



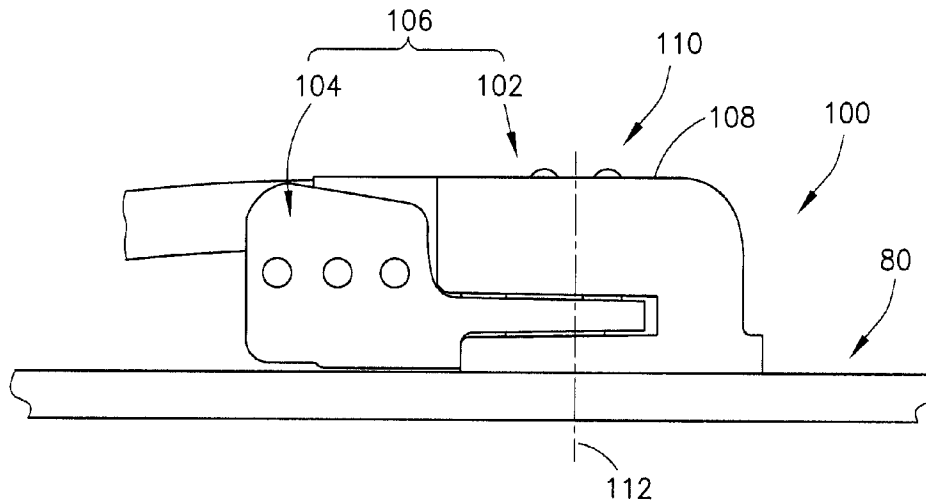
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(54) Titre : CARACTERISTIQUES TACTILES POUR GUIDER L'INTERACTION DE L'UTILISATEUR AVEC LE
CONNECTEUR POUR FLUIDE
(54) Title: TACTILE FEATURES TO GUIDE USER INTERACTION WITH FLUID CONNECTOR



(57) **Abrégé/Abstract:**

A fluid connector for use with an infusion set. The fluid connector includes a housing having a cannula integral with and extending distally from a proximal interior surface of the housing. A proximal exterior surface of the housing has a portion with a tactile feature centered about a longitudinal axis of the cannula to aid a user in connecting the fluid connector with an infusion set base.

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Abstract

A fluid connector for use with an infusion set. The fluid connector includes a housing having a cannula integral with and extending distally from a proximal interior surface of the housing. A proximal exterior surface of the housing has a portion with a tactile feature centered about a longitudinal axis of the cannula to aid a user in connecting the fluid connector with an infusion set base.

TACTILE FEATURES TO GUIDE USER INTERACTION WITH FLUID CONNECTOR

Cross-Reference to Related Application

[0001] This application claims priority under 35 USC §119(e) from U.S. provisional patent application Serial No. 62/773,662 filed on November 30, 2018, the disclosure of which is incorporated herein by reference in its entirety.

Field of the Invention

[0002] The present invention relates generally to infusion devices, and more particularly, to infusion devices to be used in conjunction with an infusion pump in the subcutaneous infusion of insulin and other medicaments.

Background of the Invention

[0003] One mode of insulin infusion treatment includes infusion pump therapy via a catheter, needle, or other type of cannula. Infusion pumps offer the advantages of continuous infusion of insulin, precision dosing, and programmable delivery schedules. Together, these advantages result in more accurate blood glucose control. In this mode of insulin infusion treatment, the infusion pump remains attached to the user and required doses of insulin are delivered to the user via the pump.

[0004] One type of cannula is a catheter, which generally is a tube that can be inserted into the body to permit the administration of fluids. In infusion pump therapy, the types and sizes of the catheter may vary, but generally, the catheter is a thin, flexible tube. In some uses, however, it may be larger and/or rigid. A rigid, hollow, metal needle may also be used in place of a soft plastic catheter.

[0005] One type of conventional infusion set is sold as the Quick-Set® infusion set by Medtronic. In such devices, the infusion pump includes a catheter assembly connected to a pump via a tubing set, and a separate insertion device inserts and/or attaches the catheter assembly into/to a user via an introducer needle provided as part of the infusion set. The infusion set and insertion device can also be combined, as in the Mio® infusion set sold by Medtronic, which is an “all-in-one” design that combines the infusion set and insertion device into one unit.

[0006] Another type of insulin infusion device, known as a “patch pump,” has recently become available. Unlike a conventional infusion pump, a patch pump is an integrated device that combines most or all of the fluid components in a single housing that is adhesively attached to an infusion site, and does not require the use of a separate infusion (tubing) set. A patch pump adheres to the skin, contains insulin (or other medication), and delivers the drug over a period of time, either transdermally, or via an integrated subcutaneous mini-catheter. Some patch pumps communicate with a separate controller device wirelessly (such as one sold under the brand name OmniPod®), while others are completely self-contained.

[0007] A conventional infusion device can include a fluid connector, which may be releasably attached to a base that can be secured to a user’s skin. An infusion pump supplies fluid to a catheter via the fluid connector/base engagement.

[0008] With such devices, however, there are concerns over the difficulty of balancing the force required to disconnect the tubing without pulling the catheter from the user’s skin versus having enough retention force to secure the infusion components for everyday infusion. Another concern is that the separation force needs to be designed such that if a user accidentally snags the extension tubing on an external structure (e.g., a doorknob), the extension tubing will disconnect from the fluid connector without removing the catheter from the user’s skin, thus saving the patient from the need to obtain, connect and re-insert a new infusion set. Yet another concern is the ability of patients, many with reduced tactile sensation, to properly and reliably connect and disconnect fluid connectors from bases.

Summary of Embodiments of the Invention

[0009] Accordingly, it is an aspect of the present invention to provide a fluid connector that is easy to connect and disconnect from a base.

[0010] The foregoing and/or other aspects of the present invention are achieved by providing a fluid connector for use with an infusion set. The fluid connector includes a housing having a cannula integral with and extending distally from a proximal interior surface of the housing. A proximal exterior surface of the housing has a portion with a tactile feature centered about a longitudinal axis of the cannula to aid a user in connecting the fluid connector with an infusion set base.

[0011] The foregoing and/or other aspects of the present invention are also achieved by providing a two-piece fluid connector for use with an infusion set. The fluid connector includes a fluid path portion, including a cannula integral with and extending from a proximal interior surface of the fluid path portion. The fluid connector also includes a latching portion secured to the fluid path portion and having a pair of displaceable arms. Each displaceable arm includes a connector latch disposed at a first, cantilevered end of the arm, and an activation lever disposed at an opposite cantilevered end of the arm. A proximal portion of the activation lever includes a lateral tactile feature to prevent distal slippage of the fluid connector from a user's grasp.

[0012] The foregoing and/or other aspects of the present invention are also achieved by providing a two-piece fluid connector for use with an infusion set. The fluid connector includes a fluid path portion, including a cannula integral with and extending from a proximal interior surface of the fluid path portion. The fluid connector also includes a latching portion secured to the fluid path portion and having a pair of displaceable arms. Each displaceable arm includes a connector latch disposed at a first, cantilevered end of the arm, and an activation lever disposed at an opposite cantilevered end of the arm. A rearmost portion of the activation lever includes a lateral tactile feature to prevent forward slippage of the fluid connector from a user's grasp.

[0013] Additional and/or other aspects and advantages of the present invention will be set forth in the description that follows, or will be apparent from the description, or may be learned by practice of the invention.

Brief Description of the Drawings

[0014] The above and/or other aspects and advantages of embodiments of the invention will be more readily appreciated from the following detailed description, taken in conjunction with the accompanying drawings, in which:

Figs. 1-4 are various views of a related art fluid connector and an associated base;

Fig. 5 is a side elevation view of a fluid connector in accordance with an embodiment of the present invention connected with a base;

Fig. 6 is a top view of the fluid connector of Fig. 5;

Fig. 7 is a perspective view of a fluid path portion of the fluid connector of Fig. 5;

Fig. 8 is a perspective view of a fluid connector in accordance with another embodiment of the present invention;

Figs. 9-17 are respective top views of fluid connectors in accordance with other embodiments of the present invention;

Figs. 18-20 are respective perspective views of fluid connectors in accordance with other embodiments of the present invention;

Figs. 21 and 22 are respective top and perspective views of a fluid connector in accordance with another embodiment of the present invention; and

Fig. 23 is a perspective view of a fluid connector in accordance with another embodiment of the present invention.

