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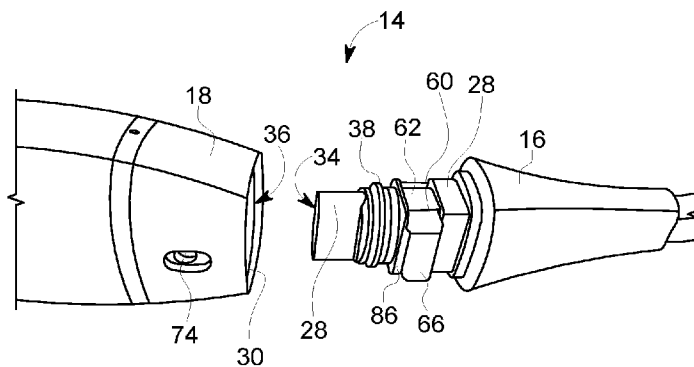


FIG. 3

(57) Abstract: A patient monitoring cable for transmission of electrical power and patient physiological data comprises at least one locking connector end having a connector configured to connect to a receptacle and a connector housing surrounding at least a portion of the connector. The connector end also has a depressible latch on the connector housing, the depressible latch having two flexible side portions that clasp notches on either side of the connector housing to maintain a top portion of the depressible latch elevated above a top surface of the connector housing. The side portions of the depressible latch flex outward to allow depression of the depressible latch.



## LOCKING CONNECTOR FOR PATIENT MONITORING CABLE

## BACKGROUND

**[0001]** The present invention relates to cables that transmit electrical power and patient physiological data for use in patient monitoring, and specifically to connectors for connecting such patient monitoring cables.

**[0002]** Patient monitoring has evolved from requiring a separate patient monitoring device for every monitoring application, to having a centralized patient monitor to which multiple different, smaller patient data recording devices can be attached. The smaller patient data recording devices may be connected to the patient monitor via cables that transmit physiological data from sensors on the patient to the monitoring device. The patient data recording devices may house some electronics, such as signal processing electronics, as well as patient isolation circuitry. For example, these electronics may be housed in a small unit on a patient monitoring cable. The cables may also transmit power from the patient monitor to electronics in the patient data recording device and/or to the sensors on the patient. For example, the cables may be universal serial bus (USB)-compliant cables having one of many types of USB-compliant connectors on either end.

## SUMMARY

**[0003]** This Summary is provided to introduce a selection of concepts that are further described below in the Detailed Description. This Summary is not intended to identify key or essential features of the claimed subject matter, nor is it intended to be used as an aid in limiting the scope of the claimed subject matter.

**[0004]** In one embodiment, a patient monitoring cable for transmission of electrical power and patient physiological data comprises at least one locking connector end having a connector configured to connect to a receptacle and a connector housing surrounding at least a portion of the connector. The connector end also has a depressible latch on the connector housing, the depressible latch having two flexible side portions that clasp or engage notches on either side of the connector housing to maintain a top portion of the depressible latch elevated above a top surface of the connector housing. The side portions of the depressible latch flex outward to allow depression of the depressible latch.

**[0005]** In another embodiment, a patient monitoring cable comprises a first cable and a second cable connected together at a locking connector. The locking connector has a receptacle, a receptacle housing surrounding at least a portion of the receptacle, a connector configured to connect to the receptacle for transmission of electrical power and patient physiological data, a connector housing surrounding at least a portion of the connector, and a depressible latch on the connector housing. The depressible latch has two flexible side portions that clasp notches on either side of the connector housing to maintain a top portion of the depressible latch above a top surface of the connector housing, wherein the side portions of the depressible latch flex when the depressible latch is depressed to allow the top portion of the depressible latch to become flush with the top surface of a connector housing. A recess in the receptacle housing receives the depressible latch when the connector is fully connected to the receptacle such that the connector is removably locked to the receptacle.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0006]** The drawings illustrate the best mode presently contemplated of carrying out the disclosure. In the drawings:

**[0007]** Fig. 1 depicts a patient monitoring cable having certain features described herein.

**[0008]** Fig. 2 depicts another view of the patient monitoring cable of Fig. 1 shown in a separated state.

**[0009]** Fig. 3 depicts one embodiment of a locking connector for a patient monitoring cable.

**[0010]** Fig. 4 depicts another embodiment of a locking connector for a patient monitoring cable.

**[0011]** Fig. 5a depicts one embodiment of a latch for a locking connector.

**[0012]** Fig. 5b depicts a side view of the latch of Fig. 5a.

**[0013]** Fig. 5c depicts a top view of the latch of Fig. 5a.

**[0014]** Fig. 6 depicts one embodiment of a locking connector end for a patient monitoring cable shown without a latch.

**[0015]** Figs. 7a and 7b show a cross-sectional view of a locking connector end depicting the latch in different positions.

**[0016]** Fig. 8 is a cross sectional view of another embodiment of a locking connector for a patient monitoring cable.

#### DETAILED DESCRIPTION

**[0017]** Fig. 1 depicts a patient monitoring cable 7. The depicted patient monitoring cable 7 connects an invasive temperature sensor to a patient monitor. The depicted patient monitoring cable 7 has a first connector end 21 that connects to a patient monitor and a second connector end 22 that connects to an invasive temperature sensor that senses a temperature of a patient. The patient monitoring cable 7 has electronics housed in the electronics housing 8, which may include computer hardware and circuitry for processing the physiological data recorded by the invasive temperature sensor and may also include patient isolation circuitry. It will be understood by one of skill in the art that the patient monitoring cable 7 depicted in Figs. 1 and 2 may be alternatively configured to connect any type of physiological sensors for patient monitoring to a monitoring device. For example, patient monitoring cables may be configured to connect any of the following exemplary type of sensor to a patient monitor and to transmit electrical power and patient physiological data between the sensor device and the patient monitor, including electrocardiograph sensors, electroencephalograph sensors, invasive blood pressure monitors, noninvasive blood pressure cuffs, SpO<sub>2</sub> sensors, pulse oximeters, and other known devices for measuring patient physiological data.

