controllers, control circuitry, etc. As an example, control circuity may operate under the control of a program, algorithm, routine, or the execution of instructions to execute methods or processes in accordance with embodiments of the invention previously described. For example, such a program may be implemented in firmware or soft-

ware (e.g. stored in memory and/or other locations) and may be implemented by processors, control circuitry, and/or other circuitry, these terms being utilized interchangeably. Further, it should be appreciated that the terms processor, microprocessor, circuitry, control circuitry, circuit board, controller, microcontroller, etc., refer to any type of logic or circuitry capable of executing logic, commands, instructions, software, firmware, functionality, etc., which may be utilized to execute embodiments of the invention.

[0048] The various illustrative logical blocks, processors, modules, and circuitry described in connection with the embodiments disclosed herein may be implemented or performed with a general purpose processor, a specialized processor, circuitry, a microcontroller, a digital signal processor (DSP), an application specific integrated circuit (ASIC), a field programmable gate array (FPGA) or other programmable logic device, discrete gate or transistor logic, discrete hardware components, or any combination thereof designed to perform the functions described herein. A processor may be a microprocessor or any conventional processor, controller, microcontroller, circuitry, or state machine. A processor may also be implemented as a combination of computing devices, e.g., a combination of a DSP and a microprocessor, a plurality of microprocessors, one or more microprocessors in conjunction with a DSP core, or any other such configuration.

[0049] The steps of a method or algorithm described in connection with the embodiments disclosed herein may be embodied directly in hardware, in a software module/firmware executed by a processor, or any combination thereof. A software module may reside in RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to the processor such the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor.

[0050] The previous description of the disclosed embodiments is provided to enable any person skilled in the art to make or use the present invention. Various modifications to these embodiments will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments without departing from the spirit or scope of the invention. Thus, the present invention is not intended to be limited to the embodiments shown herein but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

What is claimed is:

1. A finger cuff attachable to a patient's finger to be used in measuring the patient's blood pressure by a blood pressure measurement system, the finger cuff comprising:

a first side and a second side, the first side removably attached to the second side to wrap the finger cuff around the patient's finger;

a signal source and signal detector pair; and

a bladder including a pair of openings, the bladder mountable within the finger cuff such that the pair of openings surround the signal source and signal detector pair, respectively, wherein the patient's finger surrounded in the finger cuff abuts against the bladder such that the bladder and the signal source and signal detector pair are used in measuring the patient's blood pressure by the blood pressure measurement system, wherein the bladder and signal source and signal detector pair are coupled to a cable through a connector assembly, the cable providing pneumatic pressure to the bladder and receiving electrical signals from the signal source and signal detector pair.

2. The finger cuff of claim **1**, wherein the signal source and signal detector pair include a light emitting diode (LED)—photodiode (PD) pair, respectively.

3. The finger cuff of claim **2**, wherein the connector assembly comprises a plug connector removably attached to a receptacle connector, the plug connector including a first end connecting to the cable and a second end having a first plugging member and a second plugging member, wherein the receptacle connector includes a first end attached to the finger cuff and coupled to the bladder and LED-PD pair, and a second end having a first socket and a second socket such that the first plugging member is suitably pluggable into the second socket to receive electrical signals from the LED-PD pair, and the second plugging member is suitably pluggable into the first socket to provide pneumatic pressure to the bladder.

4. The finger cuff of claim **3**, wherein the first plugging member of the plug connector comprises a group of electrical contacts that engage with a corresponding group of electrical contacts within the second socket of the receptacle connector when the first plugging member is plugged into the second socket, to provide power to the LED-PD pair and receive electrical signals from the LED-PD pair, and wherein the second plugging member of the plug connector comprises a cavity to pass pneumatic pressure through the first socket of the receptacle connector and to the bladder when the second plugging member is plugged into the first socket.

5. The finger cuff of claim **2**, wherein the connector assembly comprises a snap member connected to the cable and having a loop extending from a surface of the snap member that is removably connected to a mating loop attached to an exterior of the finger cuff and coupled to the bladder and LED-PD pair.