Detailed Description of Embodiments of the Present Invention

[0015] Reference will now be made in detail to embodiments of the present invention, which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments described herein exemplify, but do not limit, the present invention by referring to the drawings.

[0016] The embodiments are not intended to be mutually exclusive; features of one embodiment can be combined with other embodiments as long as they do not contradict each other.

[0017] It will be understood by one skilled in the art that this disclosure is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the drawings. The embodiments herein are capable of other embodiments, and capable of being practiced or carried out in various ways. Phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of “including,” “comprising,” or “having” and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless limited otherwise, the terms “connected,” “coupled,” and “mounted,” and variations thereof herein are used broadly and encompass direct and indirect connections, couplings, and mountings. In addition, the terms “connected” and “coupled” and variations thereof are not restricted to physical or mechanical connections or couplings. Further, terms such as “up,” “down,” “bottom,” “top,” “front,” “rear,” “upper,” “lower,” “upwardly,” “downwardly,” and other orientational descriptors are intended to facilitate the description of the exemplary embodiments of the present invention, and are not intended to limit the structure of the

exemplary embodiments of the present invention to any particular position or orientation. Terms of degree, such as “substantially” or “approximately” are understood by those skilled in the art to refer to reasonable ranges around and including the given value and ranges outside the given value, for example, general tolerances associated with manufacturing, assembly, and use of the embodiments. The term “substantially” when referring to a structure or characteristic includes the characteristic that is mostly or entirely.

[0018] Fig. 1 is a perspective view of a related art two-piece fluid connector 10 and associated base 80, such as those found in WO 2013/086463, the disclosure of which is incorporated herein by reference in its entirety. Fig. 2 is an exploded perspective view of the fluid connector 10, Fig. 3 is a bottom view of the fluid connector 10, and Fig. 4 is a cross-sectional view of the fluid connector 10 connected with the base 80. The fluid connector 10 includes two components: a fluid path portion 12, and a latching portion 14. Together, the fluid path portion 12 and the latching portion 14 form a housing 15. The latching portion 14 includes activation levers 16, fluid connector latches 18, and a rigid stop 20.

[0019] The activation levers 16, fluid connector latches 18, and the rigid stop 20 are integrally formed as a unitary structure. Additionally, the activation levers 16 form arms with their respective fluid connector latches 18. These arms are displaceable relative to the fluid path portion 12. The fluid connector latches 18 are displaceable to a latching position in which at least a portion of the fluid connector latch 18 is disposed within the fluid path portion 12. Further, the arms are resiliently biased toward the latching position.

[0020] As best shown in Figs. 1 and 4, a top surface of the fluid connector 10 is rounded to reduce the profile and minimize potential snagging when worn by a user.

[0021] The fluid path portion 12 includes a tubing connector portion 22 for connecting the fluid connector 10 with tubing. The fluid path portion 12 can be secured to the latching portion 14 via snap-fit engagement.

[0022] As shown in Figs. 1, 3 and 4, the fluid path portion 12 has a blunt cannula 22 extending distally from a proximal interior surface of the housing 15. When connected to a corresponding base 80 with a patient cannula 84 that has been inserted into the user's skin, the blunt cannula 22 pierces a septum 86 in a mushroom-shaped head 82 of the base 80 to fluidly connect a pump with the patient cannula 86 on the distal side of the base 80.

[0023] Preferably, the user attaches the fluid connector 10 to the corresponding base 80 by pressing distally (i.e., straight down), forcing the fluid connector latches 18 outward due to contact with the mushroom-shaped head 82 of the base 80, and snapping the fluid connector 10 in place once the fluid connector latches distally bypass the mushroom-shaped head 82 due to the inward resilient bias of the fluid connector latches 18.

[0024] To release the fluid connector 10 from the base 80, the user squeezes the activation levers 16, for example, until they contact the rigid stop 20. This action disengages the fluid connector latches 18 from the mushroom-shaped head 82 of the base 80 by pivoting and displacing the fluid connector latches 18 radially outward sufficiently to clear the mushroom-shaped head 82. Then, the user lifts the fluid connector 10 proximally off the base 80.

[0025] The activation levers 16 can have finger bumps 24 centrally located thereon to aid the user in locating and using the activation levers 16.

[0026] But many users may have reduced tactile function in their fingers, and a small size of the fluid connector 10 can make connection with the base 80 difficult. Additionally, with the rounded surface of the fluid connector 10, a user's fingers can potentially slip when gripping the fluid connector. Further, many fluid connectors on the market connect to a base by sliding horizontally (i.e., substantially parallel to the skin surface) or at a non-vertical angle. Thus, the vertical connection of the fluid connector 10 with the base 80 may be unfamiliar to users. The fluid connector 10 itself does not indicate how to connect the fluid connector 10 to the base 80. Further, the central location of the finger bumps 24 on the rounded activation levers 16 can potentially result in slippage of a user's fingers.

[0027] Fig. 5 is a side elevation view of a fluid connector 100 in accordance with an embodiment of the present invention connected with a base, such as the base 80. Fig. 6 is a top view of the fluid connector 100. Together, a fluid path portion 102 and a latching portion 104 form a housing 106. The latching portion 104 is omitted from Fig. 7, which is a perspective view of the fluid path portion 102. Although not explicitly depicted, like the previously described housing 15, the housing 106 has a blunt cannula 105 extending distally from a proximal interior surface of the housing 106. The cannula 105 has a longitudinal axis 112 shown in Fig. 5.

[0028] As shown in Figs. 5-7, rather than a rounded top surface like that of fluid connector 10, a proximal exterior surface of the fluid path portion 102 has a portion 108 that has a tactile

feature 110. According to one embodiment, the portion 108 is preferably a top flattened portion 108. According to other embodiments, the portion 108 is convex or concave. According to one embodiment, the tactile feature 110 protrudes proximally from the surface 108, and is raised. Preferably, the tactile feature 110 is centered about the longitudinal axis 112 of the cannula 105. Such a tactile feature 110 provides an aid to the user in connecting the fluid connector 100 to the base 80 because it tactilely informs the user of the position of the longitudinal axis of the cannula and therefore, informs the user of the location to center the fluid connector 10 over the base 80 and to press down on the fluid connector 10 for making the connection with the base 80.

[0029] Although the tactile feature 110 is preferably raised, according to some embodiments, the tactile feature 110 can be recessed. Further, even if the tactile feature 110 is raised to protrude proximally from the portion 108, preferably, the height profile of the fluid connector 100 is at least not greater than the height profile of the fluid connector 10. Such a configuration provides a profile that can reduce snagging in comparison to the fluid connector 10.

[0030] According to one embodiment, as shown in Figs. 5-7, the tactile feature 110 is three bumps arranged in a triangle centered about the longitudinal axis 112 of the cannula. In Fig. 8, the tactile feature 110 is also three bumps arranged in a triangle centered about the longitudinal axis 112 of the cannula, but the orientation of the triangle is inverted with respect to the orientation of the triangle in Fig. 7.

[0031] Figs. 9-17 are respective top views of fluid connectors in accordance with other embodiments of the present invention. In each of these embodiments, the tactile feature is centered about the longitudinal axis 112 of the cannula. In Fig. 9, the tactile feature 110 is a ring, and in Fig. 10, the tactile feature is a plurality of concentric rings. In Fig. 11, the tactile feature 110 is a cruciform or cross-shape or cross, and in Fig. 12, the tactile feature 110 is an "X." The tactile feature 110 in Fig. 13 is crosshairs.

[0032] In Figs. 14 and 15, the tactile feature 110 is a plurality of linear ribs. In Fig. 14, the linear ribs are oriented to run front to back of the housing 106, and in Fig. 15, the linear ribs are oriented to run laterally. One skilled in the art will appreciate that other orientations of the linear ribs are possible without departing from the present invention's scope.