**[0018]** The inventors of the present application recognize that patient monitoring cables 7 have a life cycle that is often dictated by the failure of a single part. Through experimentation and research, the inventors recognize that the sensor end of the cable, or the end of the cable that connects to sensor devices, is a common source of failure because it endures a lot of abuse, including continually being connected and disconnected to sensors on patients, being exposed to forces from patient interaction, fluid exposure, etc. Furthermore, the inventors have recognized that patient monitoring cables 7 have become increasingly complex and expensive to replace, especially those cables having electronics housed therein. Accordingly, the inventors recognized the need for an improved patient monitoring cable 7 having a sensor end that is removable and replaceable. The inventors also recognized that the sensor end and the monitoring end of the patient monitoring cable must have a lockable connection that can endure significant force, such as from movement and pulling by patients and caregivers.

**[0019]** Accordingly, the present inventors developed the locking connector 14 having the elements and features disclosed herein. The disclosed locking connector 14 is beneficially designed to provide up to 50 lbf of retention force and withstand up to 50 lbf of side load without releasing. In various embodiments and for various applications, the locking connector 14 may be configured to intentionally release under a lesser load. The locking connector 14 also provides easy connection. As disclosed herein, the ease of disconnection can be varied via different configurations disclosed herein.

**[0020]** The locking connector 14 has a locking connector end 16 and a locking receptacle end 18. The locking connector 14 connects a first cable 11 and a second cable 12. In the embodiment of Figs. 1 and 2, the first cable 11 connects a patient monitor at a first connector end 21 to electronics housing 8 via shielded conductor cords 9. The second cable 12 connects physiological sensors at a second connector end 22 through shielded conductor cords 9 to the electronics housing 8 (via locking connector 14). As illustrated in Figs. 2-3, the first cable 11 and the second cable 12 connect at the locking connector 14, with the first cable 11 having a locking receptacle end 18 that receives the locking connector end 16 of the second cable 12.

**[0021]** Referring to Figs. 2-4, the locking connector end 16 has a connector 34 configured to connect with, or be received by, receptacle 36 of the locking receptacle end 18. The locking connector end 16 has a depressible latch 60 configured to lock the locking connector end 16 to the locking receptacle end 18, thereby locking the connector 34 to the receptacle 36. It will be understood by one of skill in the art that the connector 34 and the receptacle 36 may be any type of connection devices known in the art that provide transfer of electrical power and patient physiological data, including any USB-compliant devices (standard-size USB, mini USB, micro USB, or any other USB-compliant plug and receptacle pair), pin and socket connectors, blade and beam connectors, or the like. Likewise, the first connector end 21 (which in the depicted embodiment is configured to connect to a patient monitor) and the second connector end 22 (which in the depicted embodiment is configured to connect to a patient sensor) may have any connector configuration, such as the aforementioned connector types.

**[0022]** The locking connector end 16 has a connector housing 28 surrounding at least a portion of the connector 34. In the embodiment of Figs. 2-4, the connector housing 28 entirely surrounds the connector 34, which may be, for example, a circuit board providing beam connectors configured to connect with blades on the receptacle 36. The depressible latch 60 is

configured such that in a resting state, when no external pressure is applied to the depressible latch 60, a top portion 66 of the depressible latch 60 is elevated above a top surface 86 of the connector housing 28. When the locking connector end 16 connects to the locking receptacle end 18, the depressible latch 60 is depressed to allow the locking connector end 16 to enter the locking receptacle end 18. Once the locking connector end 16 is fully engaged with the locking receptacle end 18 and the connector 34 is fully connected to the receptacle 36, the depressible latch 60 returns to its resting position above the top surface 86 of the connector housing 28 to engage a recess 72 in the receptacle housing 30.

**[0023]** In the embodiment of the locking connector 14 depicted in Fig. 4, the depressible latch 60 is received in the recess 72 of the receptacle housing 30 when the connector 34 becomes fully engaged with the receptacle 36. Upon entry of the first locking connector end 16 into the locking receptacle end 18, entry edge 67 of the depressible latch 60 interfaces with entry protrusion 41 of the receptacle housing 30. In the depicted embodiment, the entry edge 67 of the depressible latch 60 is ramped such that when the depressible latch 60 encounters the entry protrusion 41, an entry edge 42 of entry protrusion 41 slides against the ramped entry edge 67 to force the depressible latch 60 downward in the direction of arrow 50. In the embodiment of Fig. 4, the entry edge 42 of the entry protrusion 41 also has a ramped edge which further facilitates the sliding interaction between the entry protrusion 41 and the depressible latch 60 as the locking connector end 16 is forced into the locking receptacle end 18. Thereby, the depressible latch 60 is depressed downward into the connector housing 28 so that the connector housing 28 can enter the receptacle housing 30 and the connector 34 can engage the receptacle 36. For example, the depressible latch 60 may be configured such that when it is depressed, the top portion 66 of the depressible latch 60 becomes flush with the top surface 86 of the connector housing 28.

**[0024]** Once the locking connector end 16 is fully received by the locking receptacle end and the connector 34 is fully connected to the receptacle 36, the locking edge 68 of the depressible latch 60 passes the locking edge 43 of the entry protrusion 41 allowing the depressible latch 60 to move upwards to its resting position above the top surface 86 of the connector housing 28. The depressible latch 60 is received in recess 72 of the receptacle housing 30. The locking edge 68 of the depressible latch 60 engages the locking edge 43 of the entry protrusion 41 to lock the connector 34 in fully connected engagement with the receptacle 36.

**[0025]** In the embodiment of Fig. 4, the locking connector 14 is tool-removable, meaning that a tool must be inserted into the device through hole 74 in the receptacle housing 30 in order to depress the depressible latch 60 and permit disconnection of the connector 34 from the receptacle 36. A plug 33 may occupy the hole 74 when the locking connector end 16 remains connected to the locking receptacle end 18 to prevent entry of fluids or particles into the locking connector 14. In one embodiment, the plug 33 may be comprised of rubber or other elastomeric substance. The plug 33 will be removed from the hole 74 prior to insertion of the removal tool. In one embodiment, the plug 33 may be removed by prying the plug 33 from the hole 74. In another embodiment, the plug 33 may have a tab or a notch that facilitates removal of the plug 33 from the hole 74.

**[0026]** The tool-removable embodiment has the benefit that the locking connector 14 cannot be inadvertently or mistakenly disconnected while the cable is in use, for example by a patient or by a caregiver in the course of performing patient care. In this embodiment, it is intended that the locking connector 14 would be disconnected by someone authorized to perform technical work on patient monitoring devices, such as a bio-med technician or a product representative. In alternative embodiments described further herein, a button 32 is provided on the exterior of the connector housing that facilitates depression of the depressible latch 60 to permit disconnection of the locking connector end 16 from the locking receptacle end 18 (see Fig. 8). This embodiment eliminates the need for a tool and makes it easier to disconnect the locking connector 14, which may be desirable for some applications.