6. The finger cuff of claim **2**, further comprising a pair of sensor symbols indicating physical positions of the LED-PD pair within the finger cuff.

7. The finger cuff of claim **6**, wherein the label and the pair of sensor symbols are located on an exterior of the finger cuff.

8. The finger cuff of claim **2**, further comprising a label having a name brand and a character or symbol portion that displays a character indicative of size of the finger cuff.

9. The finger cuff of claim **8**, wherein the character or symbol is any one of the following: XS, S, M, L, and XL, respectively, corresponding to extra small, small, medium, large, and extra-large.

10. A finger cuff connectable to a patient's finger to be used in measuring the patient's blood pressure by a blood pressure measurement system, the finger cuff comprising:

a top shell portion and a bottom shell portion forming a finger cavity of the finger cuff to be placed around the patient's finger, the bottom shell portion including a signal source and signal detector pair, and

a bladder including a pair of openings, the bladder mountable within the bottom shell portion such that the pair of openings surround the signal source and signal detector pair, respectively, wherein the patient's finger received and surrounded in the finger cavity abuts

against the bladder such that the bladder and the signal source and signal detector pair are used in measuring the patient's blood pressure by the blood pressure measurement system.

11. The finger cuff of claim **10**, wherein the signal source and signal detector pair include a light emitting diode (LED)—photodiode (PD) pair, respectively.

12. The finger cuff of claim **11**, further comprising first and second opposing adjustable sidewalls extending from the top shell portion to the bottom shell portion, and a rotatable knob connected to an exterior of the top shell portion to adjust lengths of the first and second opposing adjustable sidewalls, thereby adjusting the size of the finger cavity surrounding the patient's finger.

13. The finger cuff of claim **12**, wherein the lengths of the first and second sidewalls are shortened when the rotatable knob is turned clockwise to pull the bottom shell portion towards the top shell portion, thereby decreasing the size of the finger cavity, whereas the lengths of the first and second sidewalls are lengthened when the finger cuff handle is turned counter-clockwise to push the bottom shell portion away from the top shell portion, thereby increasing the size of the finger cavity.

14. The finger cuff of claim **12**, wherein the bottom shell portion of the finger cuff is coupled to a cable through a connector assembly for providing pneumatic pressure to the bladder and receiving electrical signals from the LED-PD pair, the connector assembly comprising:

a plug connector including a first end connecting to the cable and a second end having a first plugging member and a second plugging member, and

a receptacle connector including a first end attached to the bottom shell portion and coupled to the bladder and LED-PD pair, and a second end having a first socket and a second socket such that the first plugging member is suitably pluggable into the second socket to receive electrical signals from the LED-PD pair, and the second plugging member is suitably pluggable into the first socket to provide pneumatic pressure to the bladder.

15. The finger cuff of claim **14**, wherein the first plugging member of the plug connector comprises a group of electrical contacts that engage with a corresponding group of electrical contacts within the second socket of the receptacle connector when the first plugging member is plugged into the second socket, to provide power to the LED-PD pair and receive electrical signals from the LED-PD pair, and

wherein the second plugging member of the plug connector comprises a cavity to pass pneumatic pressure through the first socket of the receptacle connector and to the bladder when the second plugging member is plugged into the first socket.

16. A finger cuff connectable to a patient's finger to be used in measuring the patient's blood pressure by a blood pressure measurement system, the finger cuff comprising:

a shell having a first slot and a second slot on first and second opposing ends of the shell, the shell forming a finger cavity to be placed around the patient's finger;

a flexible material having a first side and a second side, wherein the first side and the second side are respectively inserted through the first slot and the second slot; and

a bladder assembly insertable into the shell, the bladder assembly comprising a shell portion having a signal source and signal detector pair, and a bladder including a pair of openings, the bladder mountable within the shell portion such that the pair of openings surround the signal source and signal detector pair, respectively, wherein the patient's finger received and surrounded in the finger cavity abuts against the bladder such that the bladder and the signal source and signal detector pair are used in measuring the patient's blood pressure by the blood pressure measurement system.

17. The finger cuff of claim **16**, wherein the signal source and signal detector pair include a light emitting diode (LED)—photodiode (PD) pair, respectively.