[0033] In Figs. 16 and 17, the tactile feature 110 is a plurality of arcuate ribs. In Fig. 16, the arcuate ribs are oriented in the same direction, and in Fig. 17, the arcuate ribs are oriented in

different directions. According to some embodiments, the tactile features 110 of Figs. 9-17 are raised, and in some embodiments, the tactile features of Figs. 9-17 are recessed.

[0034] As shown in Fig. 18, the activation lever 114 of the latching portion 104 includes a lateral tactile feature 116, which is disposed on a proximal portion of the activation lever 114. The lateral tactile feature 116 helps prevent distal slippage of the fluid connector 100 from the user's grasp. Preferably, the lateral tactile feature 116 is raised (extends radially outward, although according to some embodiments, the lateral tactile feature 116 is recessed from an outer surface of the activation lever 114. The lateral tactile feature 116 can also aid a user in lifting the fluid connector off the base 80, particularly if the lateral tactile feature is raised. According to one embodiment, the lateral tactile feature 116 is a plurality of laterally cantilevered posts 116. According to one embodiment, the plurality of laterally cantilevered posts 116 include a plurality of laterally cantilevered polygons, such as those shown in Fig. 18. According to another embodiment (not shown), the plurality of laterally cantilevered posts 116 include a plurality of laterally cantilevered rectangular posts.

[0035] As shown in Fig. 19, the lateral tactile feature 116 can include a plurality of rounded bumps 116, and as shown in Fig. 20, the lateral tactile feature 116 can include a plurality of cantilevered cylindrical posts 116.

[0036] Figs. 21 and 22 illustrate an embodiment in which the activation levers 114 each include a lateral tactile feature 118 disposed at respective rearmost portions of the activation levers 114. According to one embodiment, the lateral tactile feature 118 includes an outwardly protruding, or raised vertical ridge 118 to prevent forward slippage of the fluid connector 100 from the user's grasp. One skilled in the art will appreciate shapes other than a vertical ridge can be employed without departing from the present invention's scope. For example, some embodiments include a recessed tactile feature 118.

[0037] In Fig. 21, the unbiased or resting position of the activation lever 16 of the related art fluid connector 10 is shown in dotted lines. As can be seen in Fig. 21, the unbiased position of the activation levers 114 is splayed outward with respect to the unbiased position of the related art activation levers 16. In addition, the rigid stop 120 is laterally wider than the rigid stop 20 of the related art fluid connector 10, and the activation levers 114 have laterally inward protrusions 122. The wider rigid stop 120 and the laterally inward protrusions 122 combine to provide an

inwardly squeezed or releasing position in which the activation levers are approximately parallel, or slightly beyond parallel. In comparison to a V-shaped releasing position with the related art activation levers 16, the new configuration also helps prevent forward slippage of the fluid connector 100 from the user's grasp.

[0038] As shown in Fig. 23, the fluid connector 100 can include a combination of features for aiding positioning of the fluid connector and preventing slippage from a user's grasp. For example, the fluid connector can include a flattened portion 108 with a tactile feature 110 disposed thereon, and the activation levers 114 can include laterally cantilevered polygons 116 and a vertical ridge 118. In some embodiments, some or all of the tactile features 110, 114, and 116 are recessed. In addition, at rest, the activation levers 114 can be splayed laterally outwardly in comparison to the related art activation levers 16. Further, the portion 108 can be concave or convex in some embodiments. One skilled in the art will appreciate that other combinations of features can be employed without departing from the present invention's scope.

[0039] Although only a few embodiments of the present invention have been shown and described, the present invention is not limited to the described embodiments. It will be appreciated by those skilled in the art that other changes may also be made to the disclosed embodiments without departing from the scope of the invention. In addition, any of the embodiments, features and/or elements disclosed herein may be combined with one another to form various additional combinations not specifically disclosed, as long as the embodiments, features and/or elements being combined do not contradict each other. All such changes and combinations are considered to be within the scope of the invention as defined by the appended claims and their equivalents

Claims

1. A fluid connector for use with an infusion set, the fluid connector comprising:

a housing having a cannula integral with and extending distally from a proximal interior surface of the housing;

wherein a proximal exterior surface of the housing has a portion with a tactile feature centered about a longitudinal axis of the cannula to aid a user in connecting the fluid connector with an infusion set base.
2. The fluid connector according to claim 1, wherein the tactile feature comprises three bumps arranged in a triangle centered about the longitudinal axis of the cannula.
3. The fluid connector according to claim 1, wherein the tactile feature comprises a ring centered about the longitudinal axis of the cannula.
4. The fluid connector according to claim 1, wherein the tactile feature comprises a plurality of concentric rings centered about the longitudinal axis of the cannula.
5. The fluid connector according to claim 1, wherein the tactile feature comprises a cross centered about the longitudinal axis of the cannula.
6. The fluid connector according to claim 1, wherein the tactile feature comprises an "X" centered about the longitudinal axis of the cannula.
7. The fluid connector according to claim 1, wherein the tactile feature comprises crosshairs centered about the longitudinal axis of the cannula.

8. The fluid connector according to claim 1, wherein the tactile feature comprises a plurality of linear ribs centered about the longitudinal axis of the cannula.

9. The fluid connector according to claim 1, wherein the tactile feature comprises a plurality of arcuate ribs centered about the longitudinal axis of the cannula.

10. The fluid connector according to claim 1, wherein the housing comprises:

a fluid path portion, including the cannula; and

a latching portion secured to the fluid path portion and having a pair of displaceable arms, each arm comprising:

a connector latch disposed at a first, cantilevered end of the arm; and

an activation lever disposed at an opposite cantilevered end of the arm, wherein a proximal portion of the activation lever includes a lateral tactile feature to prevent distal slippage of the fluid connector from a user's grasp.

11. The fluid connector according to claim 10, wherein a rearmost portion of the activation lever includes a second lateral tactile feature to prevent forward slippage of the fluid connector from a user's grasp.

12. A two-piece fluid connector for use with an infusion set, the fluid connector comprising:

a fluid path portion, comprising a cannula integral with and extending from a proximal interior surface of the fluid path portion; and

a latching portion secured to the fluid path portion and having a pair of displaceable arms, each arm comprising:

a connector latch disposed at a first, cantilevered end of the arm; and

an activation lever disposed at an opposite cantilevered end of the arm, wherein a proximal portion of the activation lever includes a lateral tactile feature to prevent distal slippage of the fluid connector from a user's grasp.

13. The fluid connector according to claim 12, wherein the lateral tactile feature comprises a plurality of laterally cantilevered posts.

14. The fluid connector according to claim 13, wherein the laterally cantilevered posts are substantially rectangular.

15. The fluid connector according to claim 13, wherein the laterally cantilevered posts are substantially cylindrical.

16. The fluid connector according to claim 13, wherein the laterally cantilevered posts are comprise laterally cantilevered polygons.

17. A two-piece fluid connector for use with an infusion set, the fluid connector comprising:
a fluid path portion, comprising a cannula integral with and extending from a proximal interior surface of the fluid path portion; and
a latching portion secured to the fluid path portion and having a pair of displaceable arms, each arm comprising:
a connector latch disposed at a front, cantilevered end of the arm; and
an activation lever disposed at rear cantilevered end of the arm, wherein a rearmost portion of the activation lever includes a lateral tactile feature to prevent forward slippage of the fluid connector from a user's grasp.