**[0027]** Alternatively or additionally to the tool-removable and button-removable embodiments, the depressible latch 60 may have a locking edge 68 that is ramped to allow the connector 34 to be disconnected from the receptacle 36 by pulling the locking connector end 16 away from the locking receptacle end 18 with at least a predetermined amount of force. As shown in Fig. 4, the ramped locking edge 68 interfaces with the locking edge 43 of the entry protrusion 41 when opposing forces are applied to the locking connector end 16 and the locking receptacle end 18. The force necessary to separate the locking connector end 16 from the locking receptacle end 18 may be varied by varying the angle of the ramped locking edge 68—with a more gradual angle requiring less removal force and a steeper angle requiring more removal force. Additionally, the locking edge 43 of the entry protrusion 41 may also be rounded or

ramped to further facilitate depression of the depressible latch 60 and reduce the amount of force required for removal.

**[0028]** The locking connector end 16 and locking receptacle end 18 may have multiple O-rings 38 at various positions to prevent the entry of fluid into the locking connector 14, and specifically into the conductive portions of the connector 34 and the receptacle 36. In the depicted embodiments, O-ring 38a is fitted to the end of the connector housing 28 and O-ring 38b is fitted to the receptacle housing 30 to prevent entry of fluids to the area where the two pieces join, and thus the area where the connector 34 joins the receptacle 36. Another O-ring 38c is placed at the entry of the receptacle housing 30 to provide a seal between the receptacle housing 30 and the connector housing 28.

**[0029]** Figs. 5a-5c depict one embodiment of the depressible latch 60, which is generally C-shaped and wraps around the sides 88 of the connector housing 28 (as also shown in Figs. 2, 3, and 7a-7b). In the depicted embodiment, the depressible latch 60 has a squared C-shape having a flat top portion 66 and squared top corners 65. However, in other embodiments the depressible latch 60 may be a rounded C-shape with an arched top portion 66. In still other embodiments, the top portion 66 may be concave.

**[0030]** The depressible latch 60 has two flexible side portions 62 that extend downward along the sides of the connector housing. The side portions 62 terminate at foot ends 64. In the depicted embodiment, the side portions 62 curve inward to clasp the connector housing 28. As shown in Figs. 6 and 7a-7b, the connector housing 28 has notches 81 on either side 88. Each notch 81 receives a foot end 64 of the depressible latch 60. The foot ends 64 are configured to extend inward to fit into the notches 81 to clasp the connector housing 28.

**[0031]** The mirrored curvature of the side portions 62 of the C-shaped depressible latch 60 creates an inward pressure forcing the foot ends 64 into the notches 81 of the connector housing 28. As shown in Fig. 7a, the notches 81 are positioned on the sides 88 of the connector housing 28 such that when the foot ends 64 are in the notches 81, the top portion 66 of the depressible latch 60 is elevated above the top surface 86 of the connector housing 28. The inward force created by the side portions 62 biases the depressible latch 60 into an inward-most position in the notches 81.

**[0032]** Referring to Figs. 7a and 7b, the notches 81 have a ramped edge 83 on the bottom side such that, when a downward force is applied to the depressible latch 60, the foot ends 64

slide along the ramped edge 83 in the direction of the arrows 90. The foot ends 64 may be rounded to facilitate sliding on the ramped edges 83. The side portions 62 are thus forced to flex outward to accommodate the progressively wider area between the ramped edges 83 of the connector housing 28. The foot ends 64 slide down the ramped edges 83 until the top portion 66 of the depressible latch 60 clears the entry protrusion 41 of the receptacle housing 30. In some embodiments, the depressible latch 60 may be depressible such that the top portion 66 becomes flush with the top surface 86 of the connector housing 28. Once the downward force is released from the depressible latch 60, the inward-biased force created by the side portions 62 causes the foot ends 64 to slide back up in the ramped edges 83 and into the notches 81. Thereby, the depressible latch 60 springs back upward into its resting position. In other embodiments, the notches 81 may not have a ramped edge 83, or the ramped edge 83 may have limited length. In such embodiments, the side portion 62 of the depressible latch 60 may be configured to flex or bow outward or inward to absorb the downward force and allow sufficient depression of the depressible latch 60. In such an embodiment, the foot ends 64 may not make any downward movement with respect to the notches 81.

**[0033]** Fig. 5b depicts a side view of the depressible latch 60 showing the entry edge 67 and the locking edge 68 of the exemplary embodiment. The entry edge 67 may be ramped as shown to facilitate depression of the depressible latch 60 by the entry protrusion 41. The angle 67A of the ramp can be optimized for a particular locking connector 14, which may depend on, for example, the height  $h$  and width  $w$  of the depressible latch 60. Additionally, the angle 67A may be adjusted based on an angle of a ramped entry edge 42 of the entry protrusion. In a preferred embodiment, the entry edge 67 of the latch may be ramped at an angle 67A of  $45^\circ$ . However, other angles may be preferred based on the aforementioned factors. In still other embodiments, the entry edge 67 may be squared without any ramp. In such an embodiment, a user may depress the depressible latch 60 when inserting the locking connector end 16 into the locking receptacle end 18.

**[0034]** In the embodiment of Fig. 5b, the depressible latch 60 has a squared locking edge 68. As described above, the locking edge 68 engages the locking edge 43 of the entry protrusion 41. In other embodiments such as that depicted and described with respect to Fig. 4, the locking edge may be ramped so that the entry protrusion 41 depresses the depressible latch 60 when the

locking connector end 16 is pulled away from the locking receptacle end 18 with a predefined amount of force.

**[0035]** In embodiments where the entry edge 67 has a different geometry than the locking edge 68, the depressible latch 60 may be keyed so that the depressible latch 60 is oriented correctly on the connector housing 28. Fig. 5c shows a top view of the depressible latch 60 demonstrating one embodiment of a key 69 for guaranteeing that the depressible latch 60 is correctly oriented. One side of the depressible latch 60 has a width  $w$  and the other side is narrower, having a width  $w'$ . As shown in Fig. 3, the connector housing 28 can be molded to fit the keyed orientation so as to prevent misapplication of the depressible latch.

