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(54) **Title:** RELEASABLY ENGAGING HIGH DEFINITION MULTIMEDIA INTERFACE PLUG

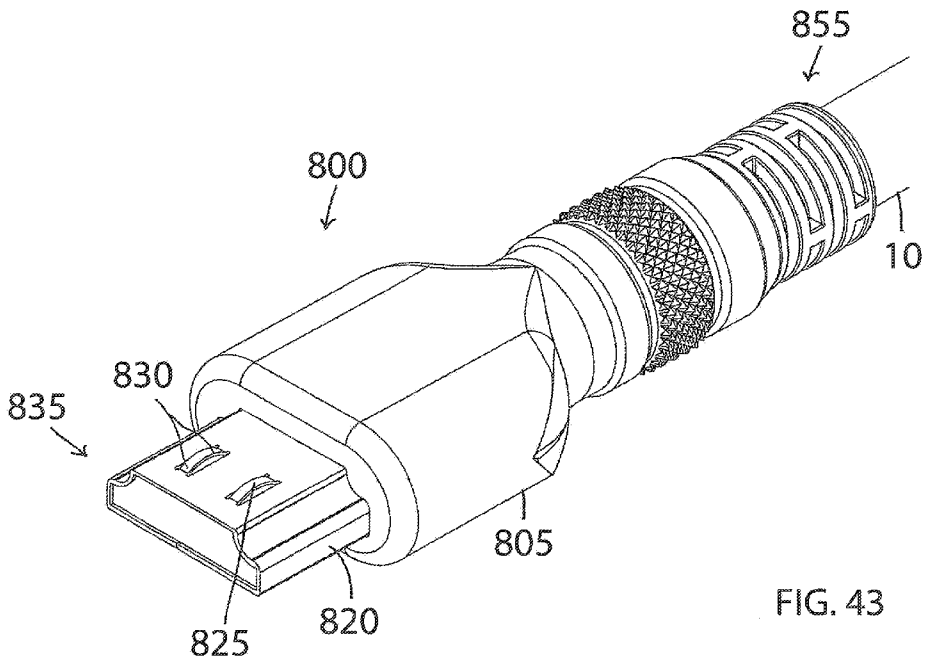


FIG. 43

(57) **Abstract:** A releasably engaging plug comprises a plug body having an extension, the outer surface of the extension having at least one projection thereon. The projection is configured to releasably engage at least one spring biased tab of a mating receptacle upon insertion of the extension into the receptacle. Engagement of the spring biased tab with the projection increases the mechanical friction fit between the mating components.

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RELEASABLY ENGAGING HIGH DEFINITION MULTIMEDIA INTERFACE PLUG

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of and claims priority from my co-pending U.S. Application No. 11/696,716 filed April 4, 2007 and entitled LOCKING HIGH DEFINITION MULTIMEDIA INTERFACE PLUG, incorporated herein by reference.

FIELD OF THE INVENTION

[0001] The present invention relates generally to high definition cable communications. More particularly, the present invention relates to a securely fastening high definition multimedia interface (HDMI) connector and related method of use.

BACKGROUND OF THE INVENTION

[0002] The onset of High Definition Televisions have led to the production of peripheral high definition (HD) components such as cable boxes, DVD players and mass storage devices that provide stored HD multimedia content. The HD components therefore necessitated the use of cables that are capable of transmitting data such as the digital visual interface (DVI) cable. The DVI cable had a shortfall of not providing an audio signal requiring an additional set of audio cables. The answer to the clutter of cables was to provide a new cable known as HIGH DEFINITION MULTIMEDIA INTERFACE that replaces the previous DVI cable. As shown in FIGS. 1-4, a standard HIGH DEFINITION MULTIMEDIA INTERFACE cable connector 1000 is commonly held onto a typical HIGH

DEFINITION MULTIMEDIA INTERFACE receptacle 20 via friction interference fittings 22, unlike the previous DVI connectors that utilized two screws to secure the connectors. Moreover, a standard HIGH DEFINITION MULTIMEDIA INTERFACE receptacle 20 generally has fittings such as spring biased tabs 22 positioned in openings 25, wherein the tabs 22 are configured to fit into corresponding detents 1030 on an extension 1020 of a typical HIGH DEFINITION MULTIMEDIA INTERFACE connector plug 1000 to provide some interference between mated components and further assist in the retention of the standard HIGH DEFINITION MULTIMEDIA INTERFACE connector plug 1000 as mated within a typical HIGH DEFINITION MULTIMEDIA INTERFACE receptacle 20. However, the common configuration of standard HIGH DEFINITION MULTIMEDIA INTERFACE connector plugs 1000 is susceptible to poor performance due to structural and operable deficiencies; the standard plugs 1000 tend to come loose. Although the common spring biased tabs 22 provide some resistance to unwanted retraction of standard HIGH DEFINITION MULTIMEDIA INTERFACE connector plugs 1000, ordinary bumping of the connector plugs 1000 or associated cables while cleaning, dusting or moving electrical devices often loosens the standard HIGH DEFINITION MULTIMEDIA INTERFACE connectors 1000 from proper mating positions with typical HIGH DEFINITION MULTIMEDIA INTERFACE receptacles 20. Moreover, the increasing use of wall mounted flat screen television, out of necessity or for the sake of aesthetics, has led to the increasing placement of HIGH DEFINITION MULTIMEDIA INTERFACE receptacles 20 that face downward. The downward orientation of the HIGH DEFINITION MULTIMEDIA INTERFACE receptacles 20 can further contribute to loose connections and signal loss if there is not sufficient friction between the connector plugs 1000 and receptacles 20 to maintain contact as the associated standard HIGH DEFINITION MULTIMEDIA INTERFACE cable connectors 1000 fall of and become unplugged or otherwise disconnected due to the pull of gravity. Accordingly, a need exists for providing a releasably locking and/or releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug.

SUMMARY OF THE INVENTION

[0003] The present invention provides an apparatus and method for use with HIGH DEFINITION MULTIMEDIA INTERFACE cable connections that offers improved reliability.

[0004] A first aspect of the invention provides a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug comprising: a connector body having at least one opening; an actuator operable with the connector body; a locking tab configured to be moved by the actuator; a first position of the actuator wherein the locking tab is biased to protrude from the opening of the body; and, a second position of the actuator, wherein the locking tab does not protrude from the body, and, wherein the actuator is operable to move the locking tab between the first position and the second position.

[0005] A second aspect of the invention provides a locking high definition multimedia interface plug comprising: a locking tab movably locatable within an opening of a plug body; and an actuator, mounted on the plug body, wherein the actuator is configured to move the locking tab into a locked position in contact with a typical opening of a standard HIGH DEFINITION MULTIMEDIA INTERFACE receptacle, and wherein the actuator is configured to move the locking tab into an unlocked position not in contact with a typical opening of a standard HIGH DEFINITION MULTIMEDIA INTERFACE receptacle.

[0006] A third aspect of the invention provides a locking HIGH DEFINITION MULTIMEDIA INTERFACE cable connector comprising: locking HIGH DEFINITION MULTIMEDIA INTERFACE cable connector comprising: a plug body having an opening; a lock button operably associated with the plug body; an actuator operably associated with the lock button; and a locking tab operably associated with the actuator, wherein the actuator is movable between a first position wherein the associated locking tab protrudes from the opening and

a second position wherein the associated locking tab is located within the opening so as not to protrude from the opening.

[0007] A fourth aspect of the invention provides a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug comprising: a body configured to be inserted into a high definition multimedia interface receptacle having openings on its outer surface; and a locking means associated with the body, said locking means configured to interact with the openings of the receptacle and securely releasably lock the body into the receptacle.

[0008] A fifth aspect of the invention provides a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug comprising: a body having an opening through which a movable locking tab extends; and an actuator associated with the body and located to move the locking tab into engagement with a typical opening of a standard high definition multimedia interface receptacle.

[0009] A sixth aspect of the invention provides a locking HIGH DEFINITION MULTIMEDIA INTERFACE connector plug comprising: a plug body, including an extension having an opening therein; a depressible lock button connected to the plug body, and an actuator coupled to a locking tab, wherein the actuator is operable with the depressible lock button; and wherein when the lock button is depressed the actuator moves the locking tab to reside within the opening.

[0010] A seventh aspect of the invention provides a locking HIGH DEFINITION MULTIMEDIA INTERFACE connector plug comprising: a plug body, including an extension having an opening therein; an inner section of the extension, the inner section having a guide portion, the guide portion having a depression; and an actuator coupled to a locking tab, the locking tab downwardly biased to reside within the depression of the guide portion when the actuator is in a second position, and wherein when the actuator is in the first position the

locking tab engages a ramp to bend the locking tab outwards to protrude from the opening.

[0011] An eighth aspect of the invention provides a locking HIGH DEFINITION MULTIMEDIA INTERFACE connector plug comprising: a plug body, having an opening therein; a hinged lock button attached to the plug body; an actuator coupled to the lock button; and a locking tab operable with the actuator; wherein when the hinged locked button is pressed toward the actuator, the actuator moves the locking tab to reside within the opening.

[0012] A ninth aspect of the invention provides a locking HIGH DEFINITION MULTIMEDIA INTERFACE connector plug comprising: a plug body having an integrally joined locking tab; wherein the locking tab is normally biased downward into an opening of the plug body; and a sliding actuator having a first position wherein the actuator resides beneath the locking tab and bends the locking tab outward from the opening of the plug body; and wherein the sliding actuator has a second position wherein the actuator resides in a slide track allowing the locking tab to be downwardly biased into a depression.

[0013] A tenth aspect of the invention provides a locking HIGH DEFINITION MULTIMEDIA INTERFACE connector plug comprising: a plug body having an HIGH DEFINITION MULTIMEDIA INTERFACE connection end, the plug body including an opening therein; an actuator operable with the plug body; and a locking tab attached to the actuator, wherein the locking tab angularly extends through the opening of the plug body and away from the HIGH DEFINITION MULTIMEDIA INTERFACE connection end when the actuator is in a first position, and wherein the locking tab is retracted beneath the opening of the plug body when the actuator is in a second position.

[0014] An eleventh aspect of the invention provides a locking HIGH DEFINITION MULTIMEDIA INTERFACE connector plug comprising: a plug

body having an extension, the extension including an opening; a sliding body lock button having an internal spring, the sliding body lock button connected to the plug body; an actuator, wherein the sliding body lock button is configured to work upon and move the actuator; and a locking tab associated with the actuator, wherein the locking tab protrudes from the opening of the body extension when the actuator is in a first position and resides within the opening of the body extension when the actuator is in a second position.

[0015] A twelfth aspect of the invention provides a locking HIGH DEFINITION MULTIMEDIA INTERFACE connector plug comprising: a receptacle-shaped plug body; an opening positioned in the receptacle shaped plug body; an actuator operable with the plug body; and a locking tab in contact with the actuator and positioned to releasably engage a typical opening of the receptacle when the plug body is mated with the receptacle, and wherein the actuator moves the locking tab to release engagement of the locking tab from the typical opening of the receptacle.

[0016] A thirteenth aspect of the present invention provides a method of locking an HIGH DEFINITION MULTIMEDIA INTERFACE plug into a receptacle comprising the steps of: providing a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug including: a body configured to be inserted into a high definition multimedia interface receptacle, an actuator operable with the body; and a locking tab coupled to the actuator, wherein the locking tab is configured to movably protrude from an opening of the body; and biasing the locking tab sufficiently to protrude from the opening of the body to engage the receptacle and releasably lock the body into the receptacle.

[0017] A fourteenth aspect of the present invention provides an HIGH DEFINITION MULTIMEDIA INTERFACE connector for connecting an HIGH DEFINITION MULTIMEDIA INTERFACE cable to an HIGH DEFINITION MULTIMEDIA INTERFACE receptacle, the HIGH DEFINITION MULTIMEDIA

INTERFACE receptacle having an internal passageway defined therein, an outer surface of the internal passageway having at least one opening, the HIGH DEFINITION MULTIMEDIA INTERFACE connector comprising: a connector body having an extension, the extension configured for insertion into the internal passageway; and, at least one projection extending from an outer surface of the extension, the projection configured to releasably engage the at least one opening upon insertion of the extension into the internal passageway.

[0018] A fifteenth aspect of the present invention provides a high definition multimedia interface connector comprising: a connector body, the connector body extending along a longitudinal axis and having a first end and a second end; an extension, the extension operatively attached to the second end of the connector body, the extension extending along the longitudinal axis; and, at least one projection on an outer surface of the extension, the projection extending away from the longitudinal axis of the extension.

[0019] A sixteenth aspect of the present invention provides a method of attaching a high definition multimedia interface connector to a high definition multimedia interface receptacle having an internal passageway defined therein, an outer surface of the internal passageway having at least one opening, comprising the steps of: providing a connector body having an extension configured to be inserted into the internal passageway, the extension having a projection extending from an outer surface of the extension, the projection configured to engage at least one spring biased tab partially disposed with the opening; inserting the extension into the high definition multimedia interface; and, engaging the projection with the opening to bias the tab sufficiently to cause a mechanical friction interference fit between the connector body and the high definition multimedia interface receptacle.

[0020] A seventeenth aspect of the present invention provides an HIGH DEFINITION MULTIMEDIA INTERFACE connector comprising: a connector

body having an extension configured to be inserted into an HIGH DEFINITION MULTIMEDIA INTERFACE receptacle having at least one opening on its outer surface; and, an engaging means associated with the extension, the engaging means configured to interact with the at least one opening of the receptacle and releasably engage the body into the receptacle.

DESCRIPTION OF THE DRAWINGS

[0021] Some of the embodiments of this invention will be described in detail, with reference to the following figures, wherein like designations denote like members, wherein:

[0022] FIG. 1 depicts a perspective view of a standard HIGH DEFINITION MULTIMEDIA INTERFACE connector of the prior art prior to mating with a typical HIGH DEFINITION MULTIMEDIA INTERFACE receptacle;

[0023] FIG. 2 depicts a perspective view of a standard HIGH DEFINITION MULTIMEDIA INTERFACE connector of the prior art as mated with a typical HIGH DEFINITION MULTIMEDIA INTERFACE receptacle;

[0024] FIG. 3 depicts a top view of a standard HIGH DEFINITION MULTIMEDIA INTERFACE connector of the prior art as mated with a typical HIGH DEFINITION MULTIMEDIA INTERFACE receptacle;

[0025] FIG. 4 depicts a partial cutaway side view of a standard HIGH DEFINITION MULTIMEDIA INTERFACE connector of the prior art as mated with a typical HIGH DEFINITION MULTIMEDIA INTERFACE receptacle;

[0026] FIG. 5 depicts a perspective view of an embodiment of a releasably locking HIGH DEFINITION MULTIMEDIA INTERFACE plug, according to the present invention;

[0027] FIG. 6 depicts a side view of an embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug mated to a receptacle;

[0028] FIG. 7 depicts a partial cutaway side view of an embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug mated with a receptacle;

[0029] FIG. 8 depicts a partial cutaway side view of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug with blow-ups of various locking tab embodiments;

[0030] FIG. 9 depicts a partial cutaway side view of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug, wherein an actuator is located in a first position;

[0031] FIG. 10 depicts a partial cutaway side view of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug, wherein an actuator is located in a second position;

[0032] FIG. 11 depicts an end view of an embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug;

[0033] FIG. 12 depicts a perspective view of an embodiment of a plug in a locked position;

[0034] FIG. 13 depicts a perspective view of an embodiment of a plug in an unlocked position;

[0035] FIG. 14 depicts a partial cutaway view of an embodiment of a plug in a locked position;

[0036] FIG. 15 depicts a partial cutaway view of an embodiment of a plug in an unlocked position;

[0037] FIG. 16 depicts an exploded view of an embodiment of a plug;

[0038] FIG. 17 depicts a top view of another embodiment of a plug;

[0039] FIG. 18 depicts a perspective view of another embodiment of a plug;

[0040] FIG. 19 depicts an end view of another embodiment of a plug;

[0041] FIG. 20 depicts a partial side view of another embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug;

[0042] FIG. 21 depicts a perspective view of another embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug;

[0043] FIG. 22 depicts a top view of another embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug;

[0044] FIG. 23 depicts an end view of another embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug;

[0045] FIG. 24 depicts a perspective view of a further embodiment of a plug in a locked position;

[0046] FIG. 25 depicts a cutaway view of a further embodiment of a plug in a locked position;

[0047] FIG. 26 depicts a cutaway view of a further embodiment of a plug in an unlocked position;

[0048] FIG. 27 depicts a perspective view of a further embodiment of a plug in an unlocked position;

[0049] FIG. 28 depicts a perspective view of a still further embodiment of a plug in a locked position;

[0050] FIG. 29 depicts a cutaway view of a still further embodiment of a plug in a locked position;

[0051] FIG. 30 depicts a perspective view of a still further embodiment of a plug in an unlocked position;

[0052] FIG. 31 depicts a cutaway view of a still further embodiment of a plug in an unlocked position;

[0053] FIG. 32 depicts a perspective view of a further embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug in a locked position;

[0054] FIG. 33 depicts a side view of a further embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug in a locked position;

[0055] FIG. 34 depicts an end view of a further embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug in a locked position;

[0056] FIG. 35 depicts a cutaway view of a further embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug in a locked position as mated with a receptacle;

[0057] FIG. 36 depicts a perspective view of a further embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug in an unlocked position;

[0058] FIG. 37 depicts a side view of a further embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug in an unlocked position;

[0059] FIG. 38 depicts an end view of a further embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug in an unlocked position;

[0060] FIG. 39 depicts a cutaway view of a further embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug in an unlocked position as mated with a receptacle;

[0061] FIG. 40 depicts a perspective view of a still further embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug prior to mating with a receptacle;

[0062] FIG. 41 depicts a pin layout of a typical HIGH DEFINITION MULTIMEDIA INTERFACE 19 pin connector;

[0063] FIG. 42 depicts a pin layout of a typical HIGH DEFINITION MULTIMEDIA INTERFACE 29 pin connector;

[0064] FIG. 43 depicts a perspective view of an embodiment of a releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug;

[0065] FIG. 44 depicts a perspective view of the HIGH DEFINITION MULTIMEDIA INTERFACE plug of FIG. 43 mated to an HIGH DEFINITION MULTIMEDIA INTERFACE receptacle;

[0066] FIG. 45A depicts a side cross-section view of the HIGH DEFINITION MULTIMEDIA INTERFACE plug of FIG. 44, either partially inserted into or almost fully withdrawn from an HIGH DEFINITION MULTIMEDIA INTERFACE receptacle.

[0067] FIG. 45B depicts a side cross-section view of the HIGH DEFINITION MULTIMEDIA INTERFACE plug of FIG. 44, either almost fully inserted into or partially withdrawn from an HIGH DEFINITION MULTIMEDIA INTERFACE receptacle.

[0068] FIG. 45C depicts a side cross-section view of the HIGH DEFINITION MULTIMEDIA INTERFACE plug of FIG. 44, fully inserted into an HIGH DEFINITION MULTIMEDIA INTERFACE receptacle.

[0069] FIG. 46 depicts a perspective view of a further embodiment of a releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug;

[0070] FIG. 47 depicts a perspective view of a further embodiment of a releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug;

[0071] FIG. 48 depicts a perspective view of a still further embodiment of a releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug.

DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0072] Although certain embodiments of the present invention will be shown and described in detail, it should be understood that various changes and modifications may be made without departing from the scope of the appended claims. The scope of the present invention will in no way be limited to the number of constituting components, the materials thereof, the shapes thereof, the relative arrangement thereof, etc., and are disclosed simply as an example of

an embodiment. The features and advantages of the present invention are illustrated in detail in the accompanying drawings, wherein like reference numerals refer to like elements throughout the drawings.

[0073] As a preface to the detailed description, it should be noted that, as used in this specification and the appended claims, the singular forms "a," "an" and "the" include plural referents, unless the context clearly dictates otherwise.