18. The fluid connector according to claim 17, wherein the lateral tactile feature comprises a vertical ridge.

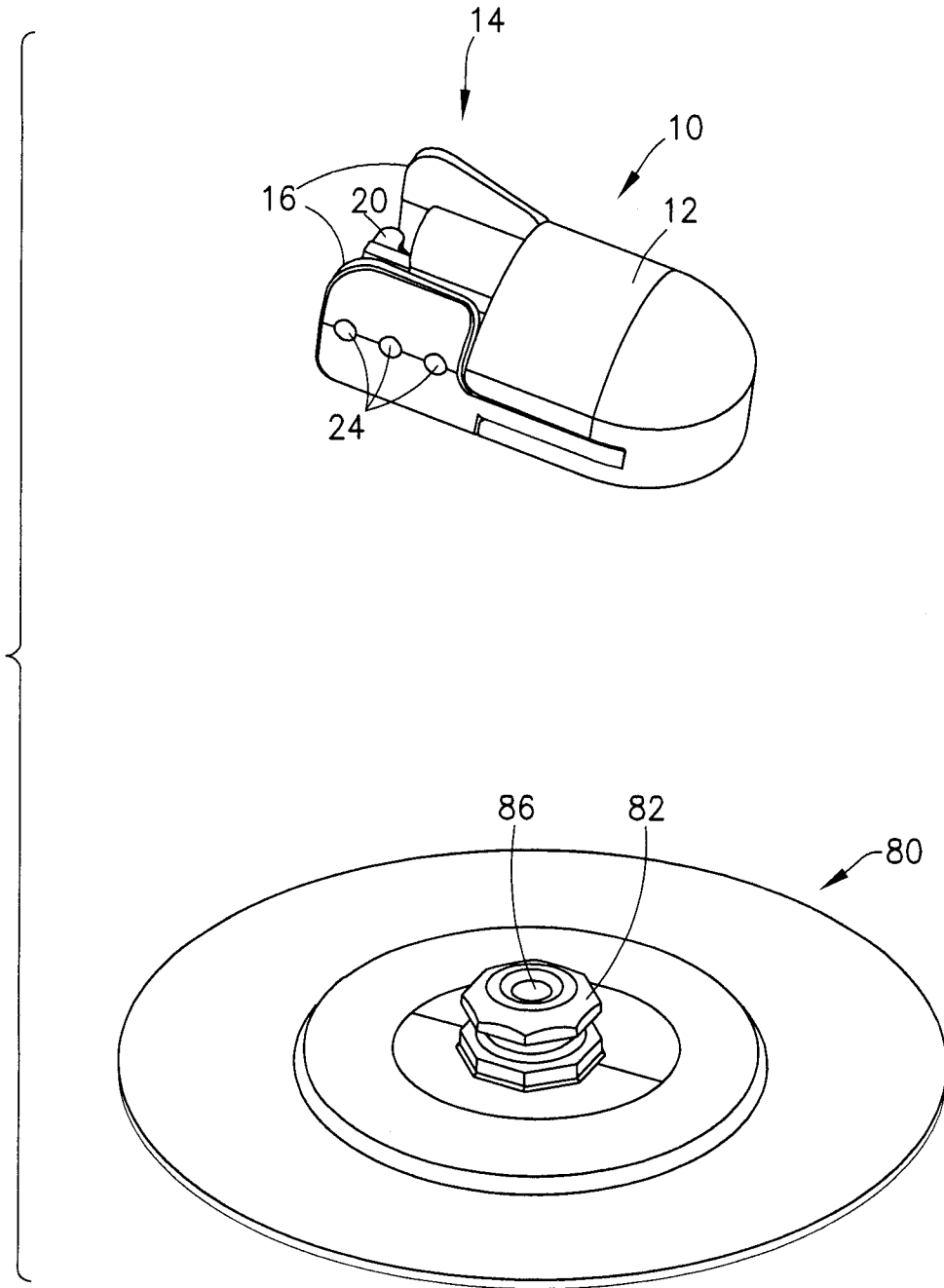


FIG. 1
(RELATED ART)

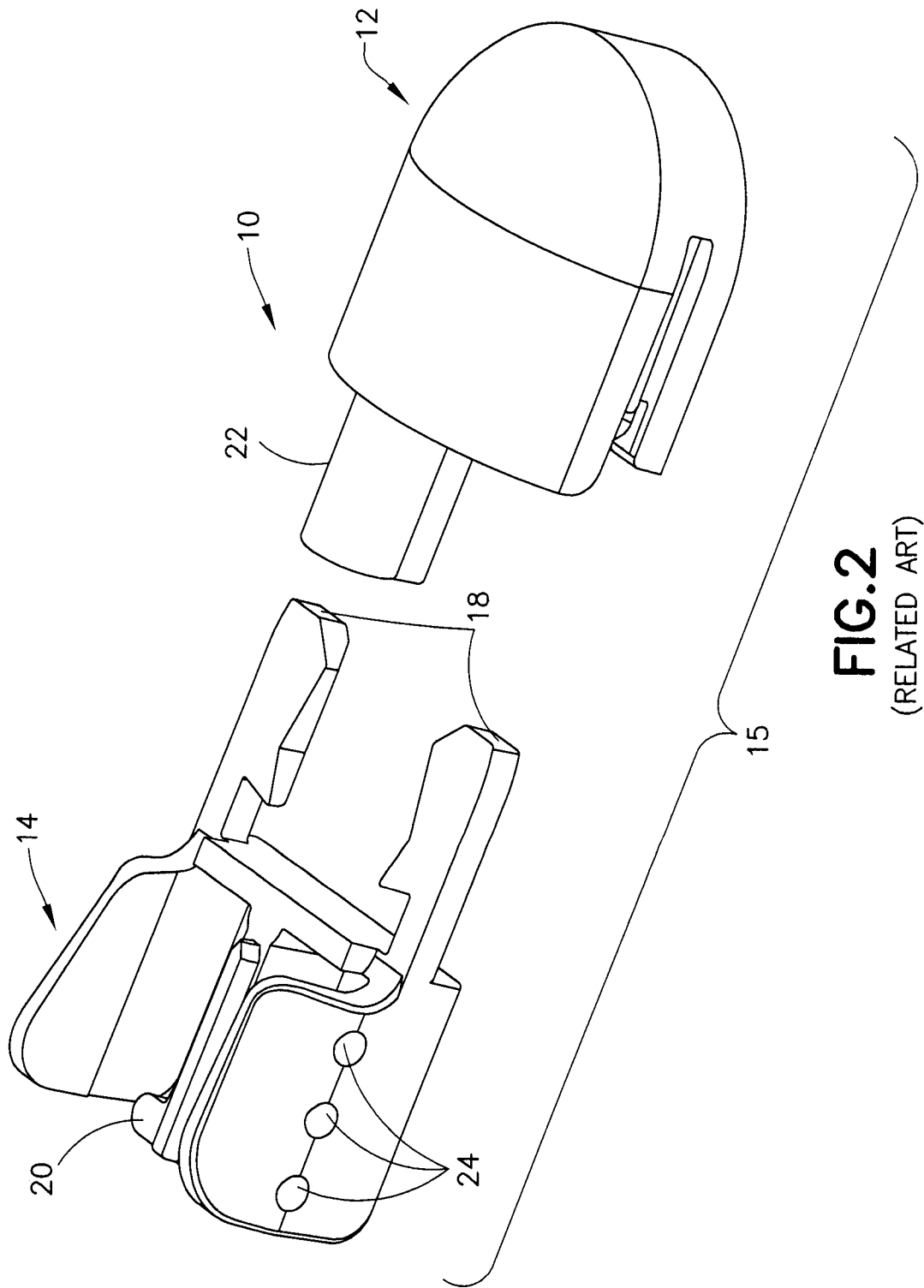


FIG.2
(RELATED ART)