**[0036]** The depressible latch may be comprised of any flexible material or materials that allow the side portions 62 to flex to enable depression of the depressible latch. In one embodiment, the depressible latch may be formed of injection-molded plastic, such as polyoxymethylene, including materials such as Delrin, Celcon, Rantal, Duracon, Kepital, and Hostaform. In one exemplary embodiment, the depressible latch 60 may be formed of injection molded Delrin 500P.

**[0037]** Fig. 8 depicts another embodiment of the locking connector 14 having a push button 32 on the receptacle housing 30 that can be pushed to depress the depressible latch 60 to permit disconnection of the connector 34 from the receptacle 36. The button 32 has a depressor extension 35 that extends from the button 32 at the surface of the receptacle housing 30, through the hole 74 in the receptacle housing 30, to the top surface of the depressible latch 60. Pressing the button 32 causes the depressible latch 60 to move downward in the direction of arrow 50 to become flush with the top surface 86 of the connector housing 28. Thereby, the depressible latch 60 can clear the entry protrusion 41 and allow the locking connector end 16 to be removed from the locking receptacle end 18.

**[0038]** This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to make and use the invention. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims.

## CLAIMS

We claim:

1. A patient monitoring cable for transmission of electrical power and patient physiological data, the patient monitoring cable comprising:  
at least one locking connector end having:
  - a connector configured to connect to a receptacle;
  - a connector housing surrounding at least a portion of the connector; and
  - a depressible latch on the connector housing, the depressible latch having two flexible side portions that clasp notches on either side of the connector housing to maintain a top portion of the depressible latch elevated above a top surface of the connector housing, wherein the side portions flex outward to allow depression of the depressible latch.
2. The patient monitoring cable of claim 1 further comprising a receptacle housing around at least a portion of the receptacle, the receptacle housing having a recess that receives the depressible latch when the connector is fully connected to the receptacle.
3. The patient monitoring cable of claim 2 wherein the top portion of the depressible latch has a ramped entry edge that slides against an entry protrusion on the receptacle housing as the connector is connected to the receptacle causing the depressible latch to be depressed.
4. The patient monitoring cable of claim 3 wherein the top portion of the depressible latch further has a locking edge that presses against the entry protrusion on the receptacle housing once the connector is fully connected to the receptacle.
5. The patient monitoring cable of claim 3 wherein the locking edge is ramped such that, upon pulling the connector away from the receptacle with a predetermined force, the entry protrusion depresses the depressible latch to permit disconnection of the connector from the receptacle.

6. The patient monitoring cable of claim 2 further comprising a hole in the receptacle housing near the recess allowing insertion of a tool to depress the depressible latch to permit disconnection of the connector from the receptacle.

7. The patient monitoring cable of claim 2 further comprising a button on the receptacle housing near the recess and configured such that pressing the button depresses the depressible latch to permit disconnection of the connector from the receptacle.

8. The patient monitoring cable of claim 1 wherein the notches have a ramped edge that allows the flexible side portions to slide downward on the connector housing when the depressible latch is depressed.

9. The patient monitoring cable of claim 7 wherein, when depressed, the top portion of the depressible latch becomes flush with the top surface of the connector housing.

10. The patient monitoring cable of claim 1 wherein the depressible latch is C-shaped.

11. The patient monitoring cable of claim 10 wherein the top portion of the depressible latch is a flat body with squared edges.

12. The patient monitoring cable of claim 1 wherein the depressible latch is made of molded polyoxymethylene.

13. The patient monitoring cable of claim 1 wherein the connector is a universal serial bus (USB)-compliant plug and the receptacle is a USB-compliant receptacle.

14. A patient monitoring cable comprising:  
a first cable and a second cable connected together at a locking connector, the locking connector having:

a receptacle;

a receptacle housing surrounding at least a portion of the receptacle;

a connector configured to connect to the receptacle for transmission of electrical power and patient physiological data;

a connector housing surrounding at least a portion of the connector;

a depressible latch on the connector housing, the depressible latch having two flexible side portions that clasp notches on either side of the connector housing to maintain a top portion of the depressible latch above a top surface of the connector housing, wherein the side portions flex when the depressible latch is depressed to allow the top portion of the depressible latch to become flush with the top surface of the connector housing; and

a recess in the receptacle housing that receives the depressible latch when the connector is fully connected to the receptacle such that the connector is removably locked to the receptacle.

15. The patient monitoring cable of claim 14 wherein the first cable has a first connector end configured to connect to a patient monitor and the second cable has a second connector end configured to connect to a sensor.

16. The patient monitoring cable of claim 14 wherein the top portion of the depressible latch has a ramped entry edge that slides against an entry protrusion on the receptacle housing as the connector is connected to the receptacle causing the latch to be depressed.

17. The patient monitoring cable of claim 16 wherein the top portion of the depressible latch further has a locking edge that presses against the entry protrusion on the receptacle housing once the connector is fully connected to the receptacle.

18. The patient monitoring cable of claim 14 further comprising a hole in the receptacle housing near the recess allowing insertion of a tool to depress the depressible latch to permit disconnection of the connector from the receptacle.

19. The patient monitoring cable of claim 14 further comprising a button on the receptacle housing near the recess and configured such that pressing the button depresses the depressible latch to permit disconnection of the connector from the receptacle.

20. The patient monitoring cable of claim 14 wherein the notches have a ramped edge that allows the flexible side portions to slide downward on the connector housing when the depressible latch is depressed.