[0074] With reference to the drawings, FIG. 5 depicts a perspective view of an embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 for connecting HIGH DEFINITION MULTIMEDIA INTERFACE cable 10 to high definition electronic components having standard HIGH DEFINITION MULTIMEDIA INTERFACE receptacles. Accordingly, the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 has an HIGH DEFINITION MULTIMEDIA INTERFACE connection end 35. The locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 comprises a connector body or plug body 105, having an opening 130. The plug body 105 may include an extension 120. The opening 130 may be located on the extension 120 of the plug body 105. The plug body 105 can help retain a connected HIGH DEFINITION MULTIMEDIA INTERFACE cable 10. The locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 may have a cable connection end 55. The locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 comprises an actuator 165 configured to move a locking tab 150. The actuator may be associated with, or physically connected to, the locking tab 150, such that movement of the actuator 165 causes the locking tab 150 to move. Moreover, the actuator 165 may operate with a lock button 140 associated with, or operably coupled to, the plug body 105. The lock button 140 is configured to be manipulated by a user in an up, down, or sideways motion to work upon the actuator 165 and cause the actuator 165 to move the locking tab 150 between a first position 160 (see FIG. 8) and a second position 170 (see FIG. 9). The lock button 140 may be integrally formed with actuator 165, or may be separately

attached to the actuator 165 and located to contact or otherwise configured to afford work upon the actuator in some operable manner. The lock button 140 may be depressible. In addition, a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 has a plug terminal contact 126.

[0075] Referring further to the drawings, FIG. 6 depicts a side view of an embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 mated to a receptacle 20 (shown in FIG. 7), the receptacle 20 may be secured to a housing 5, for example, by a mounting screw 7. The housing 5 may be any physical component of a high definition electrical device. For example, the housing may be the outer casing of a flat-screen HD television, the shell of a cable TV box, or the covering of a DVD player. The HIGH DEFINITION MULTIMEDIA INTERFACE connection end 35 of the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug may be plugged into the receptacle to facilitate a connection and allow transmission of electronic communications through the cable 10 connected to the cable connection end 55 of the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug. An extension 120 may extend from the plug body 105 and be configured to be inserted into the receptacle 20. The lock button 140 is utilized to help securely fasten the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 to the receptacle 20 mounted in the housing 5.

[0076] With continued reference to the drawings, FIG. 7 depicts a partial cutaway side view of an embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 mated with a receptacle 20. The plug terminal contacts 126 are configured to mate with a receptacle port contact 26 of the receptacle 20. A typical HIGH DEFINITION MULTIMEDIA INTERFACE receptacle, as described previously, may commonly have a sidewall opening 25 with a spring biased tab 22 (as shown in FIG. 1). The sidewall opening 25 is located on the outer surface of the receptacle and generally permits the spring biased tab 22 to protrude somewhat into a detent(s) of a standard HIGH

DEFINITION MULTIMEDIA INTERFACE plug (see FIGS. 1-4). Hence, when the spring biased tab(s) 22 protrudes into the typical detend(s) of a standard HIGH DEFINITION MULTIMEDIA INTERFACE plug, some mechanical interference between the parts is created to help retain the standard plug in mated position with the receptacle 20. However, the typical shape of the spring biased tab 22 and the associated force of the interference fit of the tab 22 with openings or detents of a standard HIGH DEFINITION MULTIMEDIA INTERFACE plug are often insufficient to securely retain the standard HIGH DEFINITION MULTIMEDIA INTERFACE plug in an appropriate mating position with the receptacle 20. Accordingly, embodiments of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 are configured such that the typical spring biased tab 22 of a standard HIGH DEFINITION MULTIMEDIA INTERFACE receptacle can protrude into the opening 130 of the body 105 helping to secure the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 to the receptacle 20. Thus, the inclusion of a locking tab 150 of the present invention facilitates a secure mating position when the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 is releasably mounted to a standard HIGH DEFINITION MULTIMEDIA INTERFACE receptacle.

[0077] The locking tab 150 of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 may be configured to be moved into a locked position 161 (as shown in FIG. 7), wherein the locking tab 150 may be located so as to operably protrude into and engage the typical sidewall opening 25 of a receptacle 20. The shape of the locking tab may be configured to substantially hinder and/or stop the retraction of the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 from a mated position with the receptacle 20 in a locking position, but be releasable simply by the provision of a motive force acting on the actuator 165 of the plug 100. The configuration of the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 may necessitate the movement of the locking tab 150 out of the opening 25 before the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug may be retracted. However, tab 150

embodiments may be provided wherein the tabs 150 are configured to slip, move, break away, or otherwise facilitate release from a locked position 161 when sufficient force is placed upon the tabs 150. Hence, the tabs 150 may release to prevent damage from occurring to the HIGH DEFINITION MULTIMEDIA INTERFACE receptacle as a result of the force. With respect to FIG. 8, various configurations of locking tab embodiments $150a_1$, $150a_2$ and $150a_3$ are shown. A locking tab embodiment $150a_1$, may include a ramped rear edge $158a_1$ having a reverse incline. The reverse incline may be angled such that sufficient force may cause the rear edge $158a_1$ to slip out of engagement with the opening 25 of a receptacle 20 (see FIG. 7). Nevertheless, the rear edge $158a_1$ may be shaped so that typical forces due to gravity, dusting, cleaning, moving electrical devices, or otherwise bumping a cable 10 (see FIGS. 5-6) or HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 will not be sufficient to break away the locking tab $150a_1$. But a substantial jerk on the cable 10 or large push against the mated plug 100 will cause the tab $150a_1$ to release so that the receptacle 20 is not damaged as a result of the force from the jerk or push.

[0078] Referring further to FIG. 8, embodiments of the locking tab 150 are configured to permit easy insertion of the plug 100 into the receptacle 20. For example, a tab 150 may have rounded, beveled or ramped forward edges 157 permitting unidirectional movement of the tab 150 into docking engagement with the receptacle 20. The plug 100 may be inserted into a receptacle 20 and the ramped forward edges 157 may allow the locking tabs 150 to slidably snap into a locked position 161 when the extension 120 is inserted such that the tab(s) 150 securely protrude into the opening(s) 25 of the receptacle 20 (see FIG. 7). Accordingly, a locking tab embodiment $150a_1$ may include a ramped edge 157a1 having a forward incline permitting the tab $157a_1$ to slidably snap into engagement with the opening 25 of the receptacle 20. However, as shown and described above the rear edge $158a_1$ may be ramped in a reverse direction and may have a steeper angle of incline making it harder for the tab $150a_1$ to slide in the reverse direction. Other embodiments of the locking tab 150, such as

embodiments $150a_2$ and $150a_3$, may also include rear edges or impedance surface(s) 158 configured to obstruct movement in the opposite releasing direction while the tab 150 is snapped into the opening 25 of the receptacle 20. For instance, tab embodiment $150a_2$ includes a vertical rear edge $158a_2$ designed to hinder movement in the reverse direction when the tab $150a_2$ is in a locked position 161 (see FIG. 7). However, the transition between the ramped forward edge $157a_2$ and vertical rear edge $158a_2$ may be rounded so that the tab $150a_2$ may move if sufficient force is provided in the reverse direction. Tab embodiment $150a_3$ includes a forward inclined rear edge $158a_3$ designed to hinder movement in the reverse direction when the tab $150a_3$ is in a locked position 161. The tab embodiment $158a_3$ may be designed to snap off or break away if sufficient force is provided in the reverse direction. Thus, embodiments of a locking tab 150 may facilitate release from a locked position 161 when sufficient force is inflicted upon the tab 150.

[0079] The locking tab 150 may be moved into and/or may be moved out of the typical opening 25 of a receptacle 20 by operation of an actuator 165. For example, a lock button 140 may be configured to be depressed, or made to slide forward and backward, to slide side-to-side, or otherwise set in motion to act upon the actuator 165, which, in turn, moves the locking tab 150. For instance, the lock button 140 may be used to move a leaf-spring type actuator 165 downward, as shown in FIG. 9, and also cause the locking tab 150 to move downward into the opening 130 of the extension 120 and out of the opening 25 of the receptacle 20 to thereby unlock the plug 100 from the receptacle 20. However, it should also be appreciated that the configurations of locking HIGH DEFINITION MULTIMEDIA INTERFACE plug embodiments, to be described later, also permit maneuvering of the lock button 140 to work upon the actuator 165 and thereby move the locking tab 150 into an interference position within the sidewall opening 25 of the receptacle 20.

[0080] With continued reference to FIGS. 1-8, when mating a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 to a receptacle 20, a user may grip the plug body 105 and advance, push or otherwise insert the connection end 35 of the plug 100 into a corresponding receptacle 20. The receptacle 20 may facilitate electrical communication with other electrical components. For example, a circuit connection end 28 (see FIG. 7) of the receptacle 20 may include contacts or leads that make possible the communication of electromagnetic signals to various electronic devices.

[0081] Embodiments of locking HIGH DEFINITION MULTIMEDIA INTERFACE plugs, such as plug 100, may utilize a movable actuator 165 to help position a locking tab 150 into an interfering location with respect to a receptacle 20. Referring to FIG. 9, a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 is shown having an actuator 165 located in a first position 160. A first position 160 of the actuator 165 may correspond to a locked position 161 when the plug 100 is mated with a receptacle 20. When the actuator 165 is located in a first position 160, the locking tab 150 may be biased to protrude from the opening 130. A lock button 140 may be operably associated with the plug body 105 and the actuator 165 may be operably associated with the lock button. Accordingly, the locking tab 150 operably associated with the actuator 165, may contact, engage, or otherwise interfere with the typical sidewall opening 25 of a standard HIGH DEFINITION MULTIMEDIA INTERFACE receptacle 20 and thereby help to restrict the unplugging of the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 from the receptacle 20.

[0082] The actuator 165 may also be movably locatable in a second position 170, wherein the associated locking tab 150 does not protrude from the opening 130 of the body, as depicted in FIG. 10. For example, when the actuator 165 is in a second position 170, the locking tab 150 may be positioned within the opening 130 of the body extension 120 so that it does not extend away from the opening 130. A second position 170 of the actuator 165 may correspond to an

unlocked position 171 when the plug 100 is mated with a receptacle 20. Hence, when the actuator 165 is in a second position 170, the locking tab(s) 150 may not contact or otherwise interfere with other physical components, such as sidewalls or openings(s) 25 of a receptacle 20, in proximate association with the extension 120. It should be appreciated that when locking HIGH DEFINITION MULTIMEDIA INTERFACE plug embodiments, such as plug 100, are mated to a receptacle 20, unlocking and efficiently retracting the plug 100 from the receptacle 20 may involve the operable positioning of the actuator 165 into a second position 170, thereby eliminating the interference between the impedance surfaces 158 of the locking tab(s) and the sidewall opening(s) 25 of the receptacle 20.

[0083] A locking HIGH DEFINITION MULTIMEDIA INTERFACE plug embodiment 100 may comprise a locking tab 150 movably locatable within an opening of a plug body 105, such as opening 130 in body extension 120. Moreover, the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 may comprise an actuator 165 operably configured to move the locking tab 150 into a locked position 161, wherein said locking tab 150 protrudes from the opening 130 of the extension 120 to securely engage an HIGH DEFINITION MULTIMEDIA INTERFACE receptacle 20. Moreover, the actuator 165 may be operably configured to move the locking tab 150 into an unlocked position 171 (see also unlocked position 671 of FIG. 39), wherein said locking tab 150 does not protrude or extend away from the opening 130.

[0084] FIG. 11 depicts an end view of an embodiment of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100. The locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 may comprise one or more locking tabs, such as locking tabs 150a and 150b. As depicted, the locking tabs 150a-b are protruding from the extension 120. Hence, the actuator 165 (not shown) may be located in a first position 160 (see FIG. 9). Whenever the tabs 150a-b are located so as to interfere with a corresponding receptacle 20, then

the corresponding location of the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 components may be attributable to a locked position 161. The tabs 150a-b must therefore be moved to an unlocked position 171, a position essentially eliminating interference with a receptacle 20, for the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 to be efficiently retracted from a mated position with the receptacle 20. A user may grip the plug body 105 and depress the lock button 140 to work upon the actuator 165 and move the locking tabs 150a-b out of sight within the opening 130 (not shown) of body extension 120. Additionally, embodiments of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 may comprise an inner section 180, the end of which being shown in FIG. 11. The inner section 180 also may include plug terminal contacts 126 configured to physically and electrically contact corresponding receptacle port contacts 26 (see FIG. 7) of a typical HIGH DEFINITION MULTIMEDIA INTERFACE receptacle 20. Plug terminal contacts 126 are further delineated in FIGS. 41-42. Accordingly, a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug embodiment 100 may include 19 terminals, as in either a typical Type A or a Type C HIGH DEFINITION MULTIMEDIA INTERFACE standard connector (see FIG. 41) or 29 terminals that are typically present in a standard Type B HIGH DEFINITION MULTIMEDIA INTERFACE connector (see FIG. 42). The inner section 180 may be integrally formed with the extension 120, may be separately joined to the extension 120, or may be removably secured within the extension 120. Moreover, the plug terminal contacts 126 may be integrally formed as part of the inner section 180, may be separately joined to the inner section 180, or may be removably secured to the inner section 180. The inner section 180 may be formed of conductive materials or may be formed of a dielectric material.

[0085] An embodiment of a body extension member 220 that may be used in a High Definition Multimedia Interface (HIGH DEFINITION MULTIMEDIA INTERFACE) communication application is shown in FIGS. 12-16. The extension 220 may have at least one opening 230 (as shown, an extension 220

preferably includes two openings 230). The extension 220 may be configured to fit into an HIGH DEFINITION MULTIMEDIA INTERFACE receptacle, such as receptacle 20, or may be configured to be used with any other receptacle that relies upon a friction or tolerance fit to retain extension 220 within the receptacle. The HIGH DEFINITION MULTIMEDIA INTERFACE standard uses a conductive surface for the extension 220, but in other applications the extension 220 may be an insulator. The extension 220 may be a metal that is stamped or otherwise formed into the desired shape or may be a conductive polymer that is injection molded or extruded. The extension 220 may be formed of dimensionally stable materials that could be made conductive if required to be used in connectors.

[0086] An extension member 220 may be retained somewhat within a plug receptacle, such as receptacle 20, by friction due to close tolerance with the receptacle. However, with respect to a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug embodiments, such as plug 100, the extension 220 may include a releasable protrusion, or locking tab 250 that may engage an opening 25 or a receptacle 20, and prevent unintended release. As shown in FIG. 13, the locking tabs 250 may be configured to reside with the opening 230 of the extension member 220. Furthermore, an HIGH DEFINITION MULTIMEDIA INTERFACE connector end 35 of the extension 220 may be inserted into an HIGH DEFINITION MULTIMEDIA INTERFACE receptacle 20 and may be selectively locked or secured into the receptacle with the use of an actuator 265. The actuator may be worked upon by a lock button 240 operated by a user. The user operates the lock button 240 either by compression or sliding until it is moved sufficiently to work upon the actuator to help secure the plug 100. To secure the HIGH DEFINITION MULTIMEDIA INTERFACE type plug extension embodiment 220 into a plug receptacle the extension 220 includes a locking tab 250 that may be biased or moved by the actuator 265.

[0087] The actuator 265 has a first position 260, as shown in FIG. 14, where the lock button 240 is slidingly moved to work upon the actuator 265 so

that the locking tab 250 is biased to protrude from said opening 230 of said extension 220. The actuator 265 has a second position 270, as shown in FIG. 15, where the lock button 240 is slidingly moved to cause the actuator 265 to move the locking tab 250 to be positioned substantially within said at least one opening 230 of said extension 220. The locking tab 250 may also be configured to be resiliently biased into a locked position 161, corresponding to the first position 260 of the actuator 265, so that the lock button 240 may be compressed moving the actuator relative to an unlocked position 171 and release the locking tab 250 out of the sidewall opening 25 of a receptacle 20 (see FIG. 7).

[0088] As shown in FIG. 12, the extension embodiment 220 may further include sub components such as an inner section 280 positioned within said extension member 220. The extension 220 may be a one-piece extension component that includes molded in or insertable terminal ends, such as plug terminal contacts 126 (see FIG. 11). The inner section 280 may also contain a guide portion 285 (see FIGS. 14-15) that may be configured as a channel, pathway or groove within the inner section 280 that may be configured to facilitate linear sliding or other guided movement of the actuator 265. The inner section 280 may be any structurally rigid material such as in injection molded plastic that would allow the introduction of the terminals, such as terminals 126.

[0089] FIG. 15 is an exploded view of an extension 220 of embodiments of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug, such as plug 100, and includes an actuator 265 having a proximate end 266 and a distal end 267, wherein the proximate end 266 may be attached to, or otherwise operable with said lock button 240, and wherein the distal end 267 may be attached to, or otherwise operable with said locking tab 250. The actuator 265 may be produced from a resilient material that may be biased to a desired orientation. Moreover, the actuator 265 material could be made of a spring-type steel or a resilient polymeric material that is either stamped or injection molded. When the button 240 works upon the actuator 265, a ramp 290 may be positioned on said

inner section 280. The movement of said locking tab 250 against said ramp 290 may be resiliently biased to protrude through said opening 230 on said extension 220 when said lock button 240 is in the first position 260. A depression 291 may be formed within said inner section 280 and may be configured to accept said locking tab 250 when said lock button 240 is in the second position 270 to allow release of the extension 220 from an HIGH DEFINITION MULTIMEDIA INTERFACE receptacle.

[0090] As shown in FIGS. 17-19, a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug embodiments may include a single large opening 231 of extension 221. An actuator 269 structure having adjoined locking tips 251 may be located in a first position 260 such that the locking tips 251 protrude above the surface of the extension embodiment 221. Moreover, the actuator 269 may be located in a second position 270 such that the locking tips 251 reside substantially within the large opening 231 of the extension 221.

[0091] As shown in FIGS. 20-23, another locking HIGH DEFINITION MULTIMEDIA INTERFACE plug embodiment 300 is depicted. The connector plug 300 may comprise a diving hinge lock button 340 operable with a plug body 300. The hinged lock button 340 may be attached to the plug body 305 or integrally formed with the plug body 305 such that the lock button 340 attaches to the plug body 305 in the general vicinity of a location 342. The lock button 340 is coupled to the actuator 365. A user may operate the lock button 340 by pressing the button 340 toward the actuator 365. The lock button 340 is configured such that motive force provided by a user transfers from the lock button 340 to the actuator 365 to move a locking tab 350. When the actuator 365 is in a first position 360 the locking tab is biased to protrude from the extension 320. Accordingly, a user can insert the HIGH DEFINITION MULTIMEDIA INTERFACE connector end 335 into a receptacle and assist the action of locking through the hinged operation of the lock button 340. Surface features 347, such as ridges, may be provided on the exterior surface of the lock button to correspond to a

better user interface during operation. The lock button 340 may contact or otherwise interact with the actuator 365 at a juncture 345. A cable 10 is connected to the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 300 at a cable connector end 355.

[0092] FIGS. 24-27 show another plug embodiment that includes a sliding actuator 465 that is coupled at a proximate end 466 to a lock button 440. The sliding actuator 440 may engage and lift the inwardly biased locking tab 450 of the plug body extension 420. The tab 450 may be formed to be normally downwardly biased having a resilient member 410 that is converted to an upward bias by movement of the distal end 468 of the sliding actuator 465 underneath the locking tab 450 when the lock button 440 is moved to the first position 460. The placement of the sliding actuator 465 beneath the locking tab 450 causes the locking tab 450 to bend outward to protrude from the opening 430 of the body extension 420. When the actuator 465 is in the second position, the locking tab may be biased downward through the opening of the body extension 420 and into a depression 492 or portion of slide track 485.