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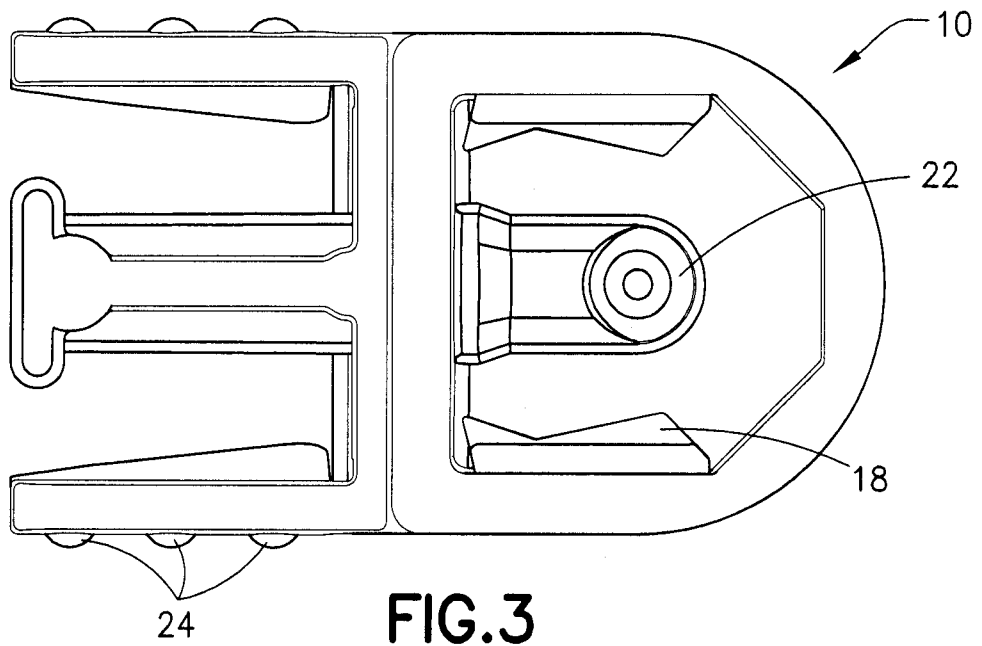


FIG. 3
(RELATED ART)

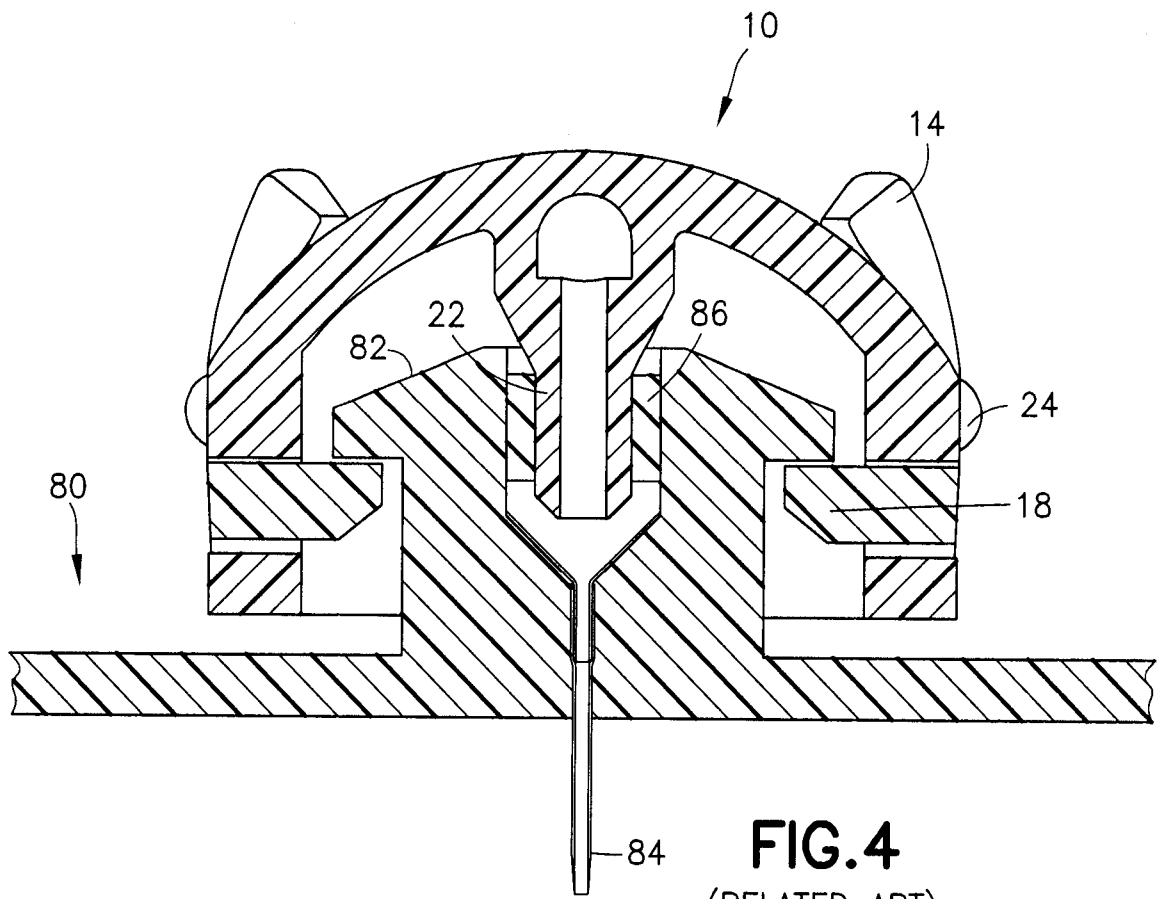
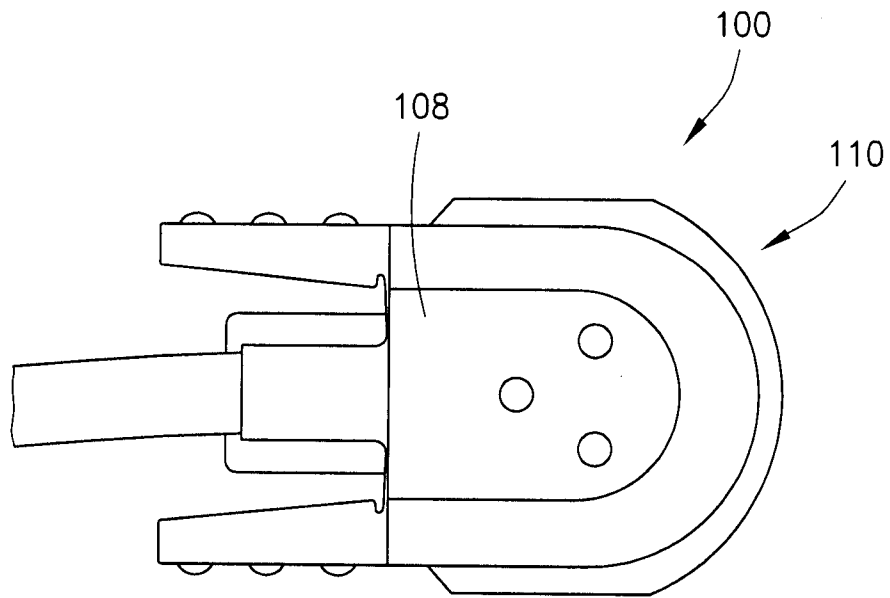
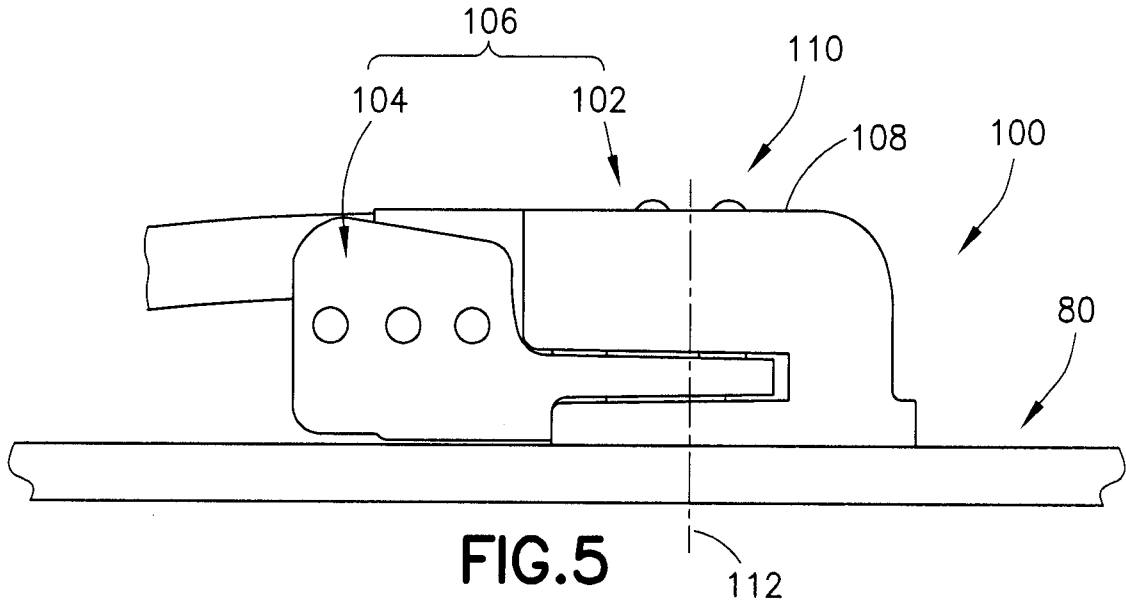