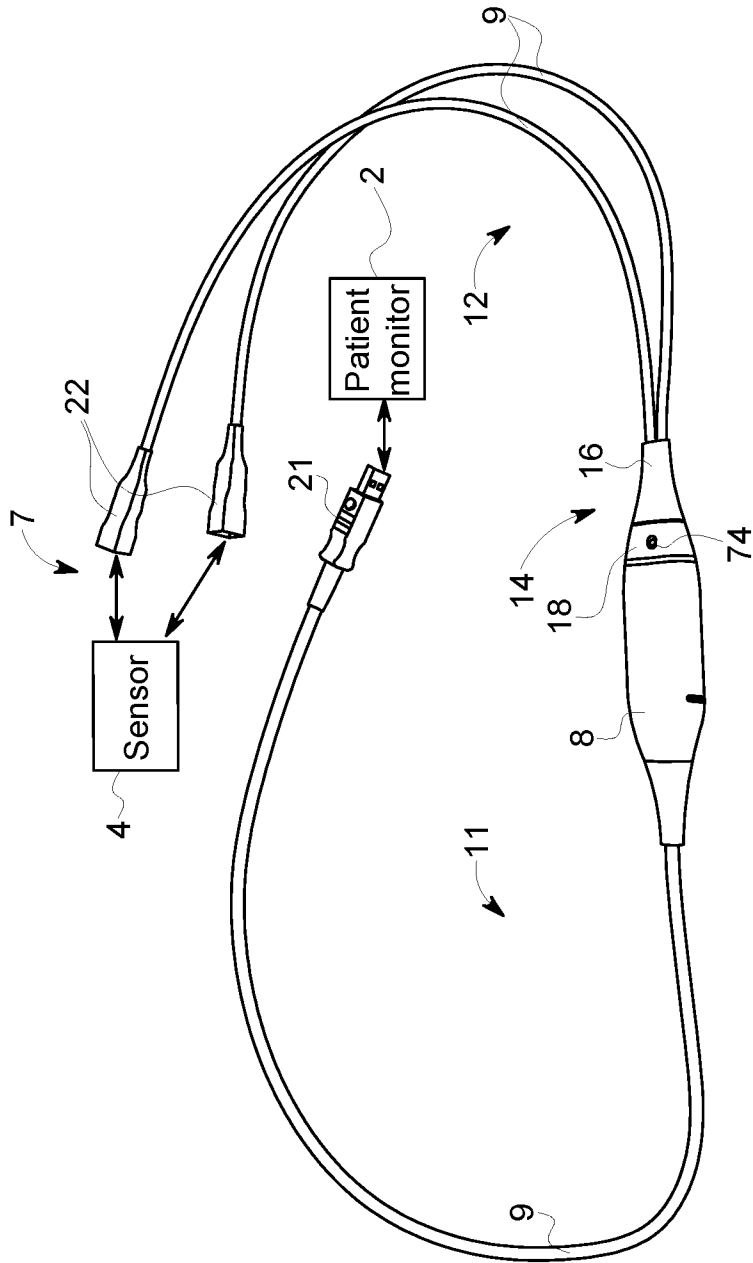


FIG. 1

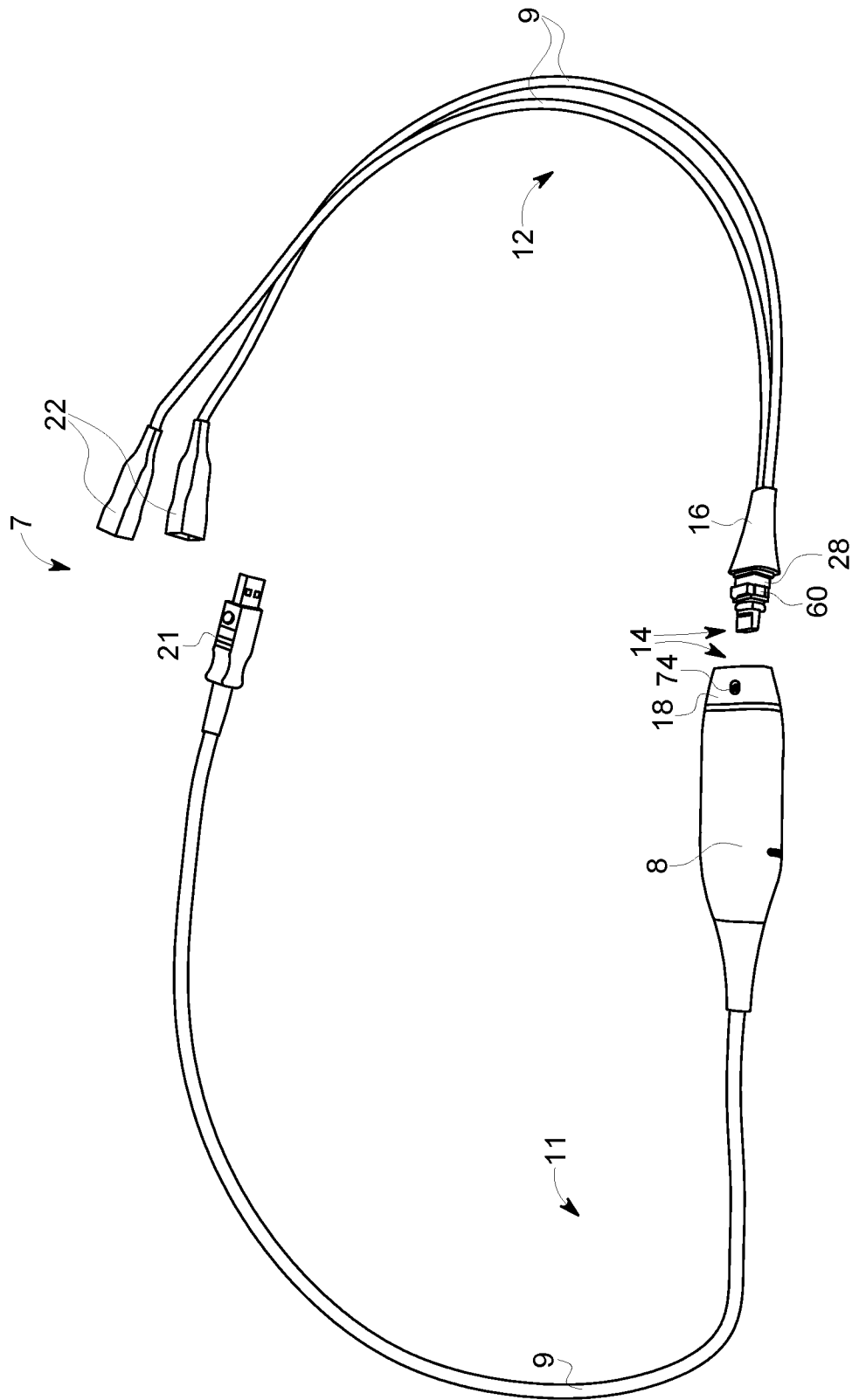


FIG. 2

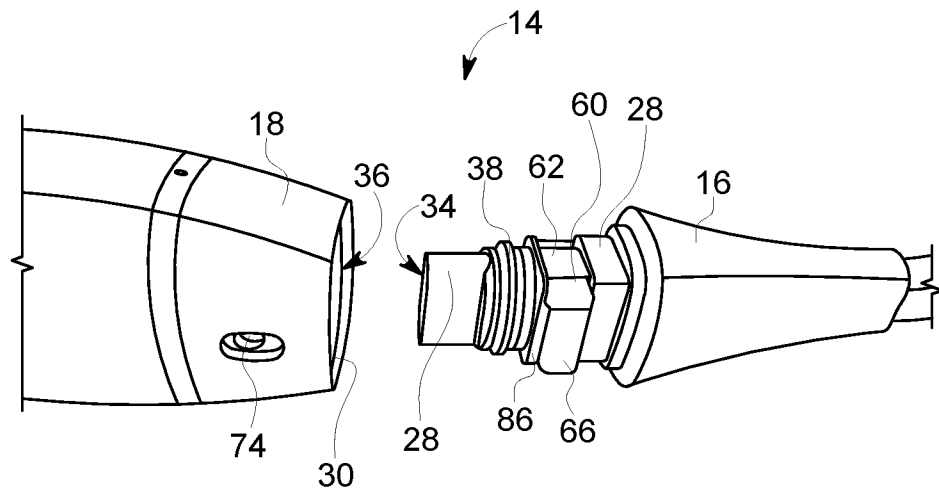


FIG. 3