[0093] The plug body extension embodiment 420 includes a slide track 485 formed in an inner section 480 similar to that shown in FIGS. 14-16, but without the inclusion of a ramp 290. In FIGS. 14-16, a ramp 290 is formed in the inner section 280, wherein said locking tab 250 is separate from the extension 220 and said locking tab 250 is resiliently biased or pushed outwards through said opening 230 in the extension 220 by said ramp 290 when the lock button 240 is slid into the first position 260.

[0094] In another embodiment, an extension 520 of a locking plug, as shown in FIGS. 28-31, may be structured to operate somewhat in contrast to embodiments previously discussed. The extension 520 includes at least one locking tab 550 that angularly protrudes and is biased away from opening 530 of the extension 520 in a direction away from the HIGH DEFINITION MULTIMEDIA

INTERFACE connection end 35 of the plug. The opening 530 of the extension 520 may include a ramped edge 524. When an actuator 565 is in a first position 560 (see FIG. 29), the extension 520 may be secured within a receptacle 20 in a locked position (see FIG. 7) since said locking tab 550 is biased upward into an opening 25 of the receptacle. Accordingly, the locking tabs 550, being angled away from the HIGH DEFINITION MULTIMEDIA INTERFACE connection end 35, facilitate snap locking of the tabs 550 into the receptacle openings 25 when the extension 520 is inserted into a receptacle 20. The angled geometry of the snap locking tabs 550, being substantially opposite to the direction of insertion, prevents the unwanted retraction of the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug embodiments once snapped into a mated position with the receptacle 20. However, the tabs 550 and related components are configured to break away or otherwise release when a substantial amount of force is applied to the snap connection, such as by a retractive jerking of the cable 10. A lock button 540 is provided to move the actuator 565 to a second position 570, as shown in FIG. 31. When the actuator 565 is moved to the second position 570, the locking tabs 550 contact edge 537 of the opening 530 thereby causing the locking tab 550 to be pushed downward and retracted and moved beneath opening 530. When the locking tabs 550 are retracted within opening 530 the plug is in an unlocked position 571 and a user may retract the plug from a receptacle 20.

[0095] A further locking HIGH DEFINITION MULTIMEDIA INTERFACE connector plug embodiment 600 is depicted in FIGS. 32-39. This embodiment employs a sliding body lock button 640 operably coupled to a plug body 605 configured to retain a cable 10. The sliding body lock button 640 may work upon an actuator 665 to move on or more locking tabs 650 such that they protrude from or reside within top surface 624 of an extension member 620. The sliding body lock button 640 may include an inner spring 643 which tends to drive the locking button toward the plug body 605. When the sliding body lock button 640 is driven to the plug body 605 by spring 643, the actuator 665 is in a first position

660 and acts to place the locking tabs 650 into a biased position protruding from the extension 620 (see FIGS. 33-34). This protruding position of the locking tabs 650 corresponds to a locked position 661 of the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 600 when the plug is mated with a receptacle 20. When the plug 600 is in the locked position, the plug 600 is securely but releasably retained within the receptacle 20.

[0096] A user may slide the sliding body lock button 640 away from the plug body 605 and compress the inner spring 643. Moreover, when the sliding body lock button 640 is slid toward the extension it engages the actuator 665 to move to a second position 670. When the actuator is in the second position 670, the locking tabs 650 may reside within the opening 630 of the extension 620 and not protrude from the top surface 624 of the extension 620 (see FIGS. 37-38). When the locking tabs 650 do not protrude from the extension 620 they do not interfere with the receptacle 20 permitting the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug to be easily retracted and unplugged from the receptacle 20.

[0097] FIG. 40 depicts a perspective view of another locking HIGH DEFINITION MULTIMEDIA INTERFACE plug embodiment 700 prior to mating with a receptacle 20. The locking plug 700 includes a receptacle-shaped plug body 705 configured to mate with and be inserted into the receptacle 20. A substantial portion of the plug body 705 is shaped having a complimentary form relative to a corresponding mating receptacle 20. An opening 730 is positioned in the body 705. An actuator 765 is configured to move locking tabs 750 into and/or out of the opening 730 of body 705. The placement of the tabs 750 out of the opening 730 corresponds to a first position 161 (see FIG. 9). The placement of the tabs within the opening 730 corresponds to a second position 171 (see FIG. 10). When the HIGH DEFINITION MULTIMEDIA INTERFACE connection end 735 is inserted into the receptacle 20, the locking tabs 750 may slide along a top interior surface of the receptacle 20 until the plug 700 is inserted to a point

where the locking tabs can engage the typical openings 25 of the receptacle. When operably plugged-in or mounted to the receptacle 20, the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 700 is firmly held by engagement of the locking tabs 750. Moreover, the spring biased tabs 22 releasably engage the opening 730 of the locking plug 700 when the plug 700 is operably mounted to the receptacle. The plug 700 may be released, unmounted, or unplugged from the receptacle 20 by moving the actuator 765 to in turn move the locking tabs 750 out of engagement with the openings 25 of the receptacle 20.

[0098] Embodiments of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug, such as plugs 100, 300, 600 and 700 may be configured as shown in FIGS. 41 and 42 to be inserted into a high definition multimedia interface receptacle corresponding to Type A, B or C HIGH DEFINITION MULTIMEDIA INTERFACE plug standards. Moreover, embodiments of a locking plug 100/300/600/700 may have a locking means to securely but releasably plug into a high definition multimedia interface receptacle, such as receptacle 20, as discussed above. The locking means may include a locking tab 150/250/251/350/450/550/650/750 configured to interact with the receptacle 20 to retain the plug 100/300/600/700 to the receptacle 20. The locking means may move into locking position through operation of an actuator 165/265/365/465/565/665/765.

[0099] A method of compliantly locking a plug 100/200/300/600/700 into a receptacle 20 is depicted in reference to FIGS. 5-42 and may comprise the steps of: providing a locking HIGH DEFINITION MULTIMEDIA INTERFACE 100/300/600/700 including a plug body 105/305/605/705. The plug body may have an extension 120/220/221/320/420/520/620 configured to be inserted into a high definition multimedia interface receptacle, such as receptacle 20. Accordingly, each of the extension embodiments, such as extensions 120/220/221/320/420/520/620 may be configured to be an operable extension of any plug embodiment. The plug 100/300/600/700 also includes an actuator

165/265/365/465/565/665/765 operable with the body 105/305/605/705. In addition, the locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100/300/600/700 includes a locking tab 150/250/251/350/450/550/650/750 coupled to the actuator 165/265/365/465/565/665/765, wherein the locking tab 150/250/251/350/450/550/650/750 is configured to movably protrude from an opening 130/230/330/430/530/630/730 of the body 105/305/605/705. The plug 100/300/600/700 may be removably secured to the receptacle, such as receptacle 20, by biasing the locking tab 150/250/251/350/450/550/650/750 sufficiently to protrude from the opening 130/230/330/430/530/630/730 of the body 105/305/605/705, or operable body extension 120/220/221/320/420/520/620, to engage the receptacle 20 and releasably lock the body 105/305/605/705 into the receptacle 20.

[00100] Embodiments of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100/300/600 may utilize an actuator 165/265/365/465/565/665/765 to bias the locking tab 150/250/251/350/450/550/650/750. Accordingly, the locking tab 150/250/251/350/450/550/650/750 may be biased by working on the actuator 165/265/365/465/565/665/765 to move the actuator 165/265/365/465/565/665/765 and move the locking tab 150/250/251/350/450/550/650/750.

[00101] Removal of the embodiments of a locking HIGH DEFINITION MULTIMEDIA INTERFACE cable connector plug 100/300/600/700 may comprise the steps of: unbiasing the locking tab 150/250/251/350/450/550/650/750 sufficiently to prevent protrusion of the locking tab 150/250/251/350/450/550/650/750 from the opening 130/230/330/430/530/630/730 of the body 105/305/605/705, or operable body extension 120/220/221/320/420/520/620, to unlock the plug 100/300/600/700 from the high definition multimedia interface receptacle, such as receptacle 20.

[00102] Embodiments of a locking HIGH DEFINITION MULTIMEDIA INTERFACE plug 100/300/600 may utilize an actuator 165/265/365/465/565/665/765 to unbias the locking tab 150/250/251/350/450/550/650/750. Accordingly, the locking tab 150/250/251/350/450/550/650/750 may be unbiased by working on the actuator 165/265/365/465/565/665/765 to move the actuator 165/265/365/465/565/665/765 and move the locking tab 150/250/251/350/450/550/650/750.

[00103] Certain embodiments may utilize the operation of a lock button 140/240/340/440/540/640/740 to work on the actuator 165/265/365/465/565/665/765 and accomplish the biasing or unbiasing of the locking tab 150/250/251/350/450/550/650/750 sufficiently to enable protrusion or prevent protrusion of the locking tab 150/250/251/350/450/550/650/750 from the opening 130/230/330/430/530/630/730 of the body 105/305/605/705, or operable body extension 120/220/221/320/420/520/620, to lock or unlock the plug 100/300/600/700 from the high definition multimedia interface receptacle, such as receptacle 20.

[00104] With reference to the drawings, FIG. 43 depicts a perspective view of an embodiment of a releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug 800 for connecting HIGH DEFINITION MULTIMEDIA INTERFACE cable 10 to high definition electronic components having standard HIGH DEFINITION MULTIMEDIA INTERFACE receptacles. Accordingly, the releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug 100 has an HIGH DEFINITION MULTIMEDIA INTERFACE connection end 835 and an HIGH DEFINITION MULTIMEDIA INTERFACE cable connection end 855. The releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug 800 comprises a connector body or plug body 805. The plug body 805 may include an extension 820. The plug body 805 can help retain a connected HIGH DEFINITION MULTIMEDIA INTERFACE cable 10. Extension 820 may have

projection(s) 825 located on its outer surface. In this instance, the projections are disclosed as convex surfaces.

[00105] Referring further to the drawings, FIG. 44 depicts a perspective view of an embodiment of a releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug 800 whereby extension 820 is fully inserted into receptacle 20. In this instance, projections 825 have releasably engaged and fully biased spring biased tabs 22, which are disposed within sidewall openings 25. The HIGH DEFINITION MULTIMEDIA INTERFACE connection end 835 of the releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug may be plugged into the receptacle to facilitate a connection and allow transmission of electronic communications through the cable 10 connected to the cable connection end 855 of the releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug. Extension 820 is configured to be inserted into the receptacle 20.

[00106] Referring to FIGS. 45A, 45B and 45C, FIG. 45A depicts a partial cutaway side view of an embodiment of a releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug 800, either partially inserted into or almost fully withdrawn from receptacle 20. As extension 820 is inserted into receptacle 20, transitional surfaces 830 engage and begin to bias spring biased tabs 22 disposed within sidewall openings 25. As extension 820 is further inserted into receptacle 20 (see FIG. 45B), transitional surfaces 830 bias spring biased tabs 22 further, until extension 820 is fully inserted into receptacle 20 (see FIG. 45C). At this point, spring biased tabs 22 are fully biased, causing an increased mechanical friction fit. Upon the application of a sufficient retractive force of the extension 820 from the receptacle 20 in the direction *a* indicated in FIGS. 45B and 45C, transitional surface 830 will begin to unbias the spring biased tabs 22. As extension 820 is further withdrawn from receptacle 20 (see FIG. 45A), transitional surfaces 830 unbias spring biased tabs 22 further, until

extension 820 is fully withdrawn from receptacle 20 (see FIG. 45C). Spring biased tabs 22 have now substantially returned to their pre-biased shape.

[00107] With continued reference to the drawings, FIG. 45C depicts a partial cutaway side view of an embodiment of a releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug 800 fully inserted into receptacle 20. Receptacle port contact 26 of the receptacle 20 is configured to mate with the plug terminal contacts (not shown). A typical HIGH DEFINITION MULTIMEDIA INTERFACE receptacle, as described previously, may commonly have a sidewall opening 25 with a spring biased tab 22 (as shown in FIG. 1). The sidewall opening 25 is located on the outer surface of the receptacle and generally permits the spring biased tab 22 to protrude somewhat into a detent(s) of a standard HIGH DEFINITION MULTIMEDIA INTERFACE plug (see FIGS. 1-4). Hence, when the spring biased tab(s) 22 protrudes into the typical detent(s) of a standard HIGH DEFINITION MULTIMEDIA INTERFACE plug, some mechanical friction fit between the parts is created to help retain the standard plug in mated position with the receptacle 20. However, the typical shape of the spring biased tab 22 and the associated force of the friction fit of the tab 22 with openings or detents of a standard HIGH DEFINITION MULTIMEDIA INTERFACE plug are often insufficient to securely retain the standard HIGH DEFINITION MULTIMEDIA INTERFACE plug in an appropriate mating position with the receptacle 20. Accordingly, embodiments of a releasably engaging HIGH DEFINITION MULTIMEDIA INTERFACE plug 800 provide projection(s) 825 that are positioned on extension 820 to mate with the sidewall openings 25 of the receptacle 20. Projections 825 are configured to increase the amount of mechanical friction fit between the spring biased tab(s) 22 and the plug body 805, thereby preventing the connector 800 from unintentionally falling out of the receptacle 20. Projections 825 may include transitional surface(s) 830 formed in the direction of insertion and withdrawal of the plug body 805 into the receptacle 20. Transitional surface(s) 830 are configured to allow for insertion and withdrawal of the plug body 805 into the receptacle 20 without the use of tools

and without causing damage to the mating receptacle 20 and/or connector 800. Transitional surfaces 830 are configured to release when a sufficient amount of retractive force is applied to the connection, such as a jerking of cable 10 and the like.

[00108] Referring to FIGS 43 and 46-48, projections 825 may take various shapes, including convex, arcuate, ramped or radial. An arcuate shape includes surfaces that are arched or curved. FIG. 43 shows a convex surface 825, FIG. 46 shows an arcuate surface 825A, FIG. 47 shows a ramped surface 825B, FIG. 48 shows a radial surface 825C.

[00109] While this invention has been described in conjunction with the specific embodiments outlined above, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, the preferred embodiments of the invention as set forth above are intended to be illustrative, not limiting. Various changes may be made without departing from the spirit and scope of the invention as defined in the following claims. The claims provide the scope of the coverage of the invention and should not be limited to the specific examples provided herein.

I Claim:

1. A high definition multimedia interface connector for connecting a high definition multimedia interface cable to a high definition multimedia interface receptacle, the high definition multimedia interface receptacle having an internal passageway defined therein, a surface of the internal passageway having at least one opening, the high definition multimedia interface connector comprising:

a connector body having an extension, the extension configured for insertion into the internal passageway; and,

at least one projection extending from an outer surface of the extension, the projection configured to releasably engage the at least one opening upon insertion of the extension into the internal passageway.

2. The high definition multimedia interface connector of Claim 1 further comprising:

at least one spring biased tab partially disposed within the at least one opening, whereby insertion of the extension into the internal passageway causes the projection to bias the at least one spring biased tab to cause a mechanical friction fit between the high definition multimedia interface connector body and the high definition multimedia interface receptacle.

3. The high definition multimedia interface connector of Claim 2, wherein the projection is configured to unbias the at least one spring biased tab upon the application of a retractive force sufficient to remove the extension from the internal passageway.

4. The high definition multimedia connector of Claim 3, wherein the projection has at least one transitional surface.

5. The high definition multimedia interface connector of Claim 3, wherein the at least one projection is arcuate.

6. The high definition multimedia interface connector of Claim 3, wherein the at least one projection is convex.

7. The high definition multimedia interface connector of Claim 3, wherein the at least one projection is radial.

8. The high definition multimedia interface connector of Claim 3, wherein the at least one projection is ramped.

9. A high definition multimedia interface connector comprising:

a connector body, the connector body extending along a longitudinal axis and having a first end and a second end;

an extension, the extension operatively attached to the second end of the connector body, the extension extending along the longitudinal axis; and,

at least one projection on an outer surface of the extension, the projection extending away from the longitudinal axis of the extension.

10. The high definition multimedia interface connector of Claim 9, wherein the at least one projection has a transitional surface.

11. The high definition multimedia interface connector of Claim 9, wherein the at least one projection is an arcuate surface.

12. The high definition multimedia interface connector of Claim 9, wherein the at least one projection is convex.

13. The high definition multimedia interface connector of Claim 9, wherein the at least one projection is radial.

14. The high definition multimedia interface connector of Claim 9, wherein the at least one projection is ramped.

15. A method of attaching a high definition multimedia interface connector to a high definition multimedia interface receptacle having an internal passageway defined therein, an outer surface of the internal passageway having at least one opening, comprising the steps of:

providing a connector body having an extension configured to be inserted into the internal passageway, the extension having a projection extending from an outer surface of the extension, the projection configured to engage at least one spring biased tab partially disposed within the opening;

inserting the extension into the high definition multimedia interface; and,

engaging the projection with the opening to bias the tab sufficiently to cause a mechanical friction fit between the connector body and the high definition multimedia interface receptacle.

16. The method of Claim 15, further comprising the steps of:

unbiasing the tab sufficiently to remove the extension from the high definition multimedia interface receptacle.

17. A high definition multimedia interface connector comprising:

a connector body having an extension configured to be inserted into a high definition multimedia interface receptacle having at least one opening on its outer surface; and,

an engaging means associated with the extension, said engaging means configured to interact with the at least one opening of the receptacle and releasably engage the body into the receptacle.