18. The finger cuff of claim **17**, wherein the bladder assembly further comprises a connector having one end connected to the shell portion and coupled to the bladder and LED-PD pair and another end connect to a cable, the cable providing pneumatic pressure through the connector to the bladder and receiving electrical signals from the LED-PD pair.

19. The finger cuff of claim **18**, wherein the shell portion further includes a shell cavity at a convex edge of the shell portion, and wherein a portion of the connector is secured into the shell cavity when the bladder assembly is inserted into the shell.

20. The finger cuff of claim **16**, wherein an interior of the first side of the flexible material is removably attached to a first outward-facing surface of the flexible material, and an interior of the second side of the flexible material is permanently attached to a second outward-facing surface of the flexible material.

21. The finger cuff of claim **20**, wherein the first side of the flexible material is pullable to effectively tighten the flexible material around the patient's finger.

22. A finger cuff connectable to a patient's finger to be used in measuring the patient's blood pressure by a blood pressure measurement system, the finger cuff comprising:

a fixed shell including a first slot and a second slot; and

a wrapping portion within the fixed shell, the wrapping portion including a first side and a second side respectively inserted through the first slot and the second slot forming a finger cavity of the wrapping portion to be placed around the patient's finger, a signal source and signal detector pair, and a bladder including a pair of openings, the bladder mountable within the wrapping portion such that the pair of openings surround the signal source and signal detector pair, respectively, wherein, the patient's finger surrounded in the finger cavity abuts against the bladder such that the bladder and the signal source and signal detector pair are used in measuring the patient's blood pressure by the blood pressure measurement system.

23. The finger cuff of claim **22**, wherein the signal source and signal detector pair include a light emitting diode (LED)—photodiode (PD) pair, respectively.

24. The finger cuff of claim **23**, wherein interiors of the first side and second side of the wrapping portion are secured together forming a pull member pullable to effectively tighten the wrapping portion around the patient's finger, and wherein an exterior of the pull member is removably attached to an exterior of the fixed shell to effectively secure the patient's finger within the finger cavity.

25. The finger cuff of claim **24**, wherein the fixed shell further includes a shell cavity that receives and guides a cable through the fixed shell, the cable coupling to the

bladder and LED-PD pair, providing pneumatic pressure to the bladder and receiving electrical signals from the LED-PD pair.

26. The finger cuff of claim **24**, wherein an exterior of the pull member comprises a label having a name brand and a character or symbol portion that displays a character indicative of size of the wrapping portion.

27. The finger cuff of claim **26**, wherein the character or symbol is any one of the following: XS, S, M, L, and XL, respectively corresponding to extra small, small, medium, large, and extra-large.

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专利名称(译)	手指套		
公开(公告)号	US20190029542A1	公开(公告)日	2019-01-31
申请号	US16/045378	申请日	2018-07-25
[标]申请(专利权)人(译)	爱德华兹生命科学公司		
申请(专利权)人(译)	爱德华生命科学公司		
当前申请(专利权)人(译)	爱德华生命科学公司		
[标]发明人	LI PEIYUAN VAN GOUDOEVER JEROEN		
发明人	LI, PEIYUAN VAN GOUDOEVER, JEROEN		
IPC分类号	A61B5/022 A61B5/0225 A61B5/00		
CPC分类号	A61B5/02241 A61B5/02255 A61B5/6831 A61B5/6826 A61B2562/227		
优先权	62/539317 2017-07-31 US		
外部链接	Espacenet USPTO		

摘要(译)

公开了一种指套，其可附接到患者的手指以用于测量患者的血压。指套包括第一侧和第二侧。第一侧可拆卸地连接到第二侧，以将指套包裹在患者的手指周围。指套还包括信号源和信号检测器对以及气囊。囊包括一对开口并且可安装在指套内，使得该对开口分别围绕信号源和信号检测器对。手指套中包围的患者手指抵靠膀胱，使得膀胱和信号源和信号检测器对用于测量患者的血压。此外，气囊和信号源和信号检测器对通过连接器组件耦合到电缆。电缆向气囊提供气动压力并接收来自信号源和信号检测器对的电信号。