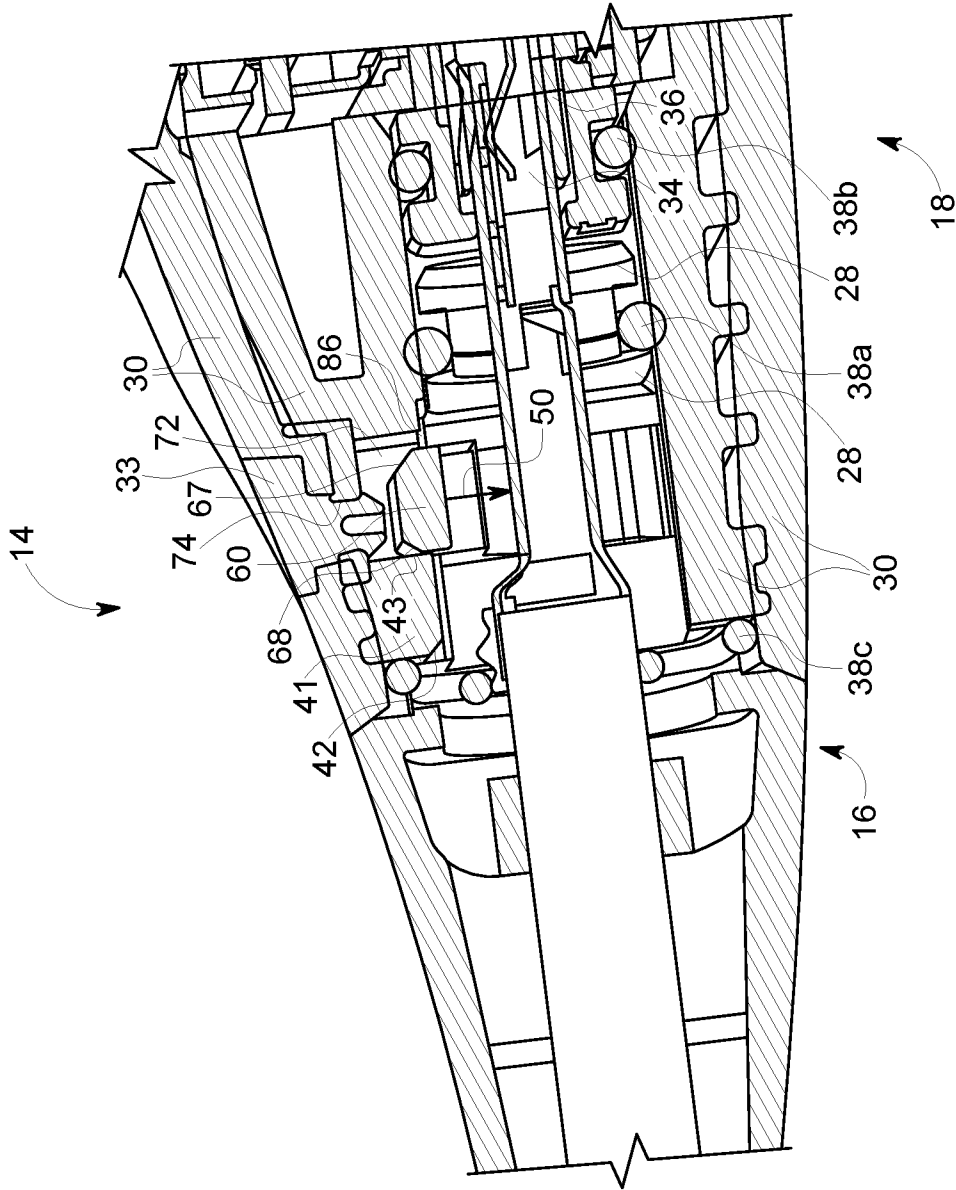


FIG. 4

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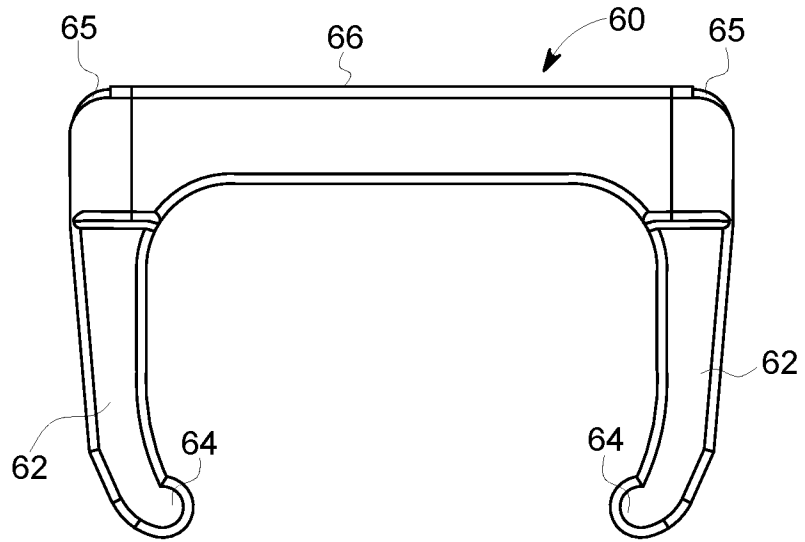