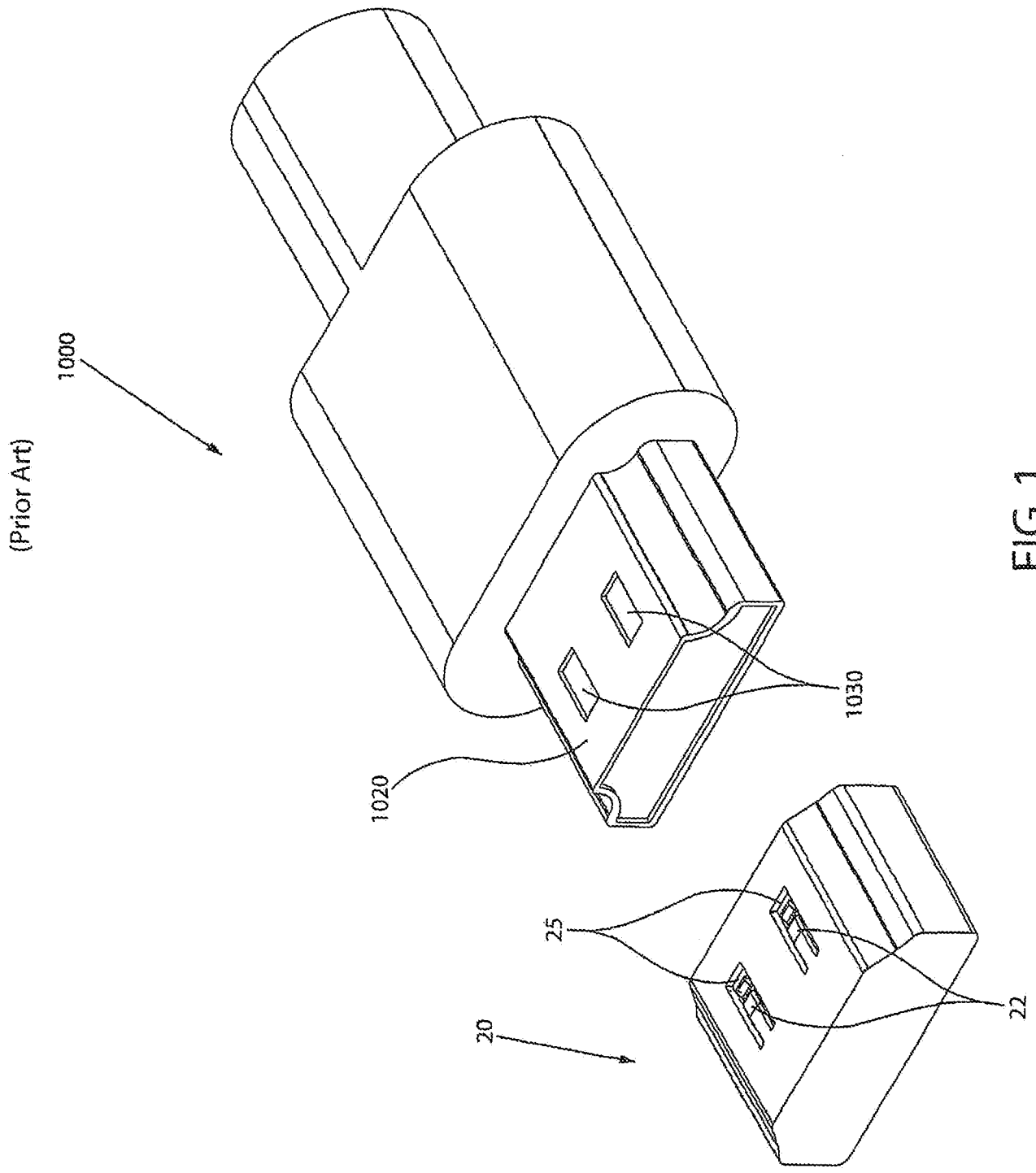


FIG. 1

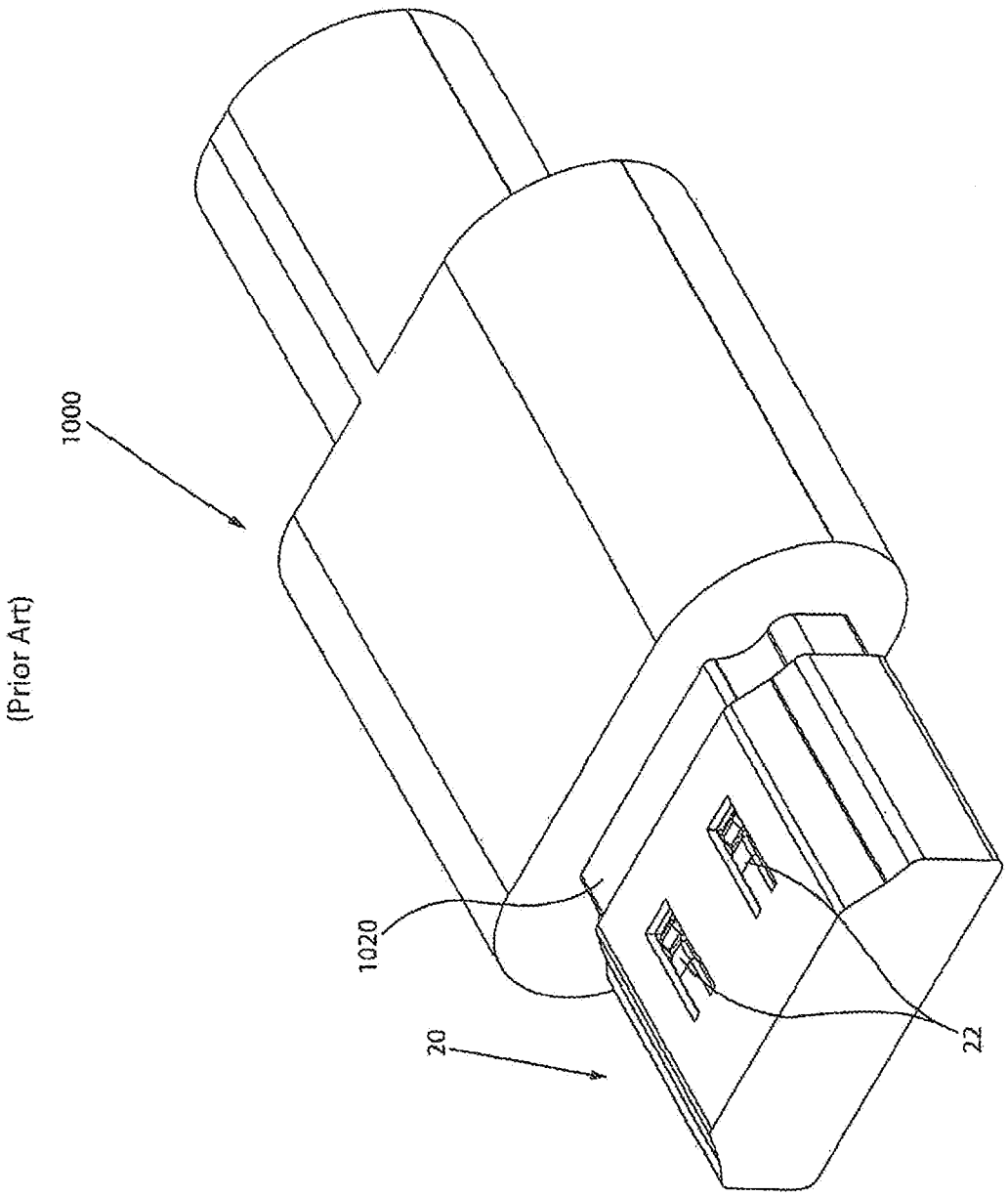
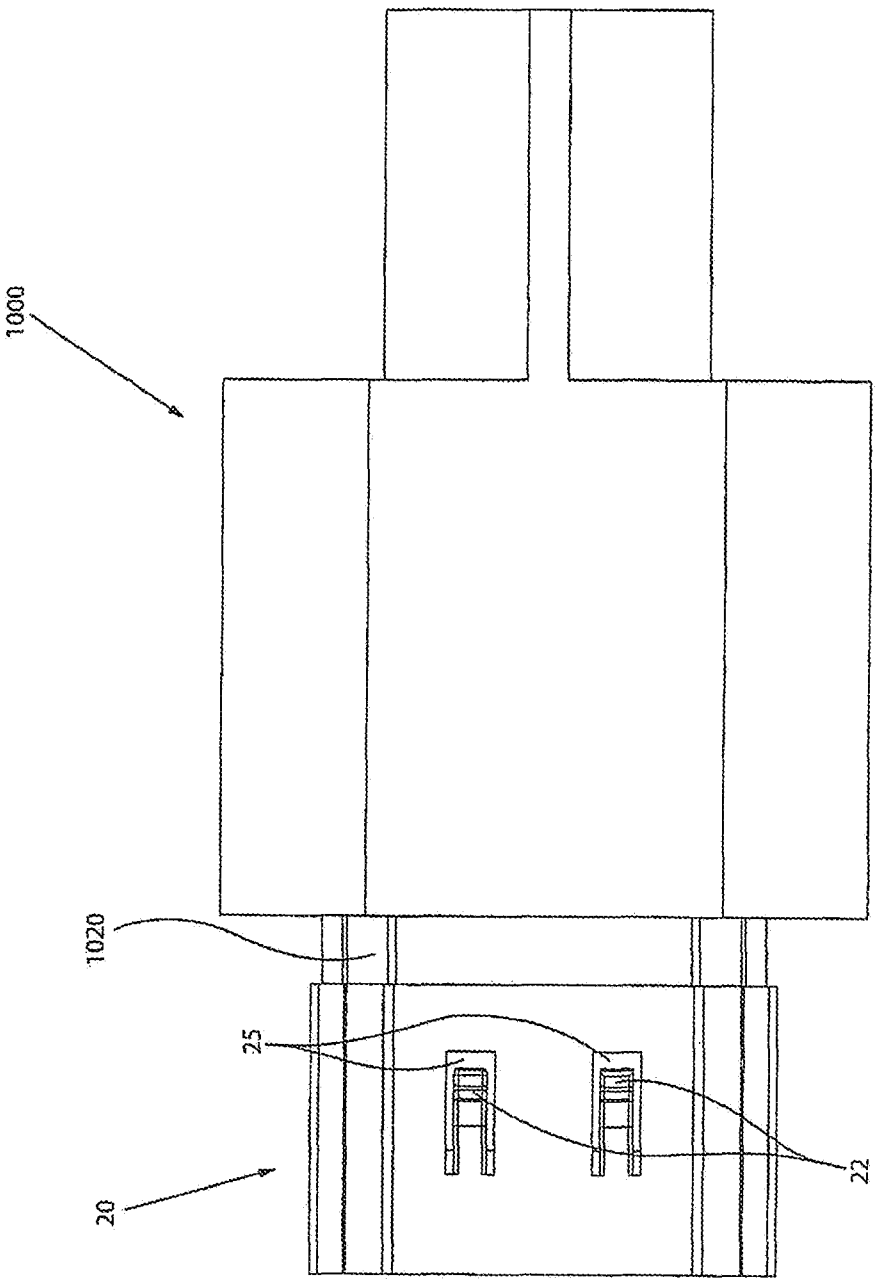
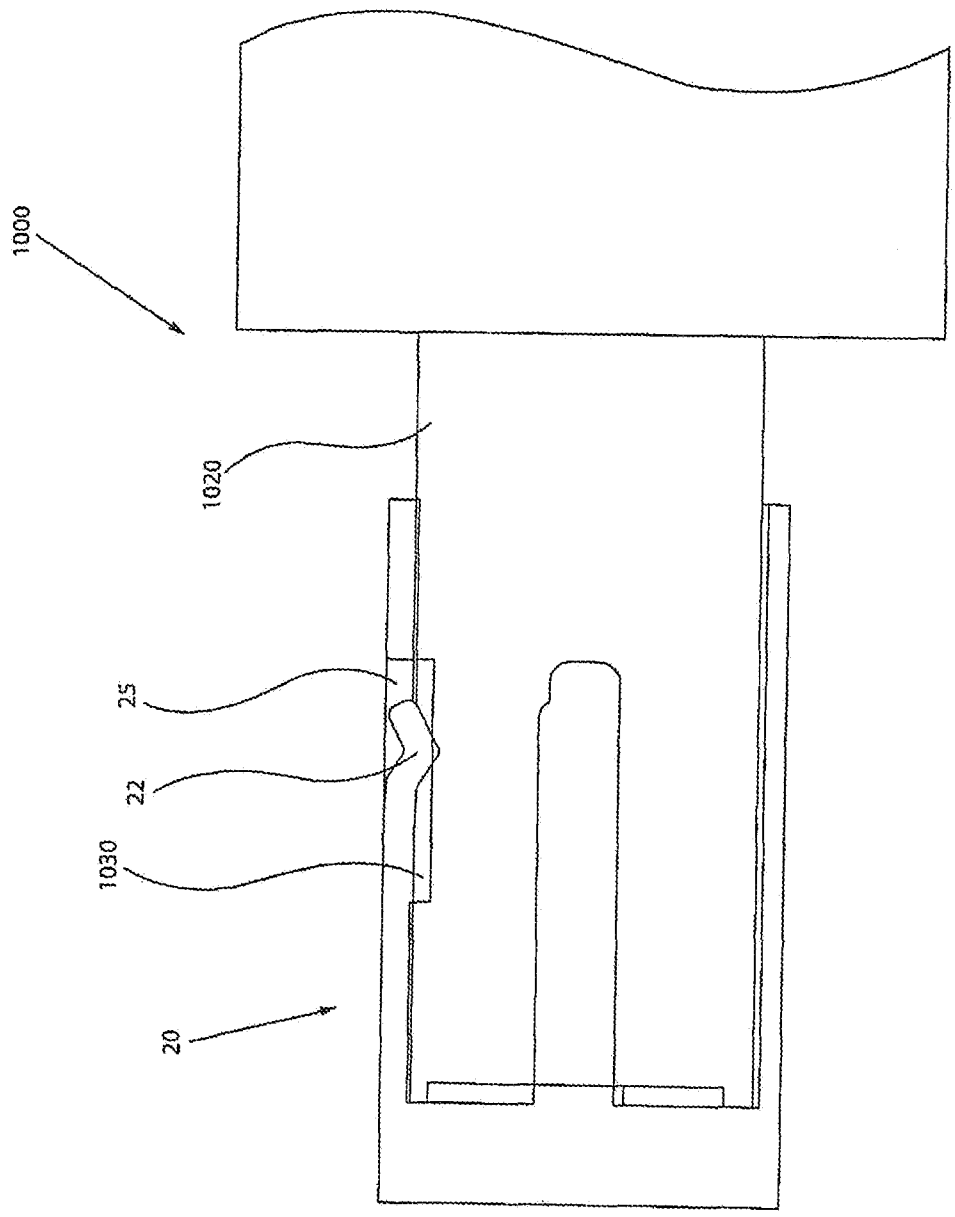


FIG. 2



(Prior Art)

FIG. 3



(Prior Art)