FIG. 4
(RELATED ART)



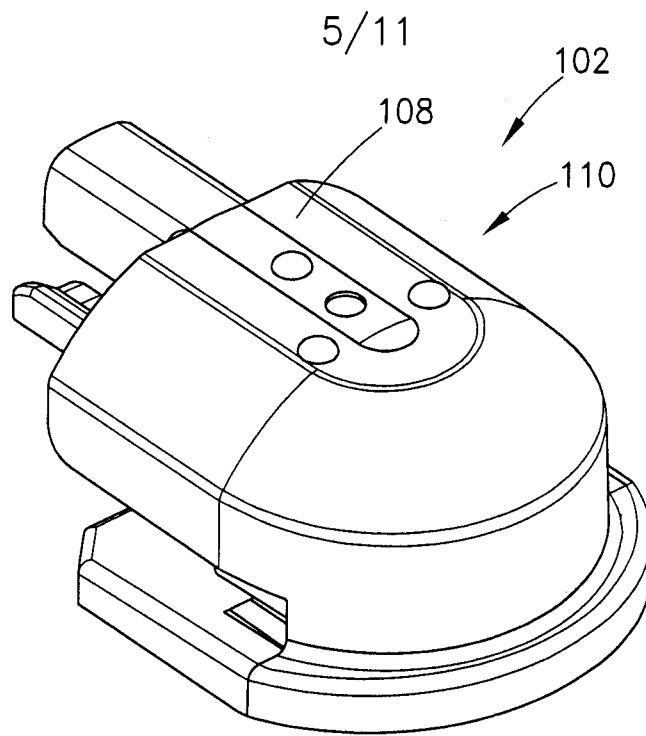


FIG. 7

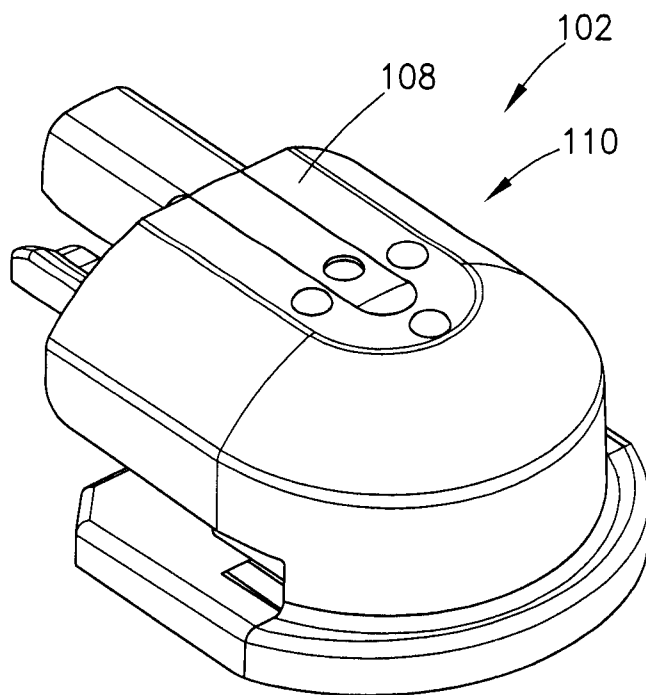


FIG. 8

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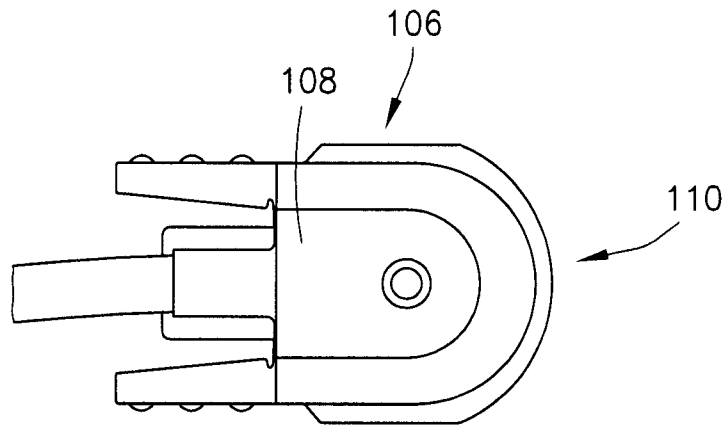


FIG. 9

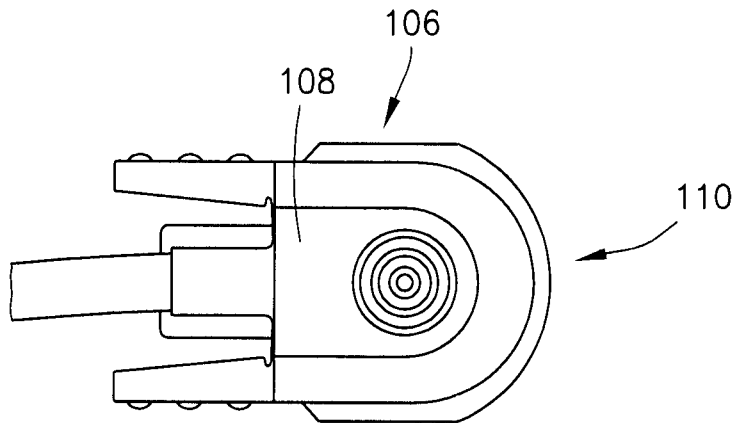


FIG. 10

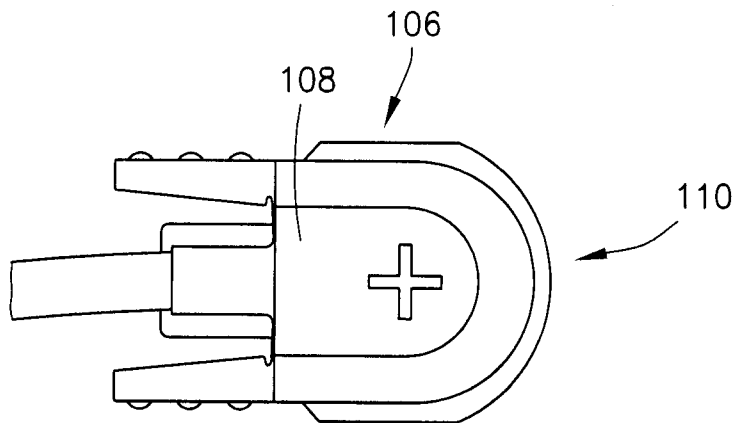


FIG. 11

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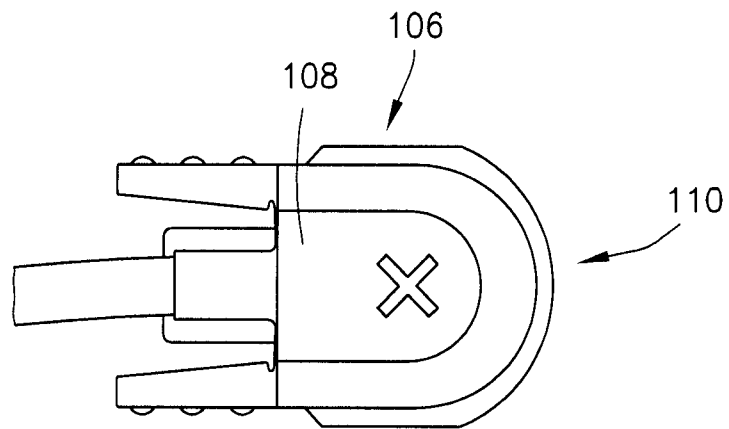