FIG. 5a

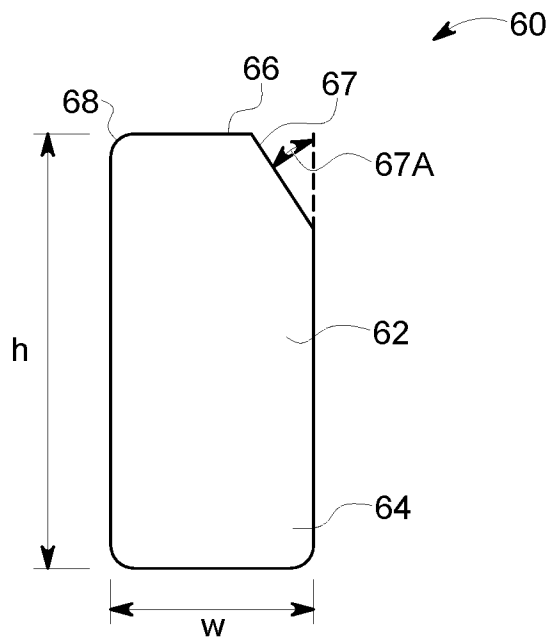


FIG. 5b

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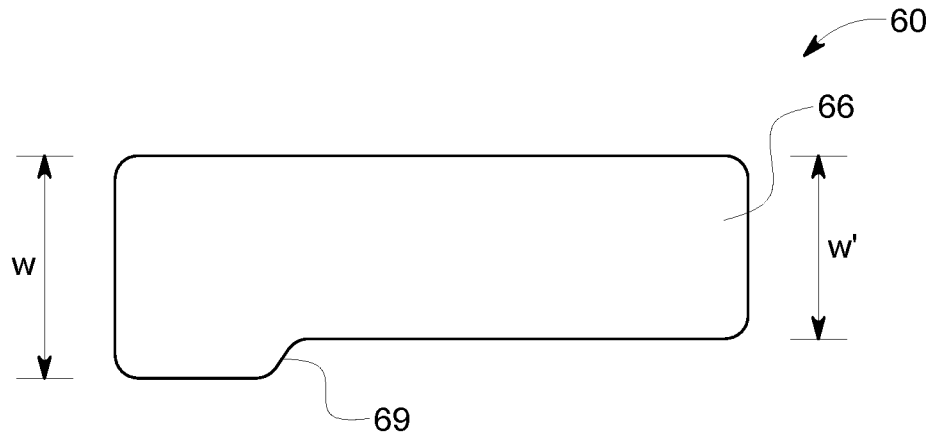


FIG. 5c

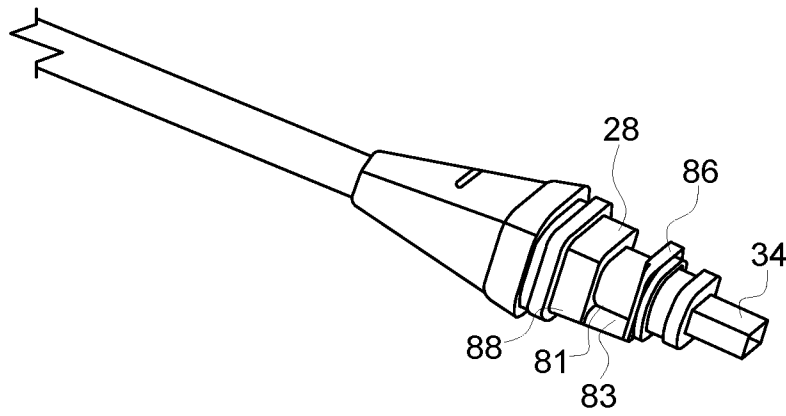


FIG. 6

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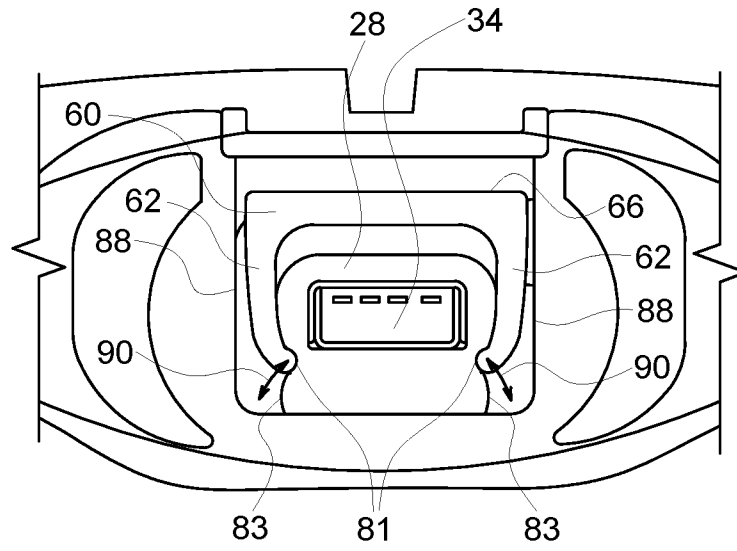