FIG. 4

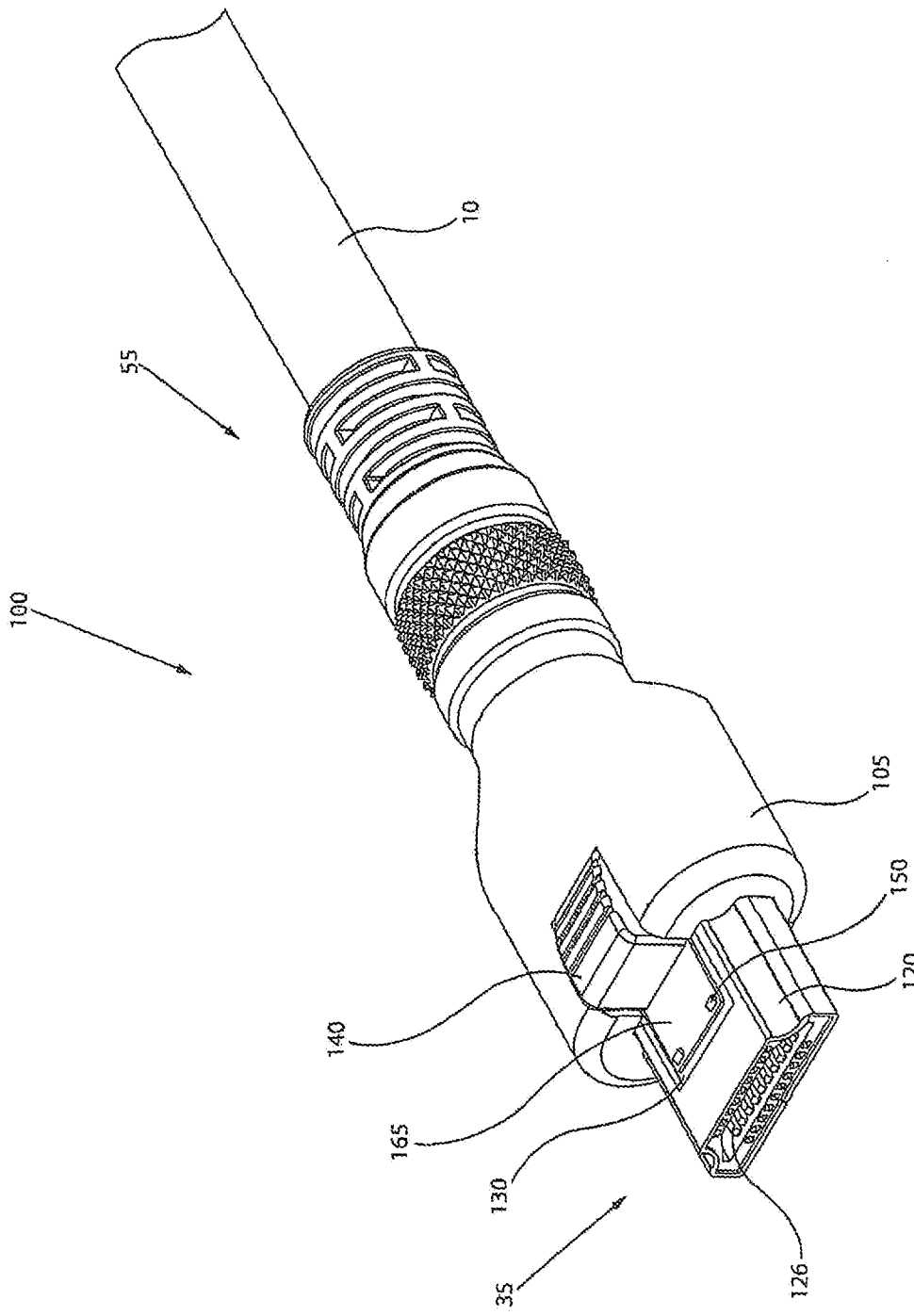


FIG. 5

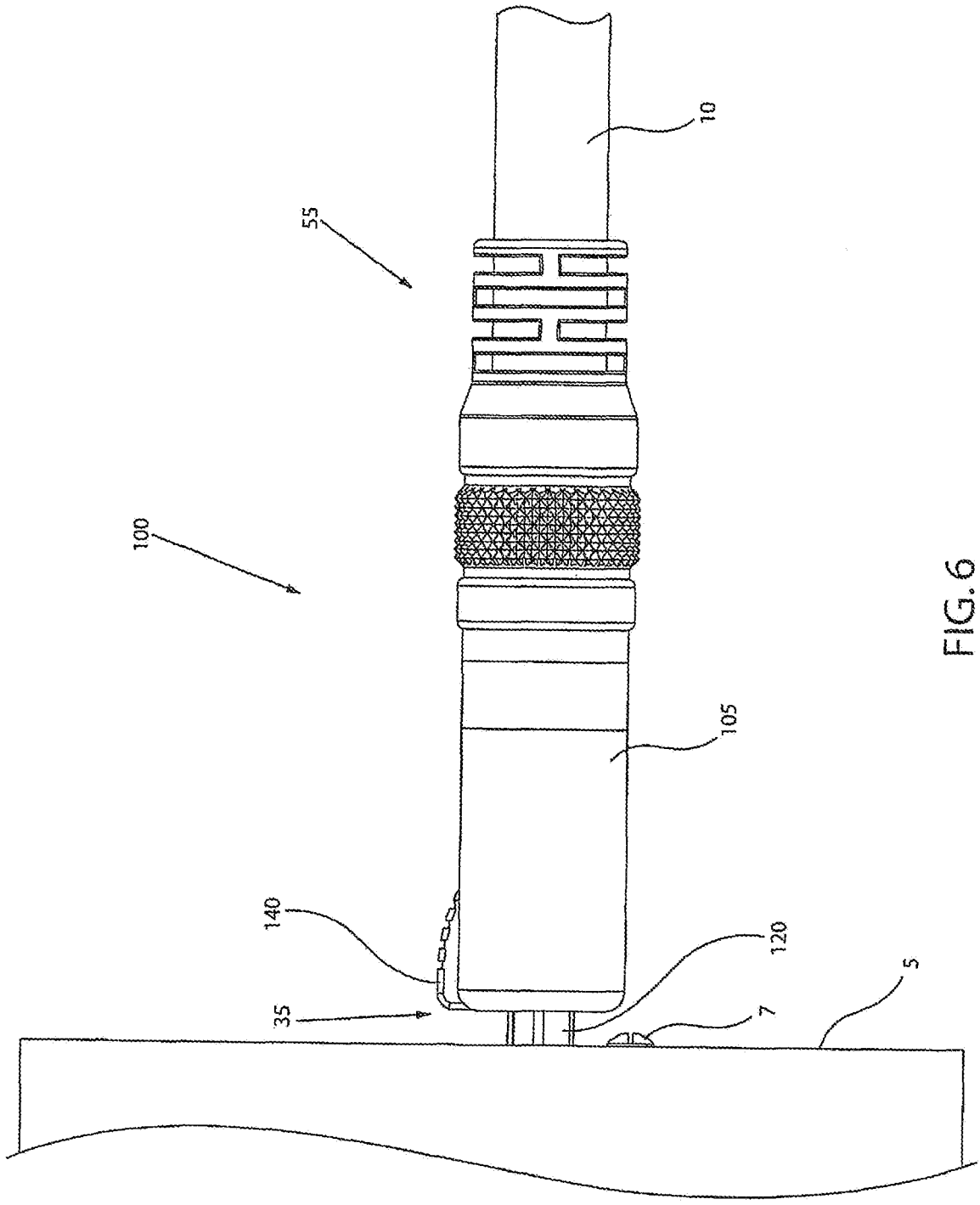


FIG. 6

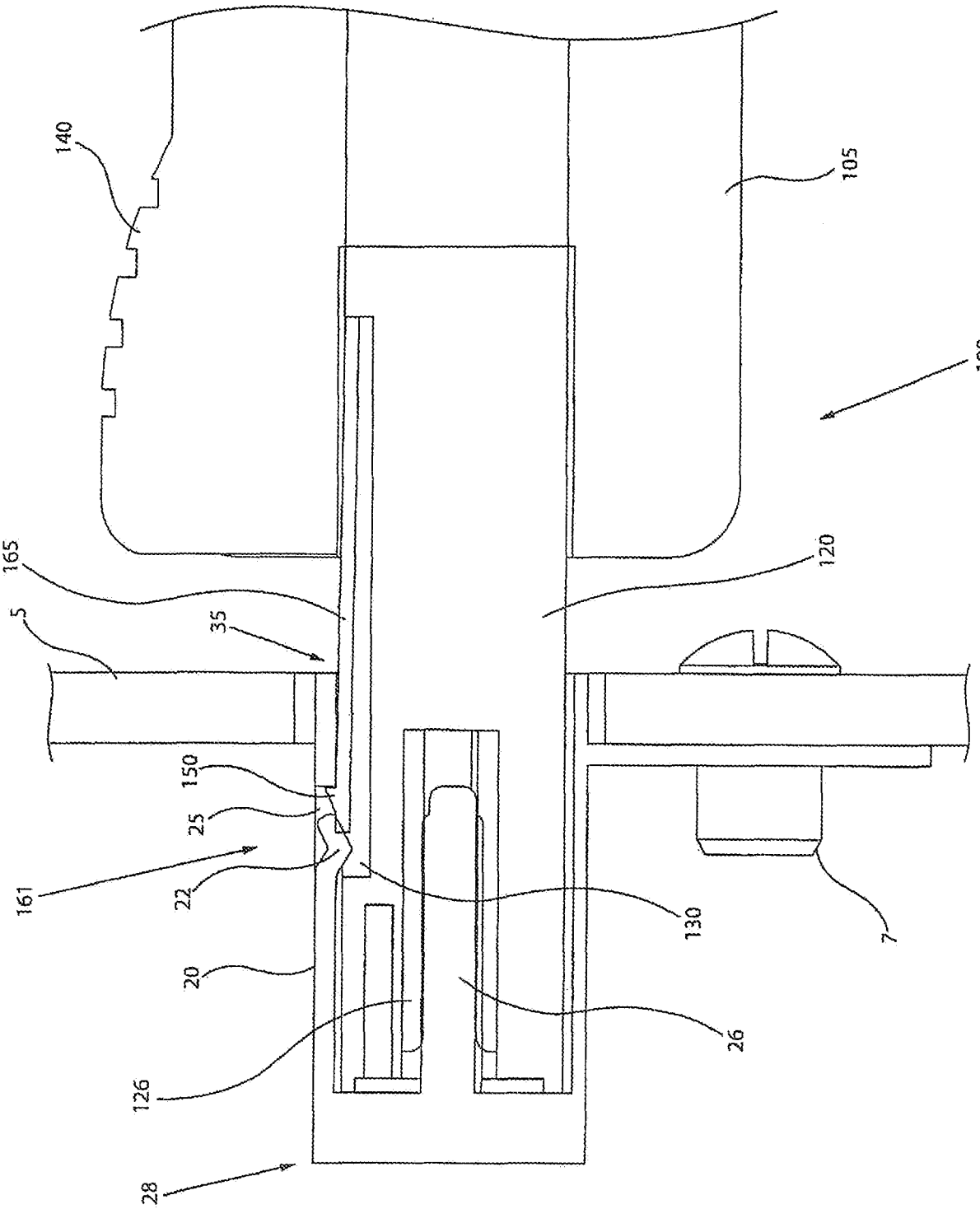


FIG. 7

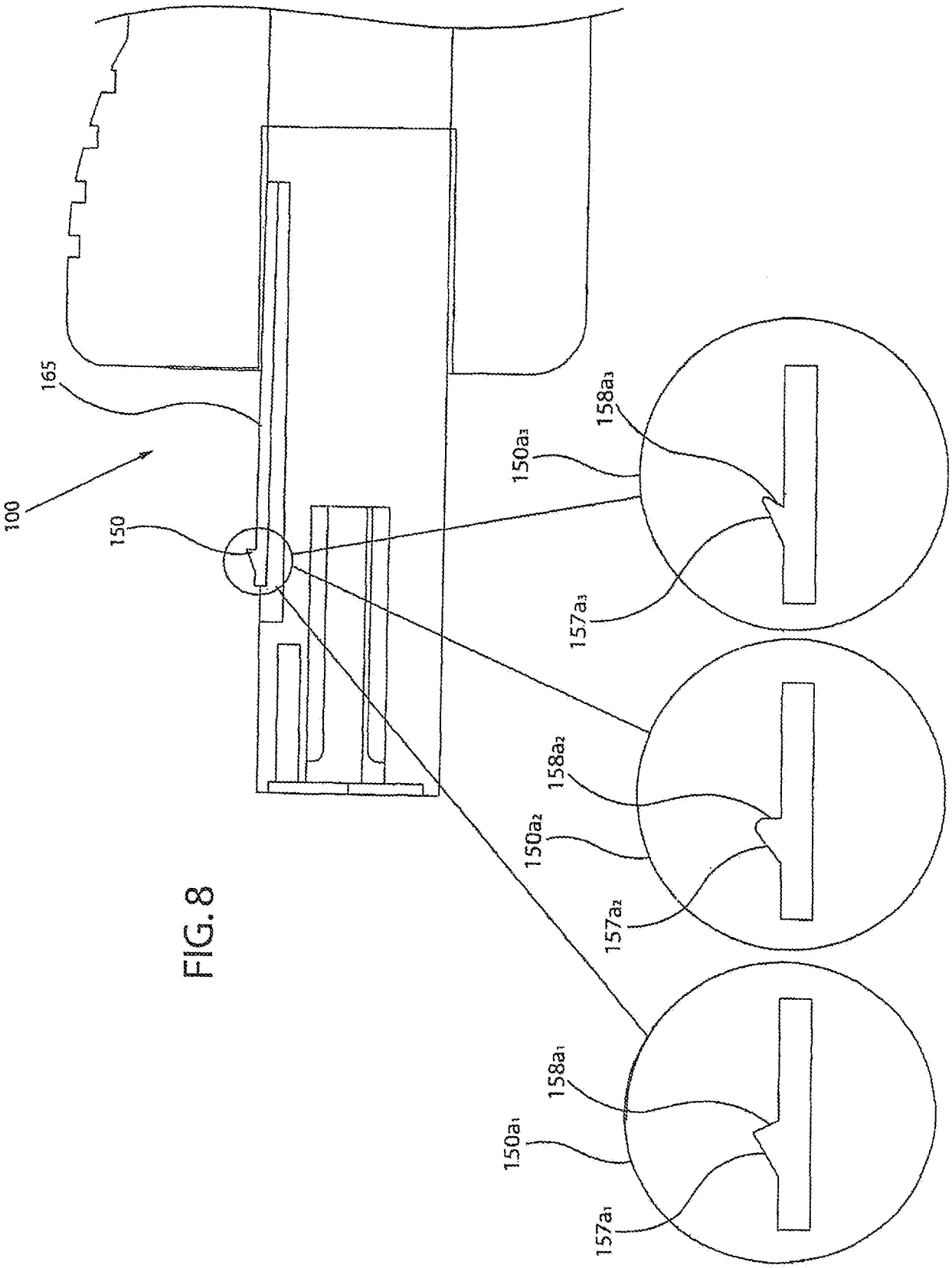

165
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158a3
157a3
158a2
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157a2
158a1
150a1
157a1