FIG. 12

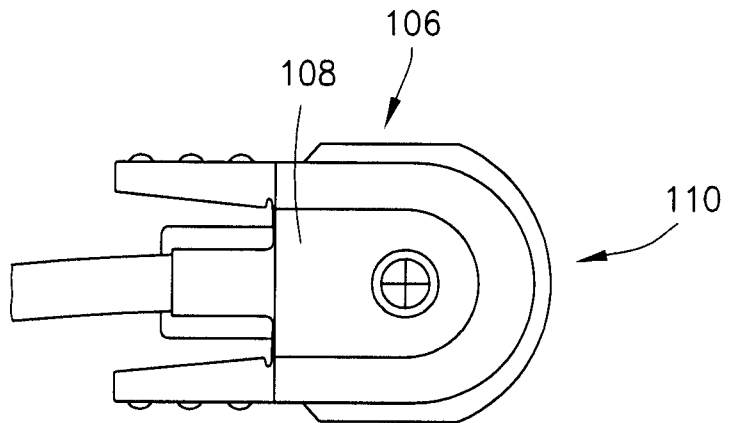


FIG. 13

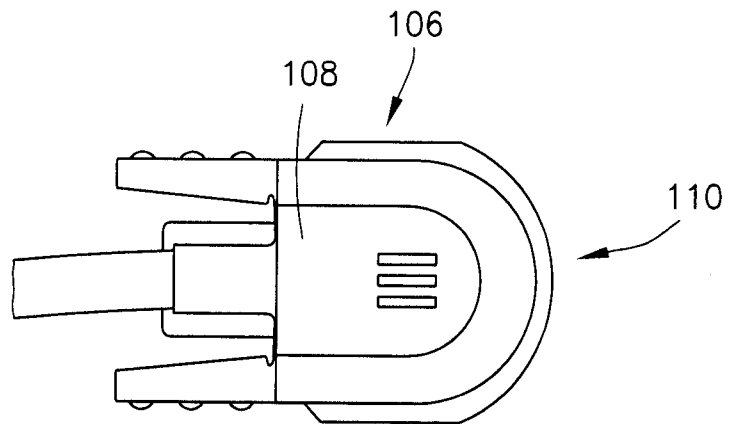
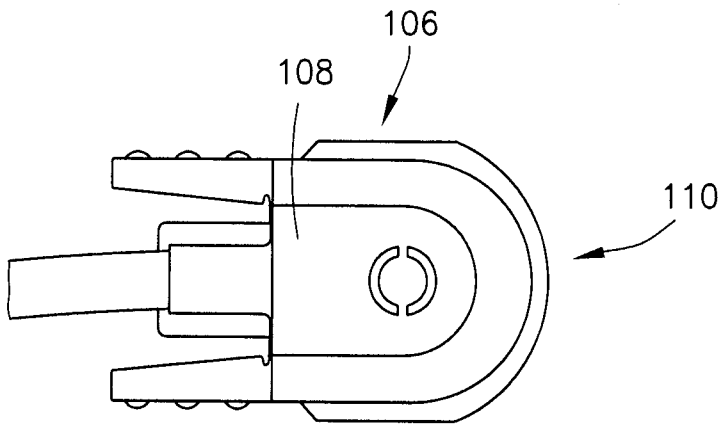
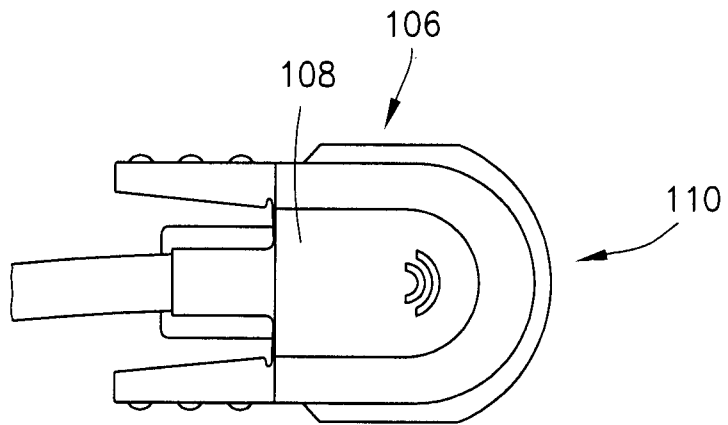
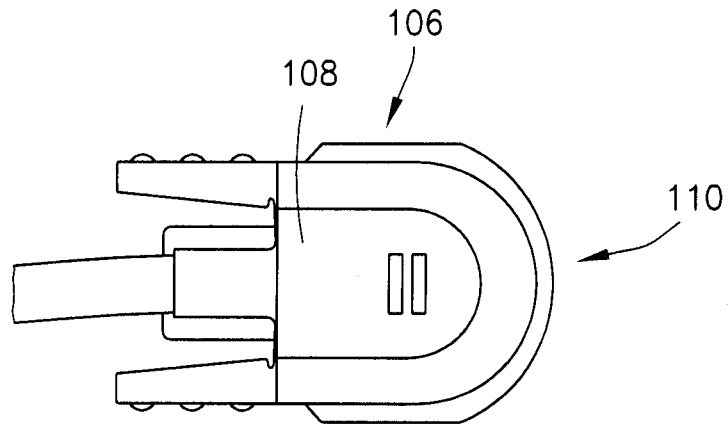