FIG. 7a

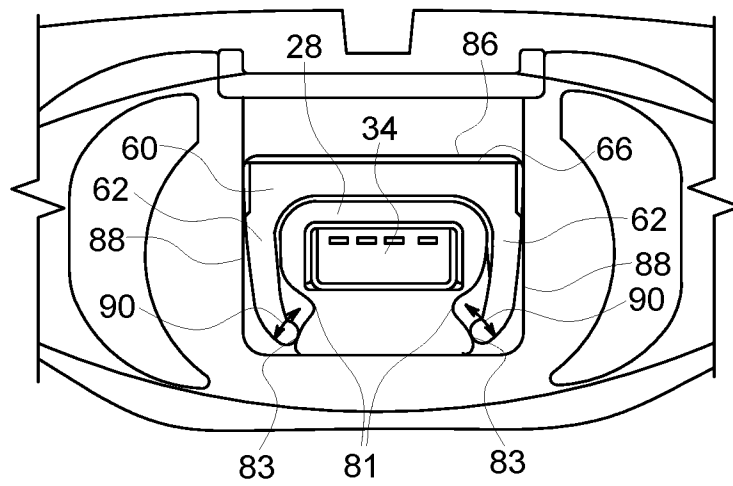


FIG. 7b

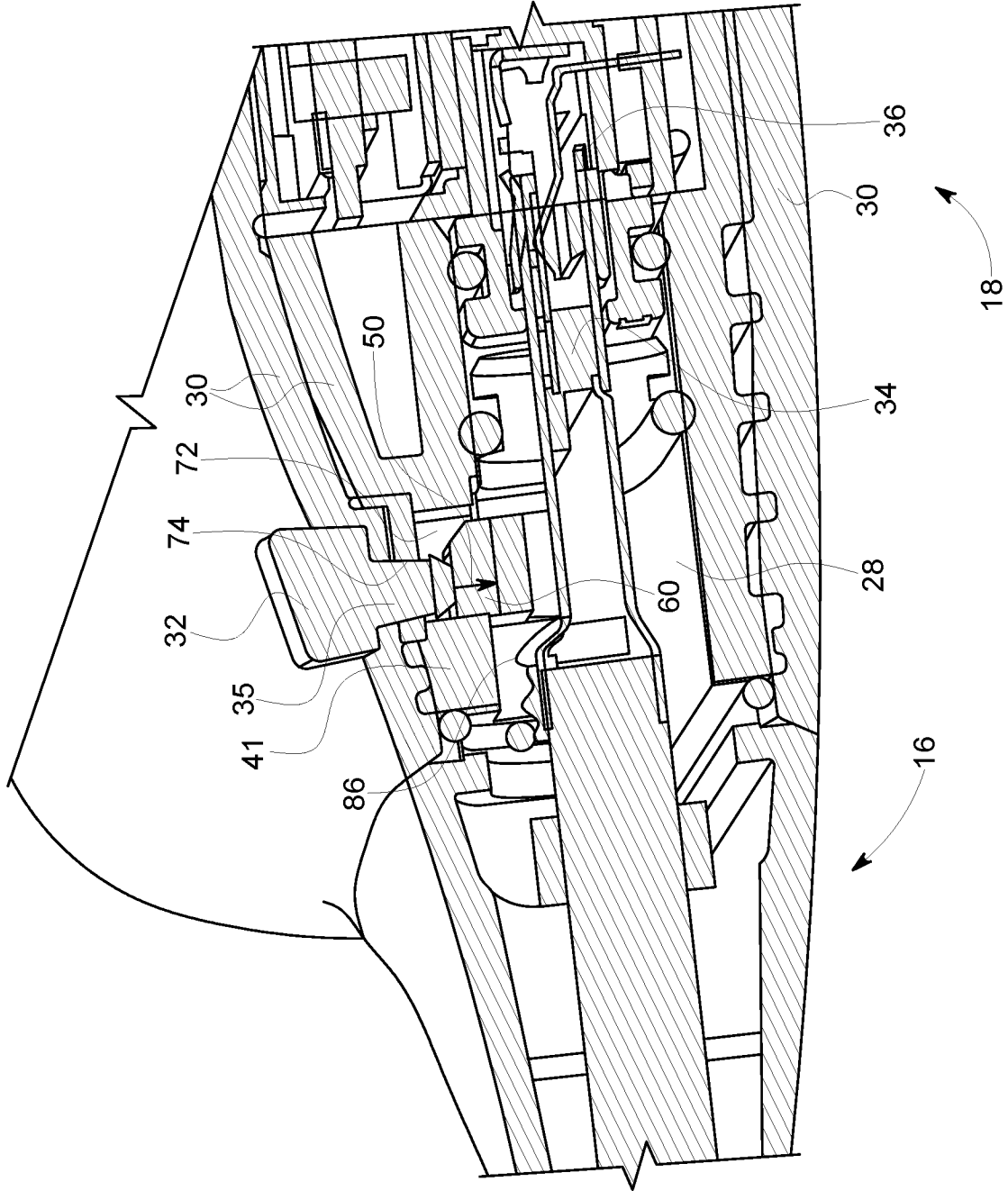


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 16/26639

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H01R 13/24, H01R 31/06, H01R 13/20, H01R 13/627, H01R 13/639 (2016.01)  
 CPC - H01R13/24, H01R31/06, H01R13/20, H01R13/627, H01R13/6273, H01R13/639, H01R2201/12  
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 IPC (8) H01R 13/24, H01R 31/06, H01R 13/20, H01R 13/627, H01R 13/639 (2016.01)  
 CPC: H01R13/24, H01R31/06, H01R13/20, H01R13/627, H01R13/6273, H01R13/639, H01R2201/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
 IPC (8) H01R 13/24, H01R 13/26, H01R 31/06, H01R 13/20, H01R 13/627, H01R 13/639, A61B 5/0428, A61B 5/00 (2016.01)  
 CPC: H01R13/24, H01R13/26, H01R31/06, H01R13/20, H01R13/627, H01R13/6275, H01R13/6273 (keyword limited; terms below)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
 PatBase; Google Patents; Google Scholar; Google Web;  
 Search terms used: Patient monitoring cable transmit transmission electrical power data locking connector latch medical cable depressible connector receptacle receiver press notches securing fastening adapter

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,341,812 A (Allaire et al.) 30 August 1994 (30.08.1994), entire document, especially Fig. 1, 2A, 2B, 2C; col 4, ln 17-19; col 5, ln 41-44; col 4, ln 52-54; col 5, ln 67 to col 6, ln 3; col 6, ln 6-10;	1-20
A	US 2014/0073167 A1 (Al-Ali et al.) 13 March 2014 (13.03.2014), entire document, especially Fig. 5, 8A; para[0037]; para[0039]; para[0042];	1-20
A	US 2002/0031944 A1 (Endo) 14 March 2002 (14.03.2002), entire document, especially Fig. 1, 2; para[0036]; para[0037]; para[0038]; para[0040];	1-20
A	US 2011/0092833 A1 (Farrior) 21 April 2011 (21.04.2011), entire document	1-20
A	US 6,280,213 B1 (Tobler et al.) 28 August 2001 (28.08.2001), entire document	1-20
A	US 2002/0173197 A1 (Endo) 21 November 2002 (21.11.2002), entire document	1-20
A	US 3,354,454 A (Rueger) 21 November 1967 (21.11.1967), entire document	1-20
A	US 2010/0105238 A1 (Good) 29 April 2010 (29.04.2010), entire document	1-20

Further documents are listed in the continuation of Box C.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search  
 10 June 2016

Date of mailing of the international search report  
 07 JUL 2016

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