FIG. 8

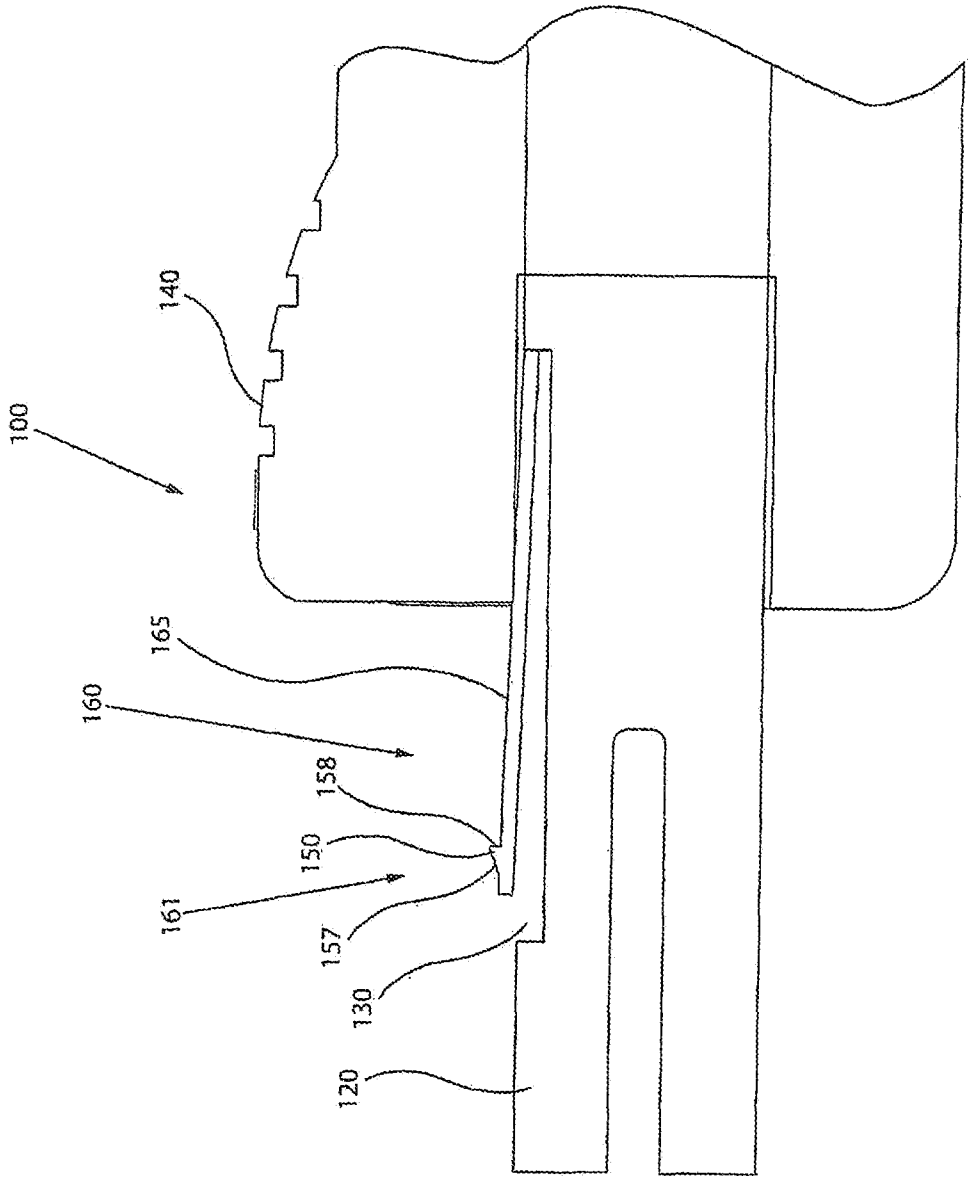


FIG. 9

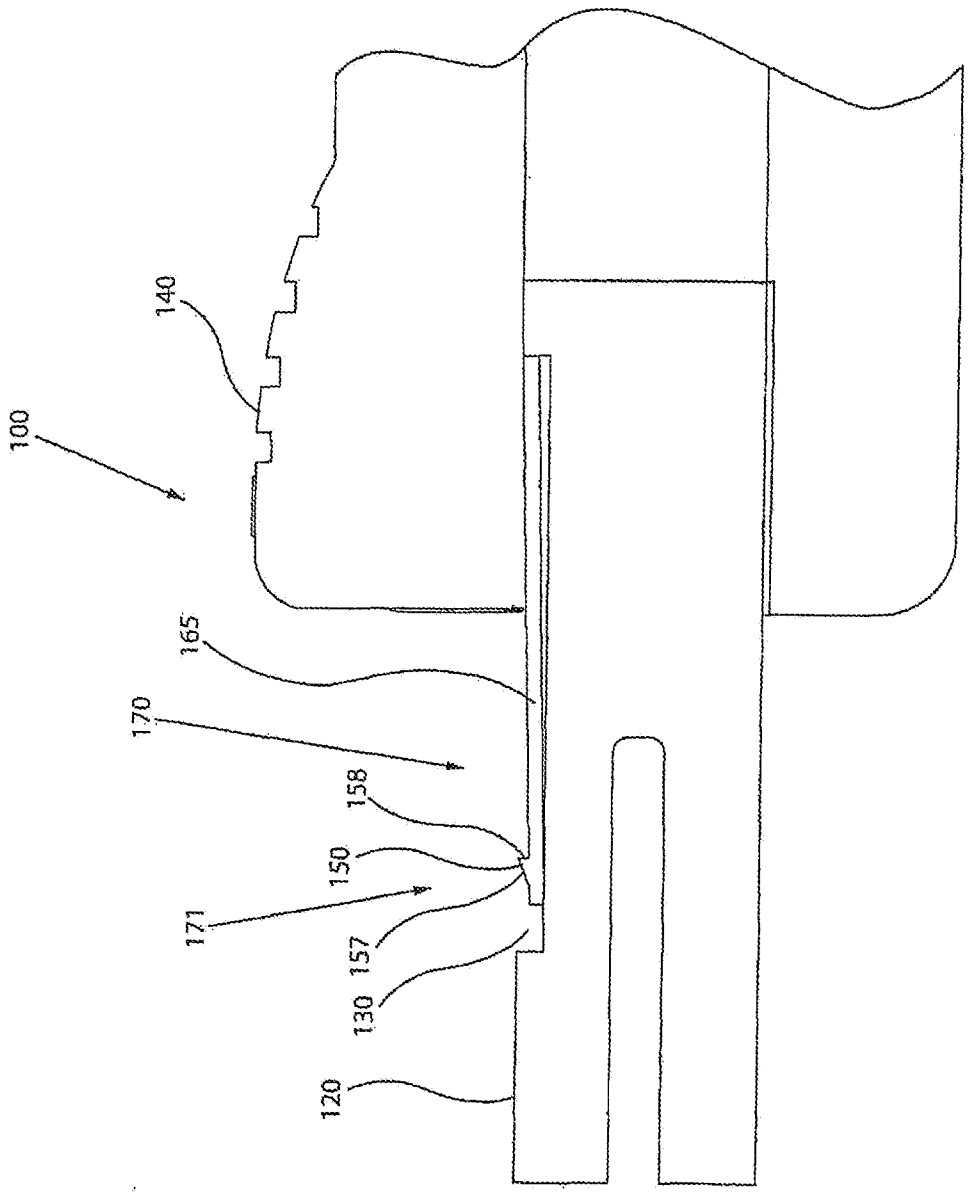


FIG. 10

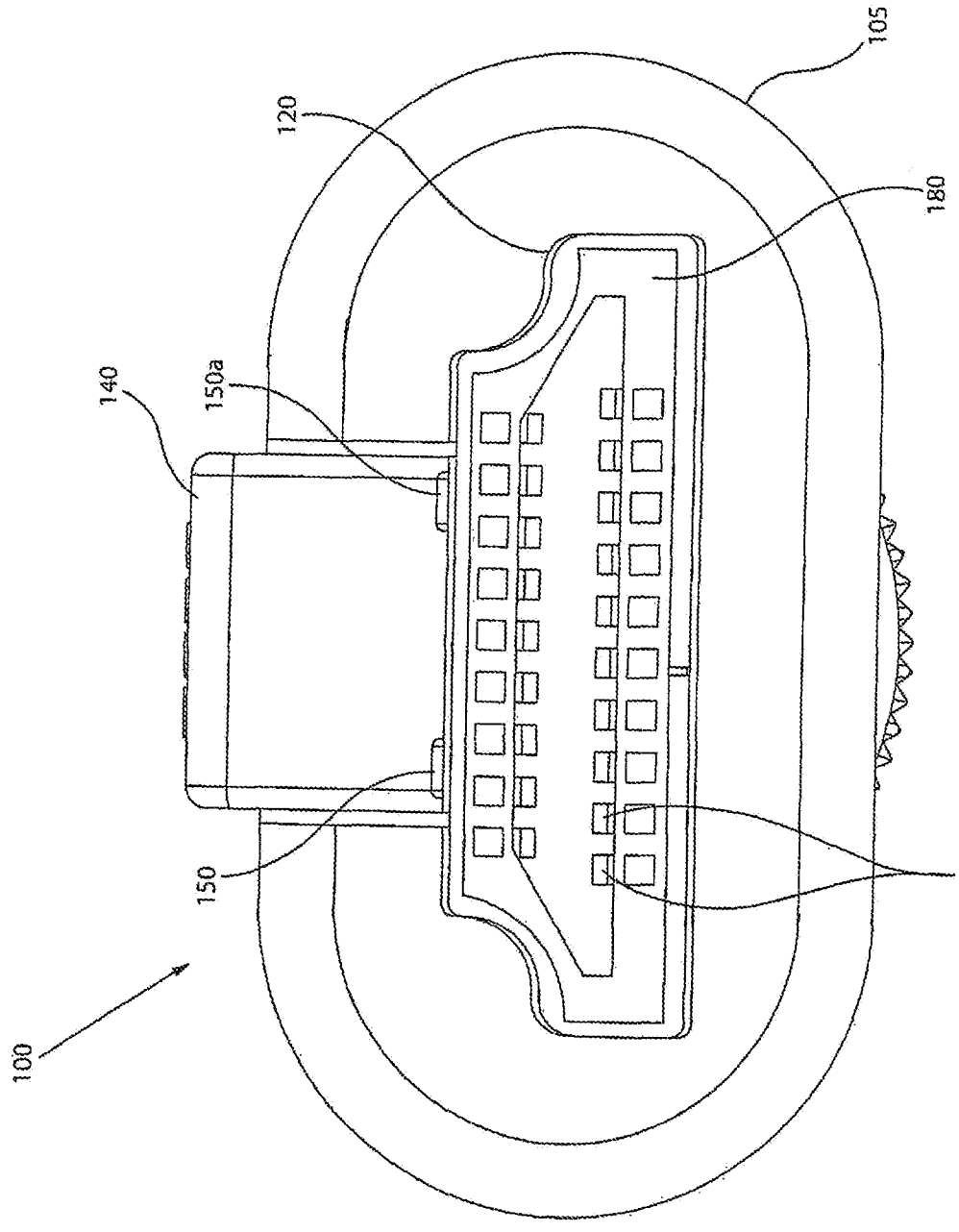


FIG. 11

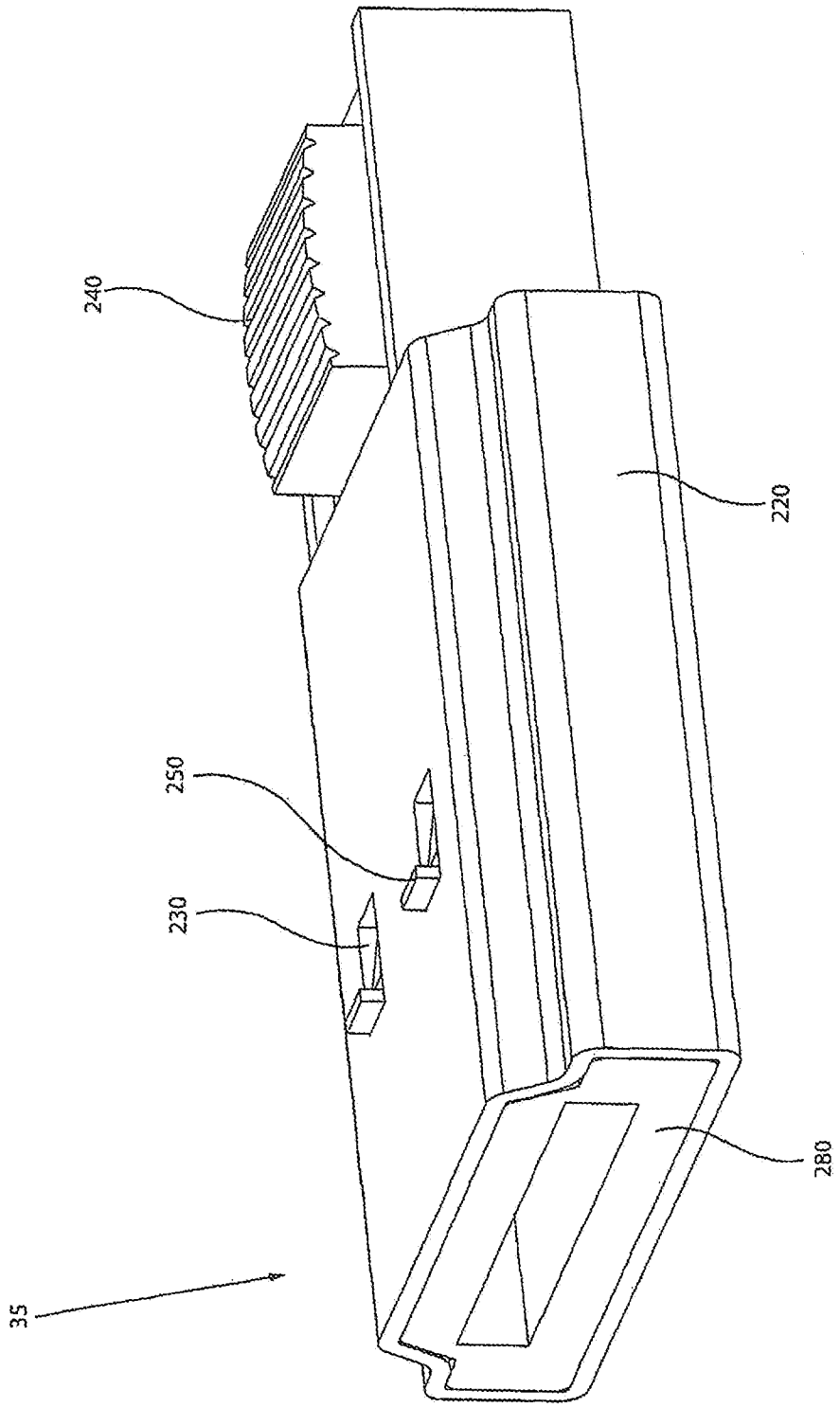


FIG. 12

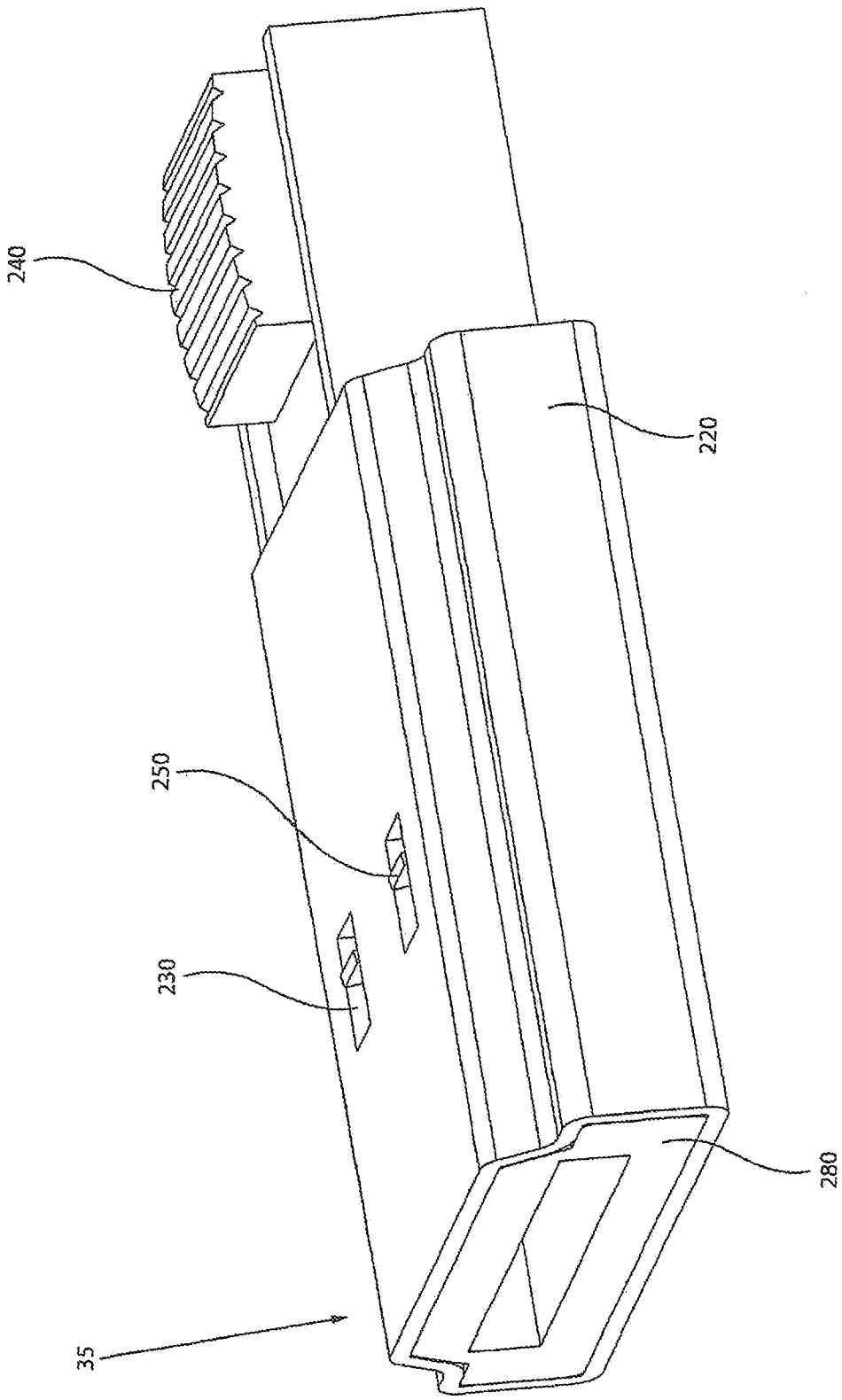


FIG. 13

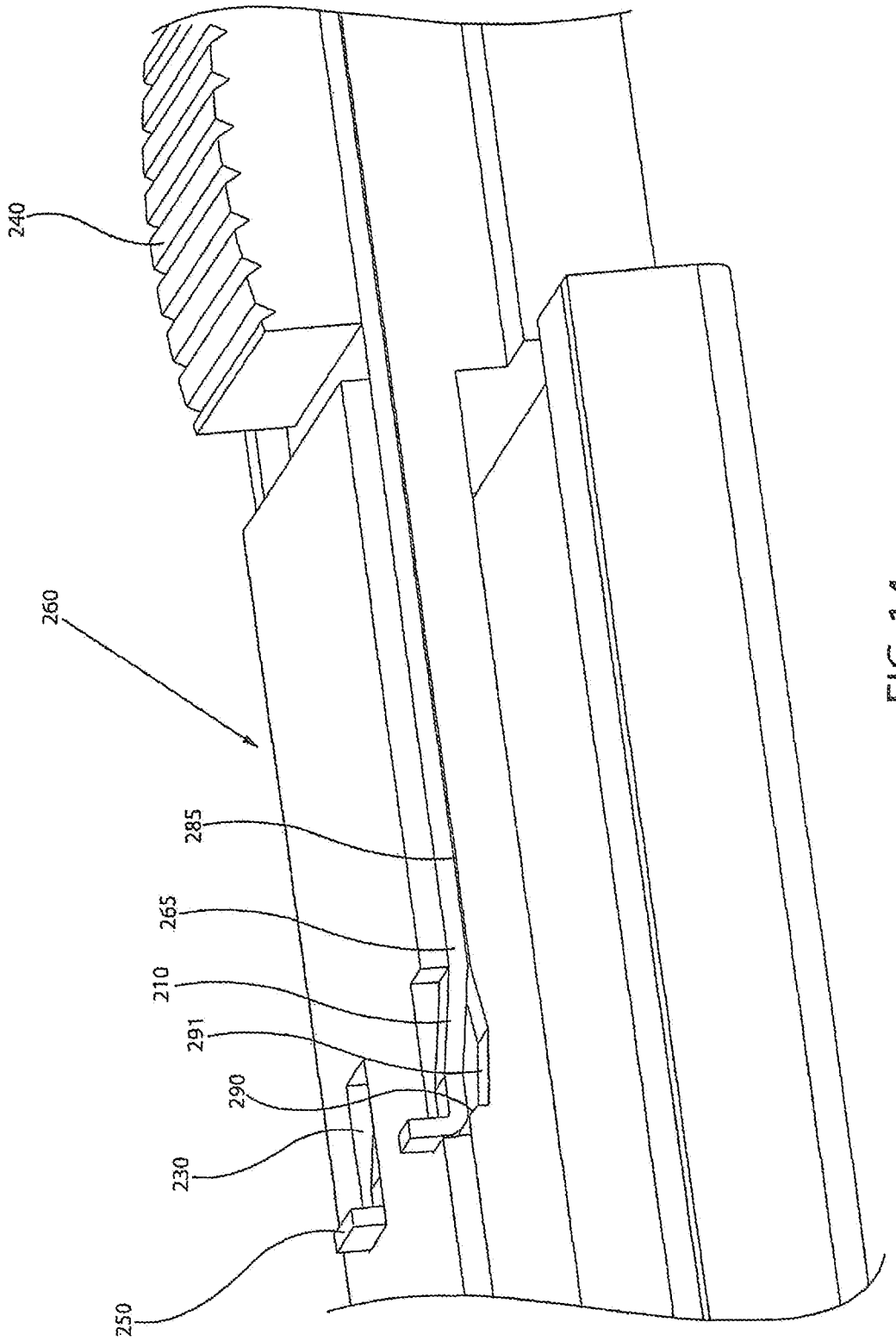


FIG. 14

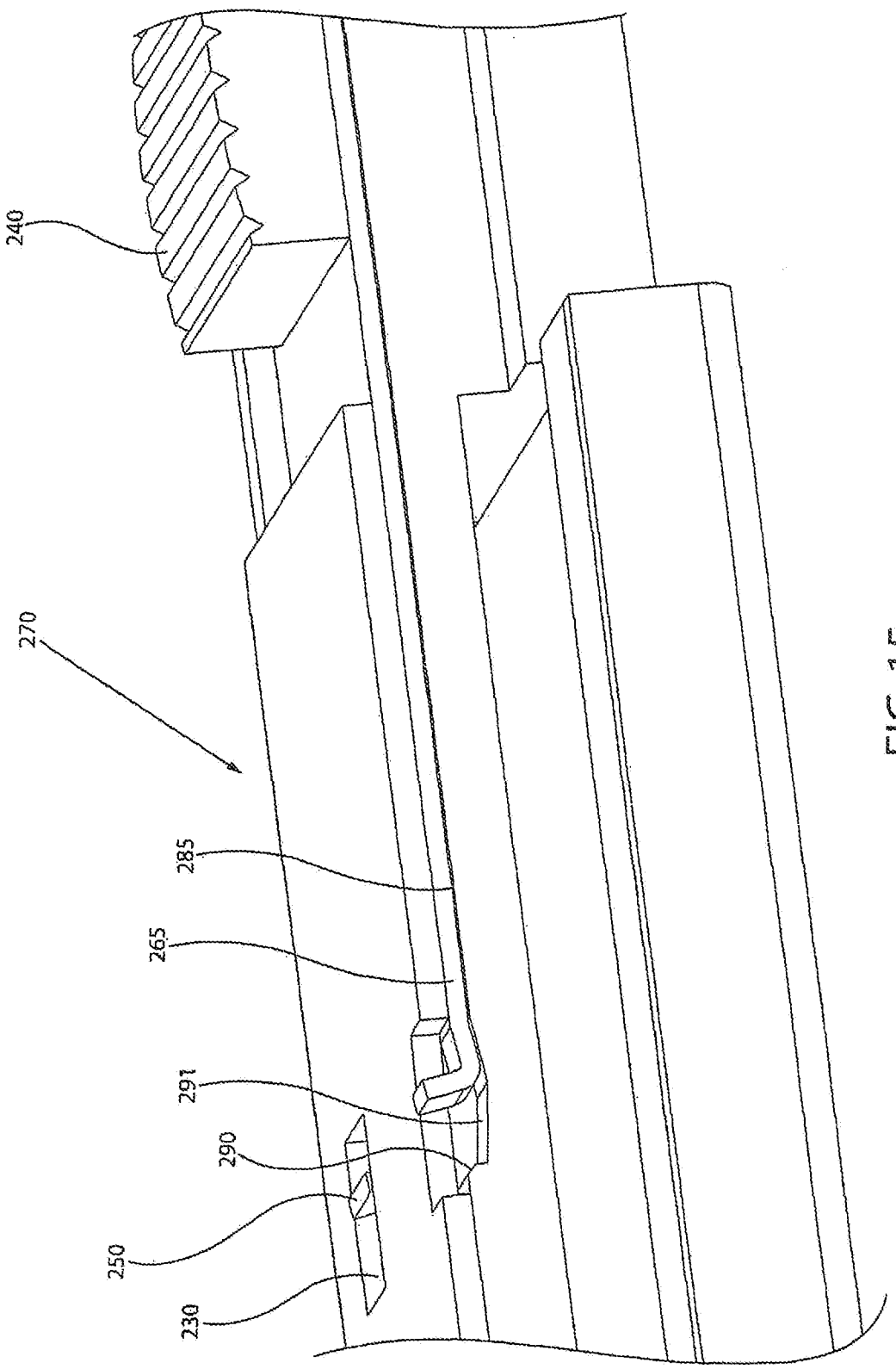