FIG. 14

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9/11

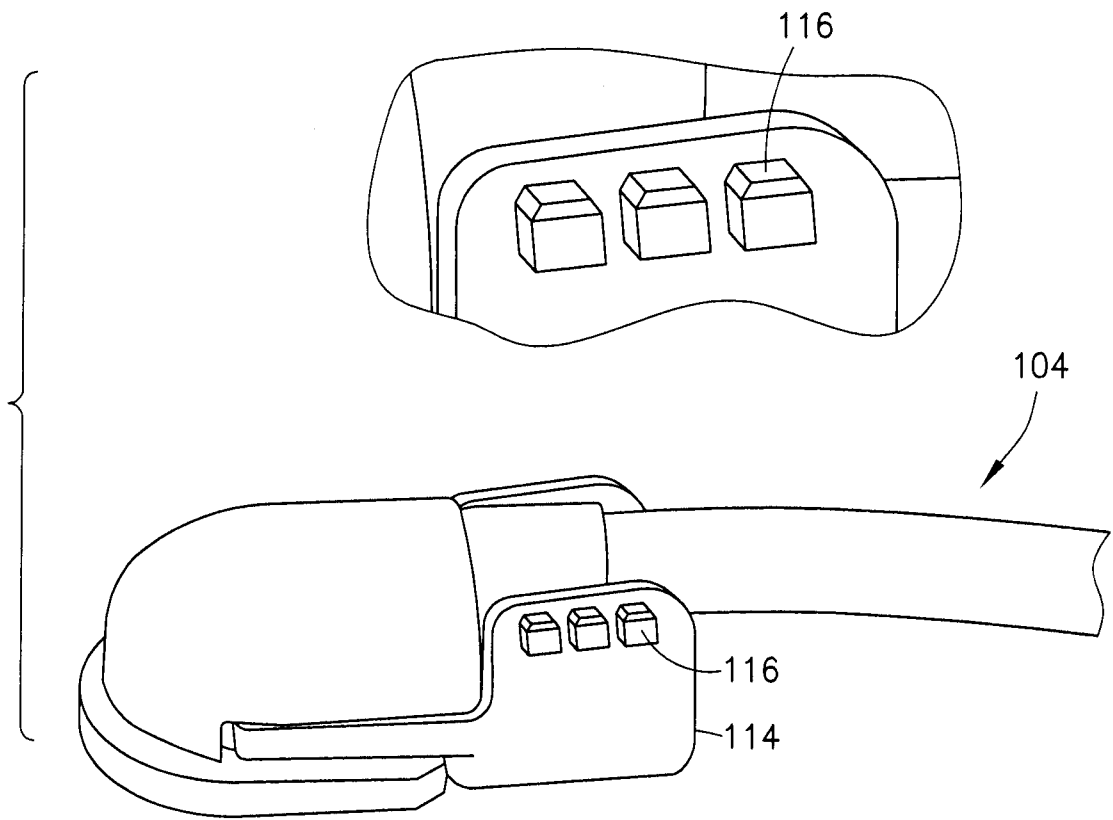


FIG. 18

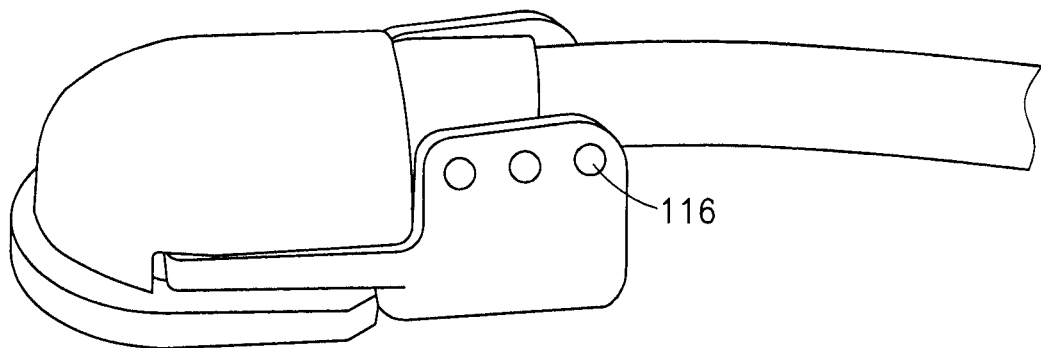


FIG. 19

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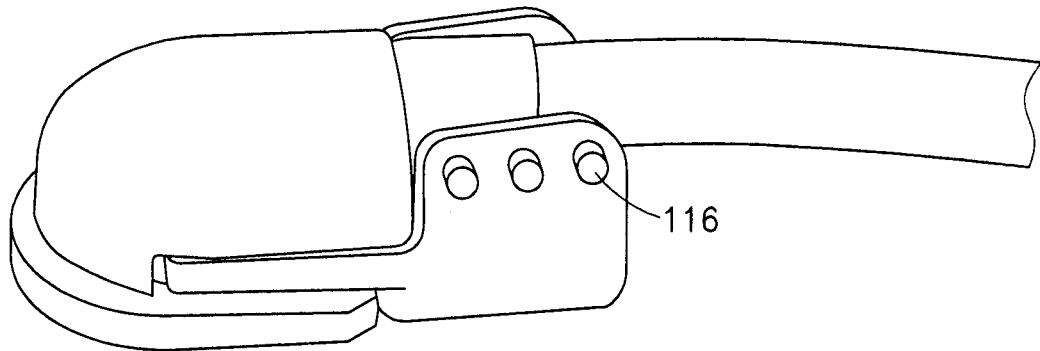


FIG. 20

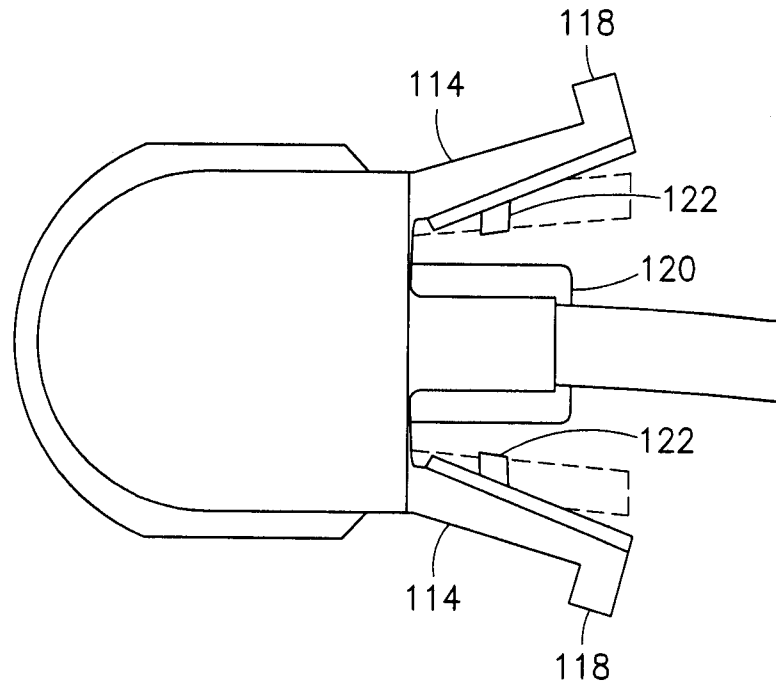


FIG. 21

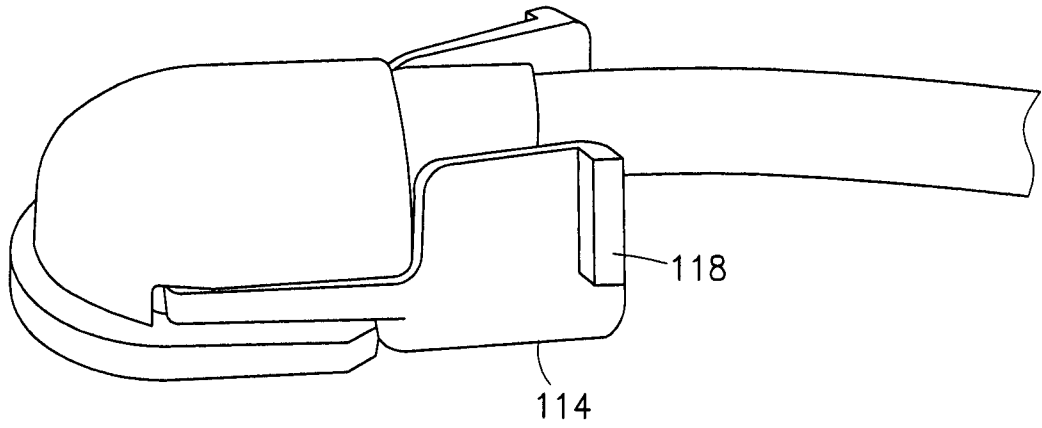


FIG. 22

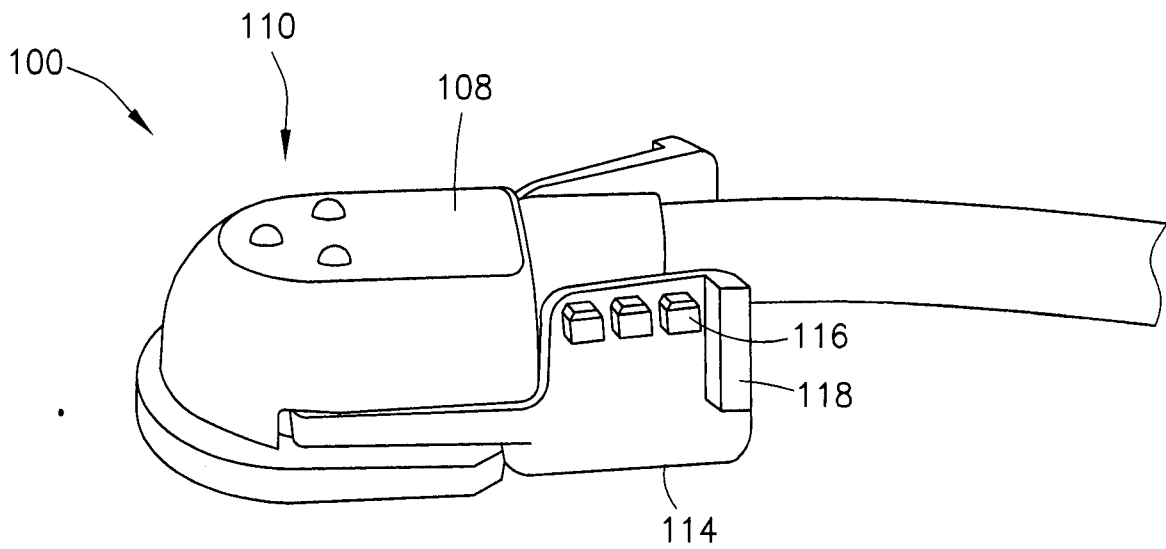


FIG. 23