FIG. 15

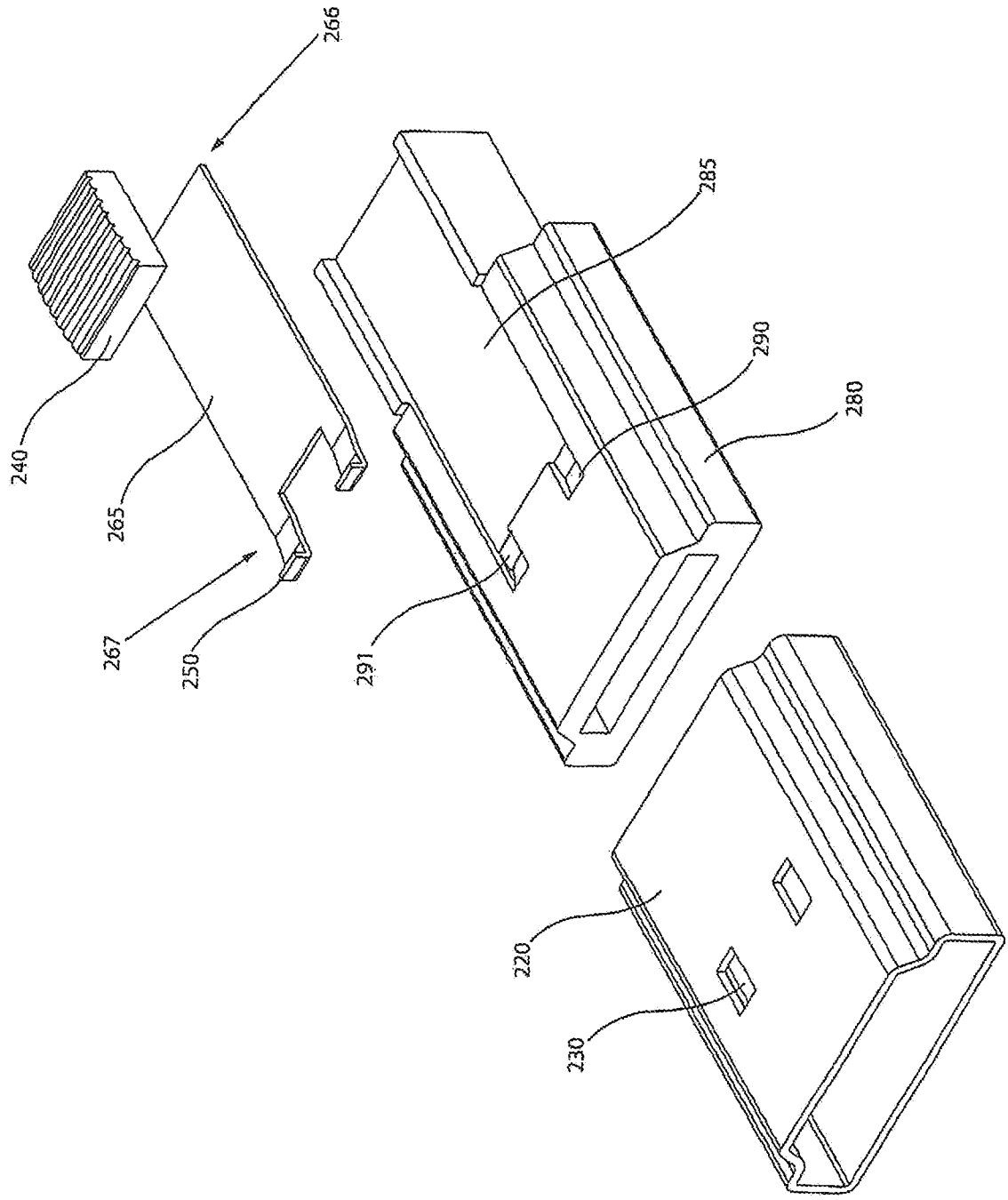


FIG. 16

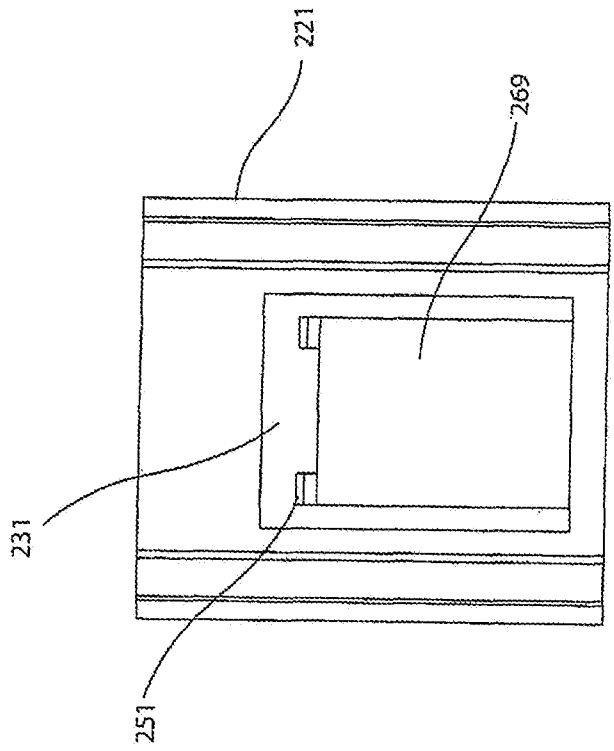


FIG.17

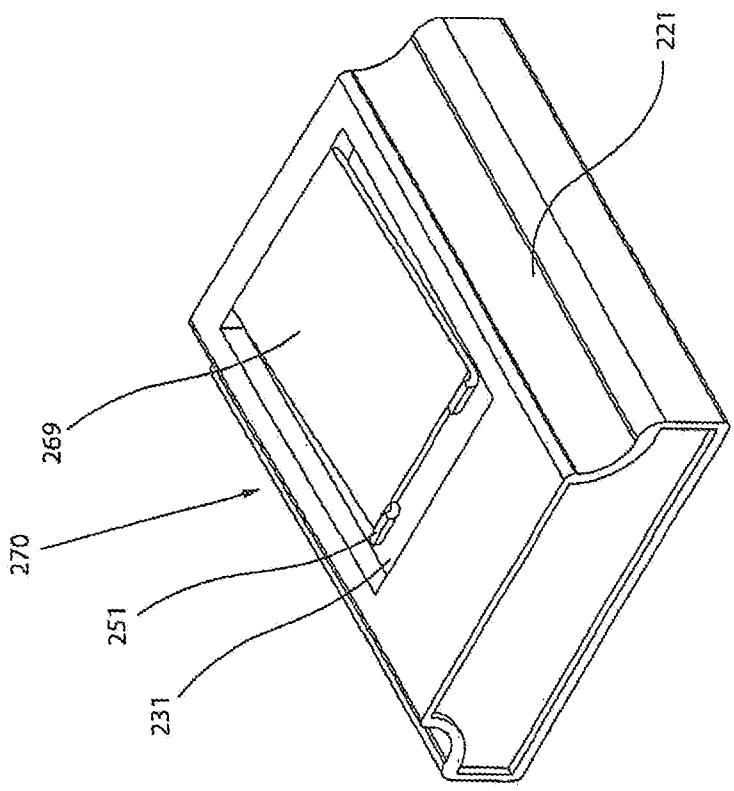


FIG. 18

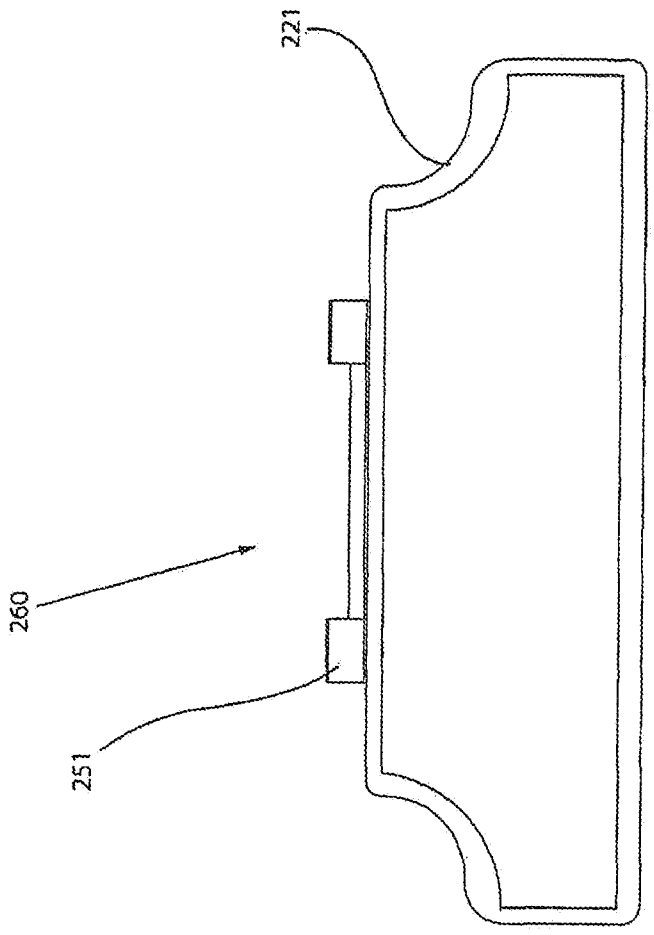


FIG. 19

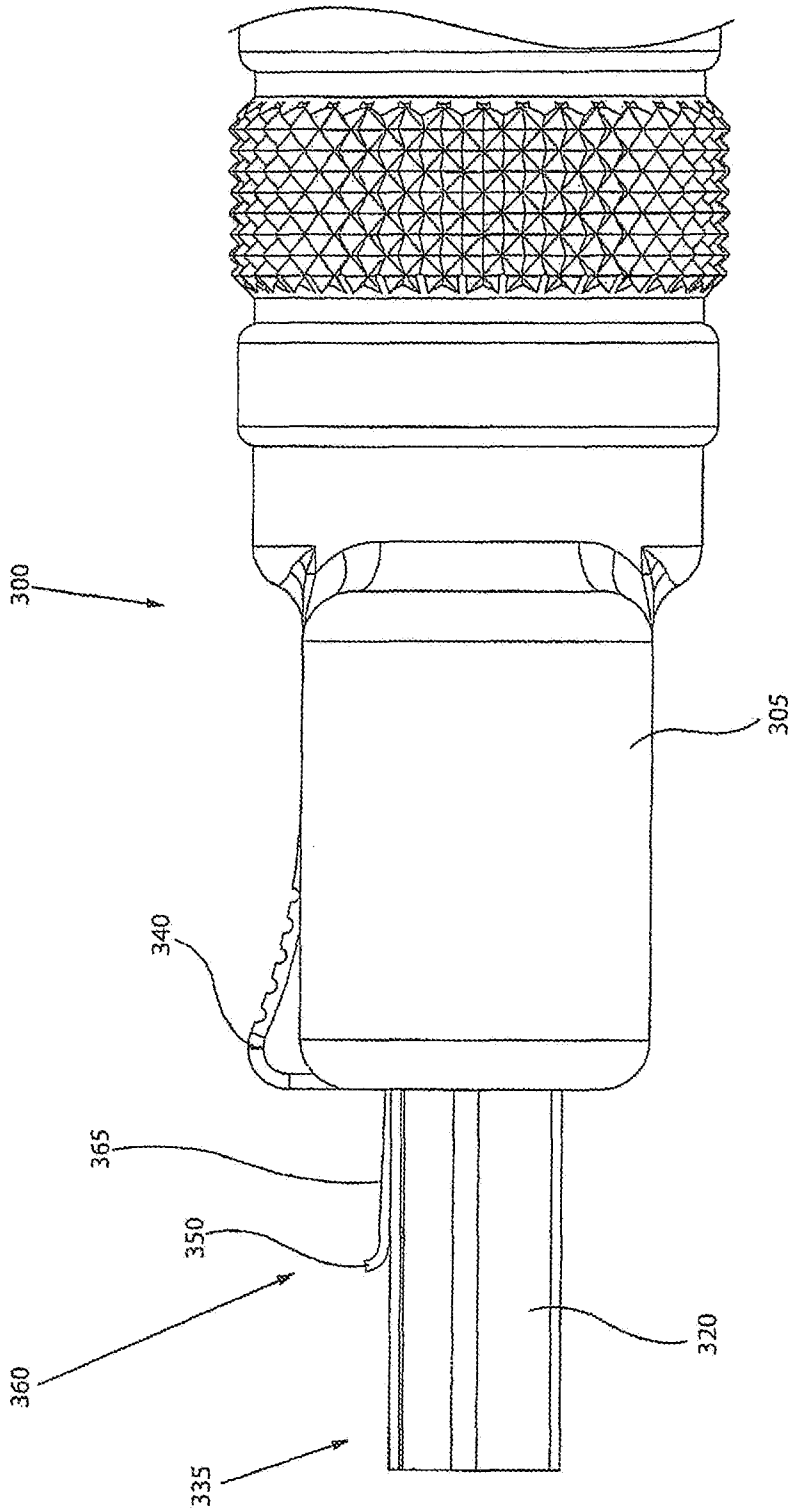


FIG. 20

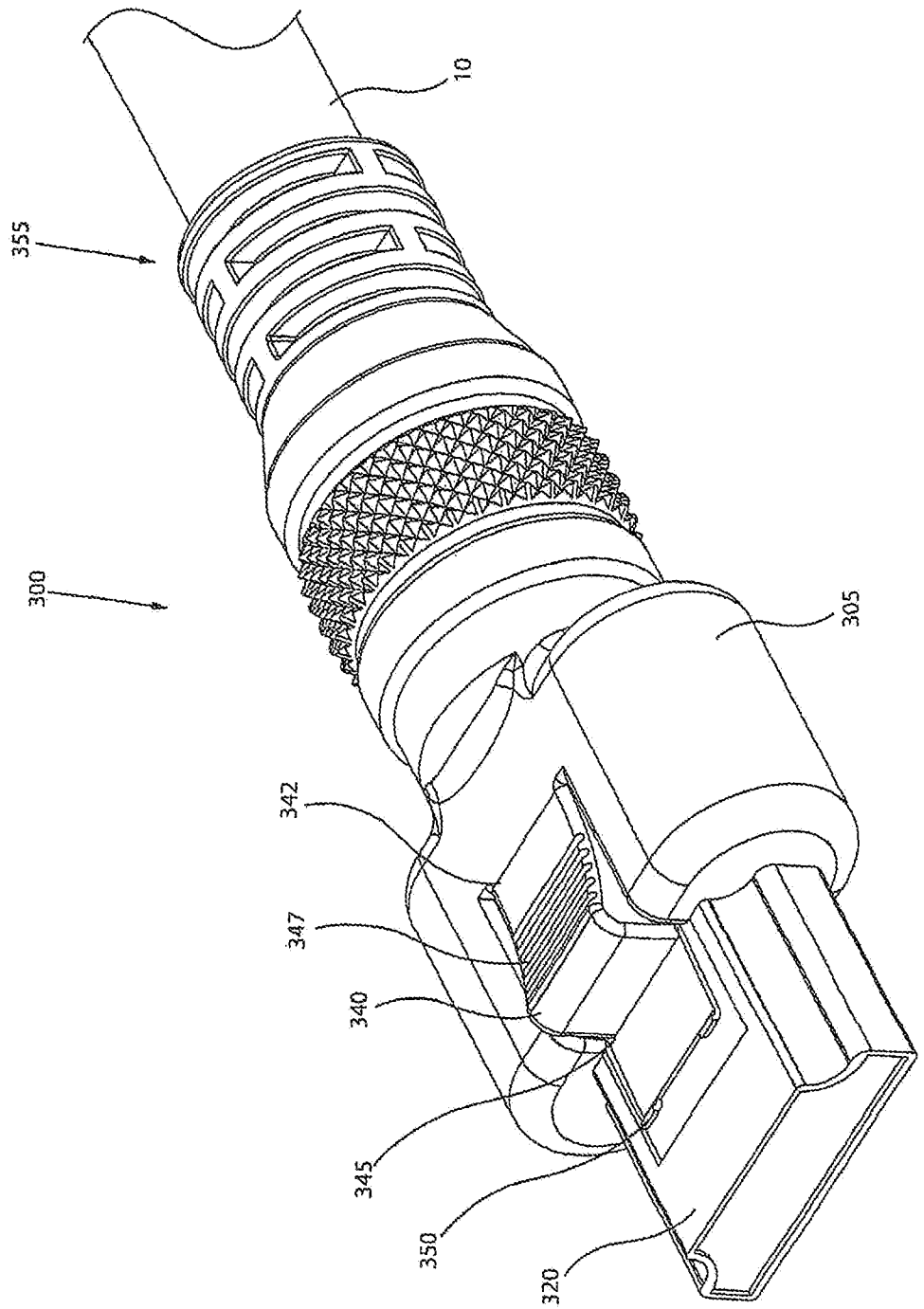


FIG. 21

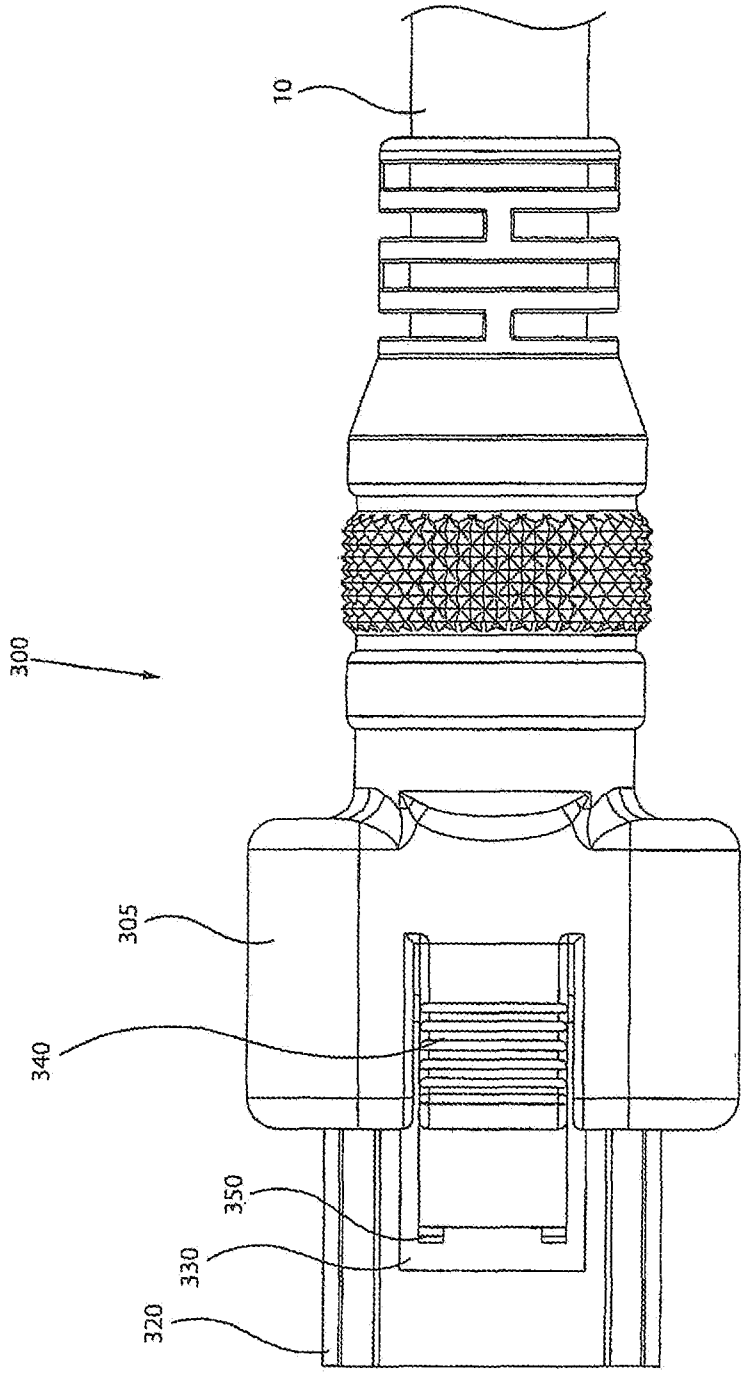


FIG. 22

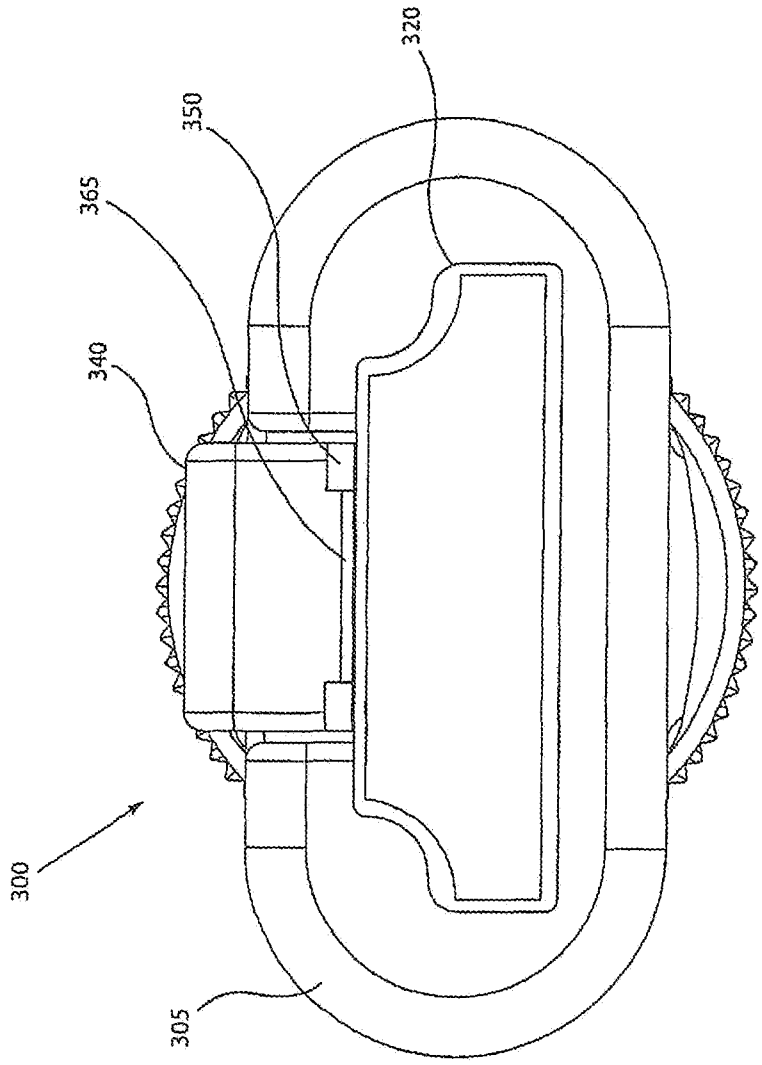


FIG. 23

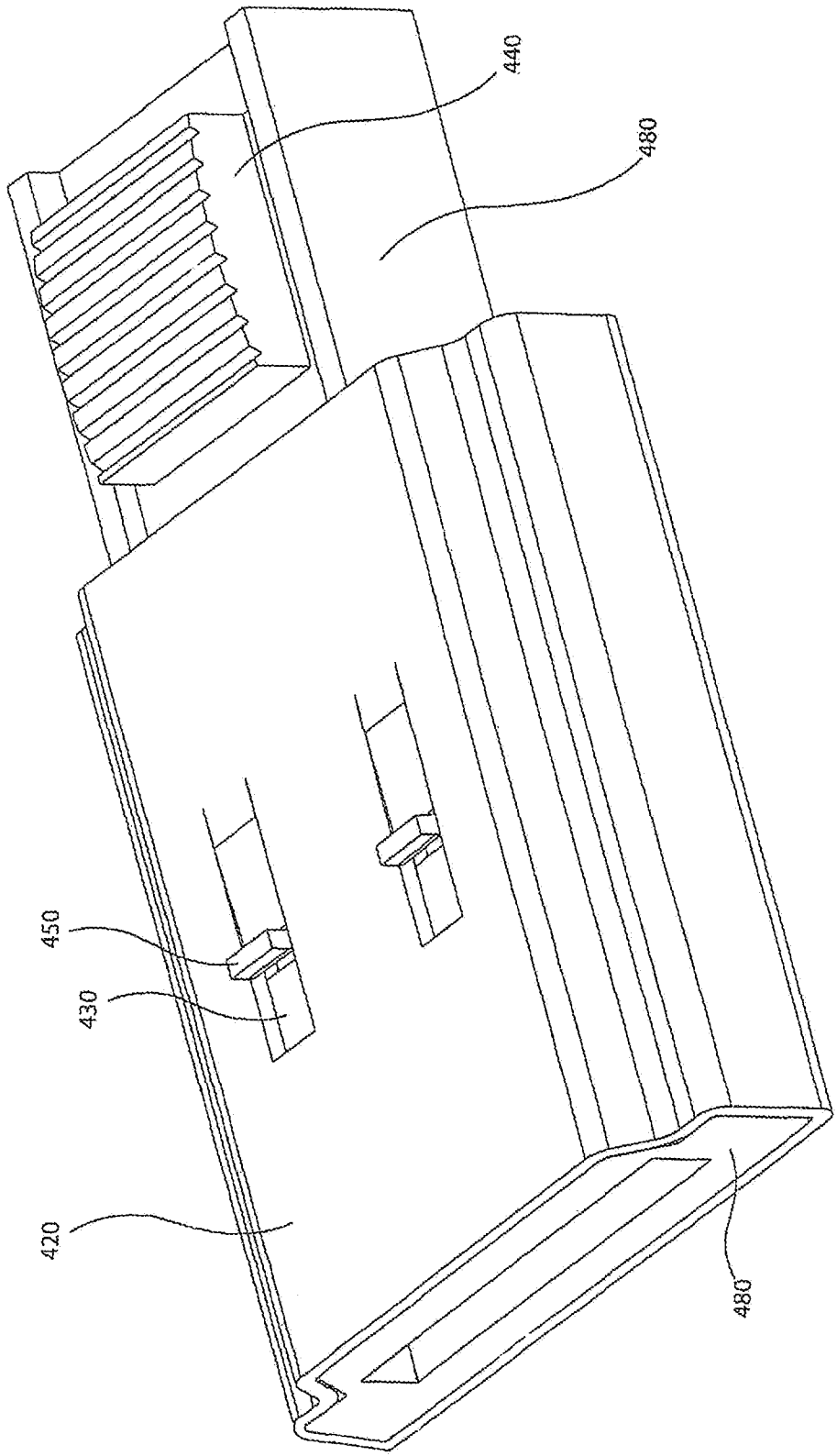


FIG. 24

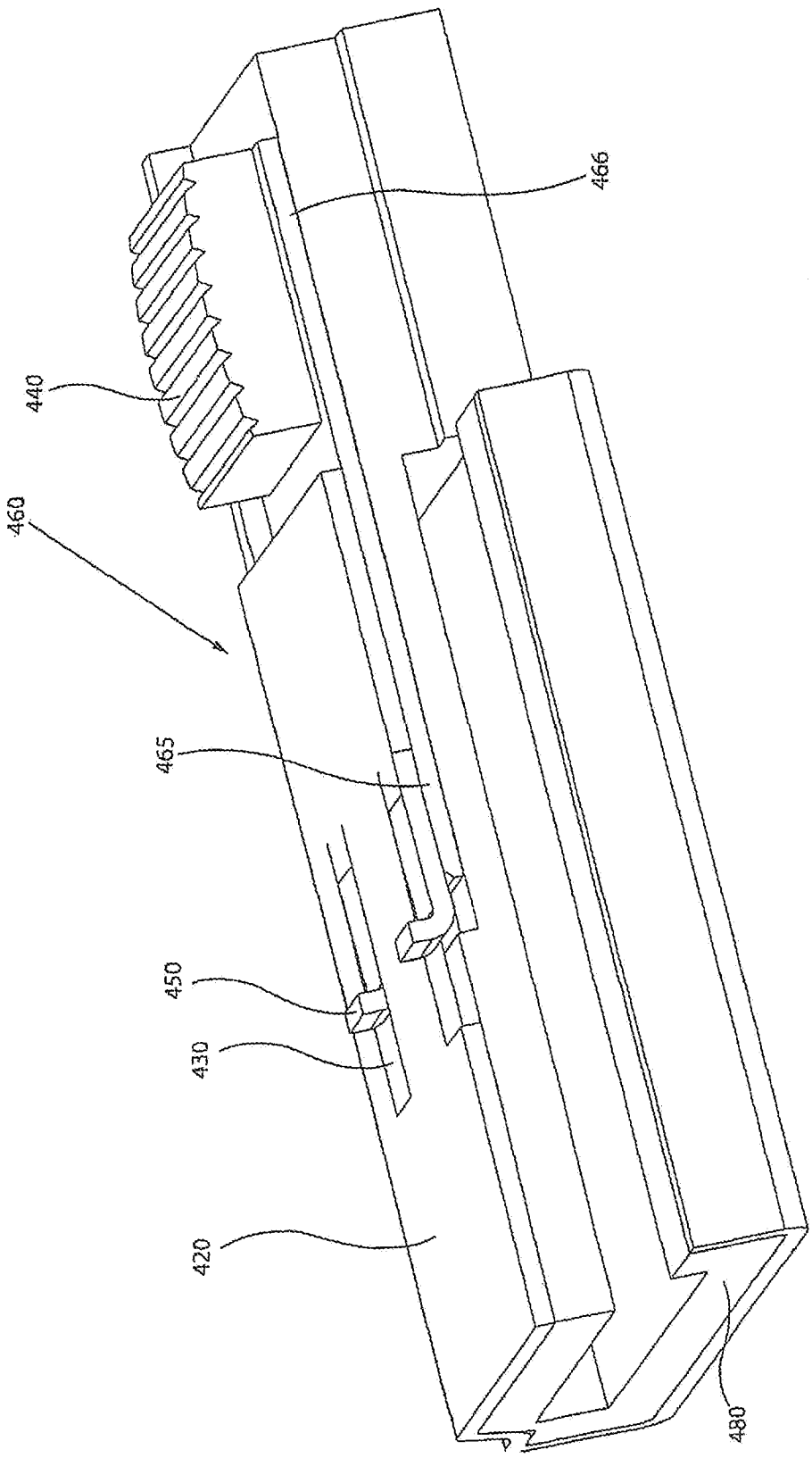


FIG. 25

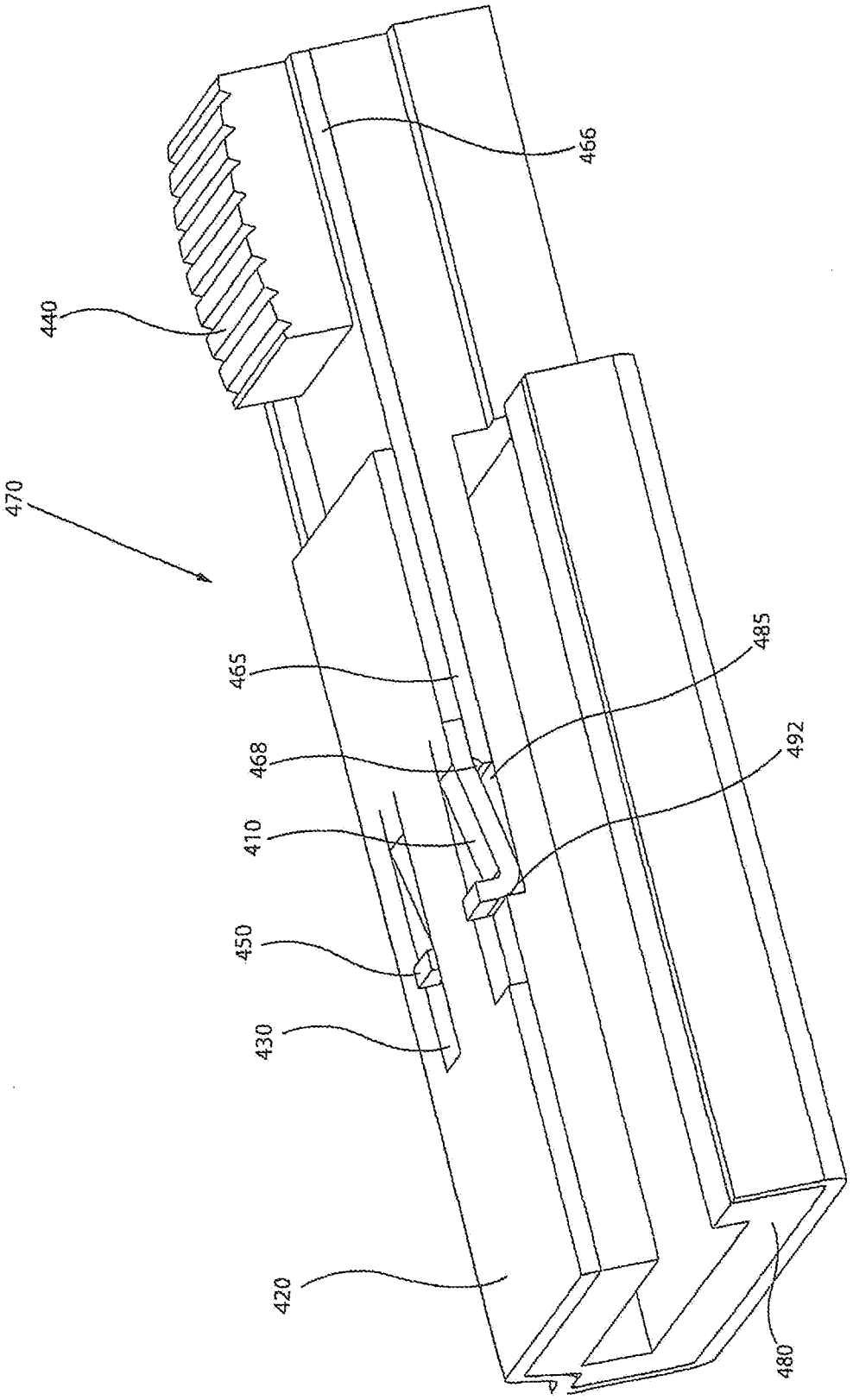


FIG. 26

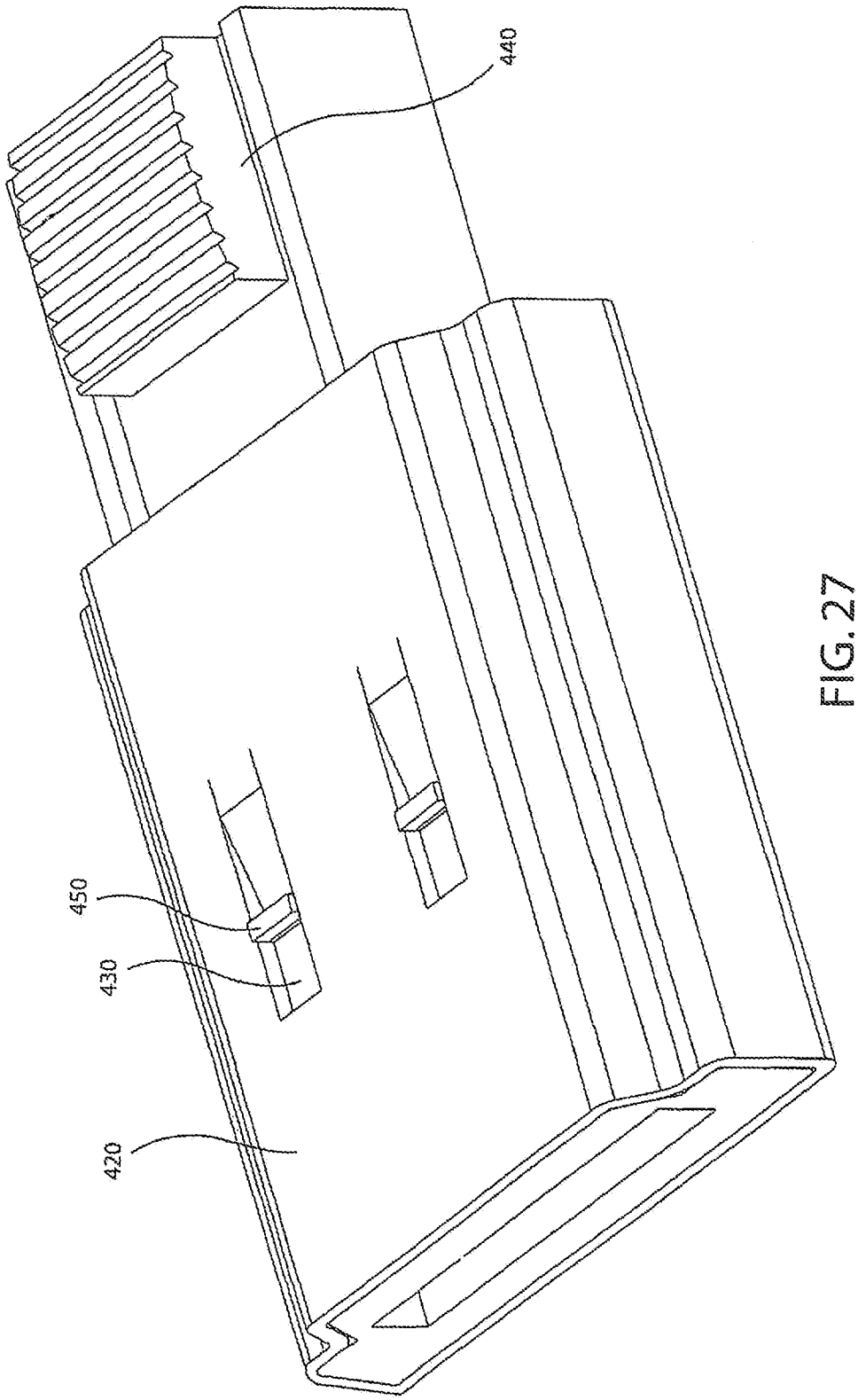


FIG. 27

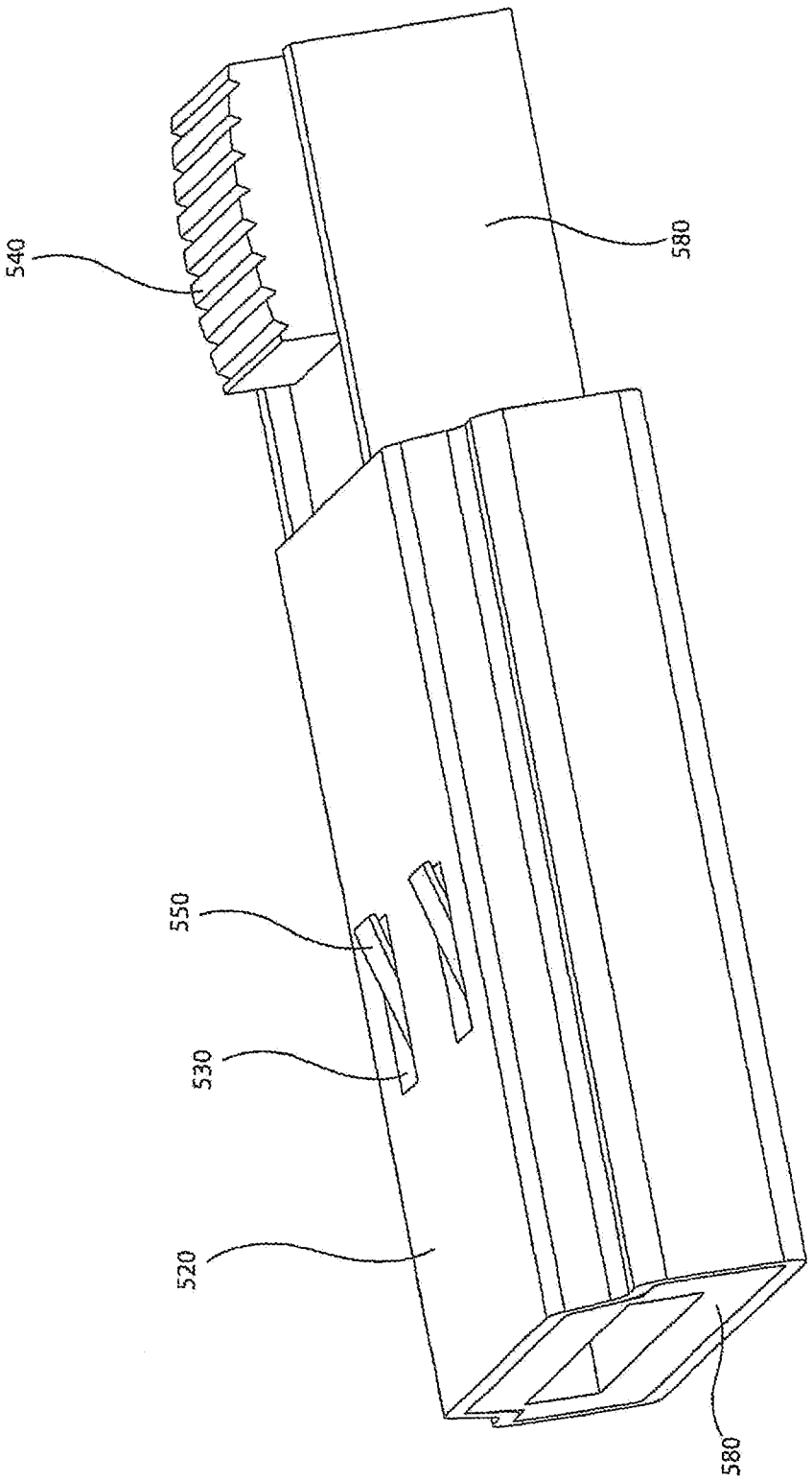


FIG. 28

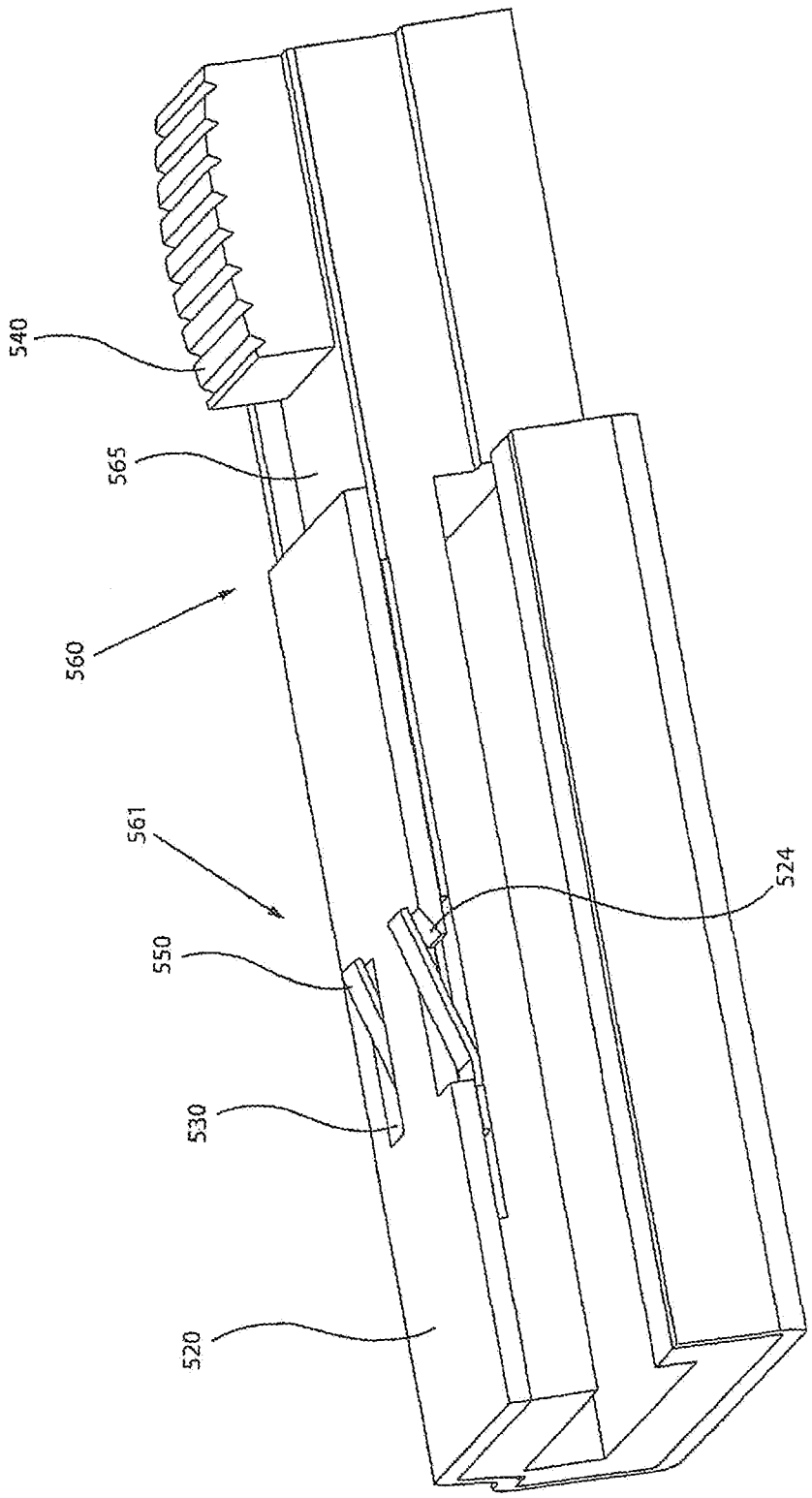


FIG. 29

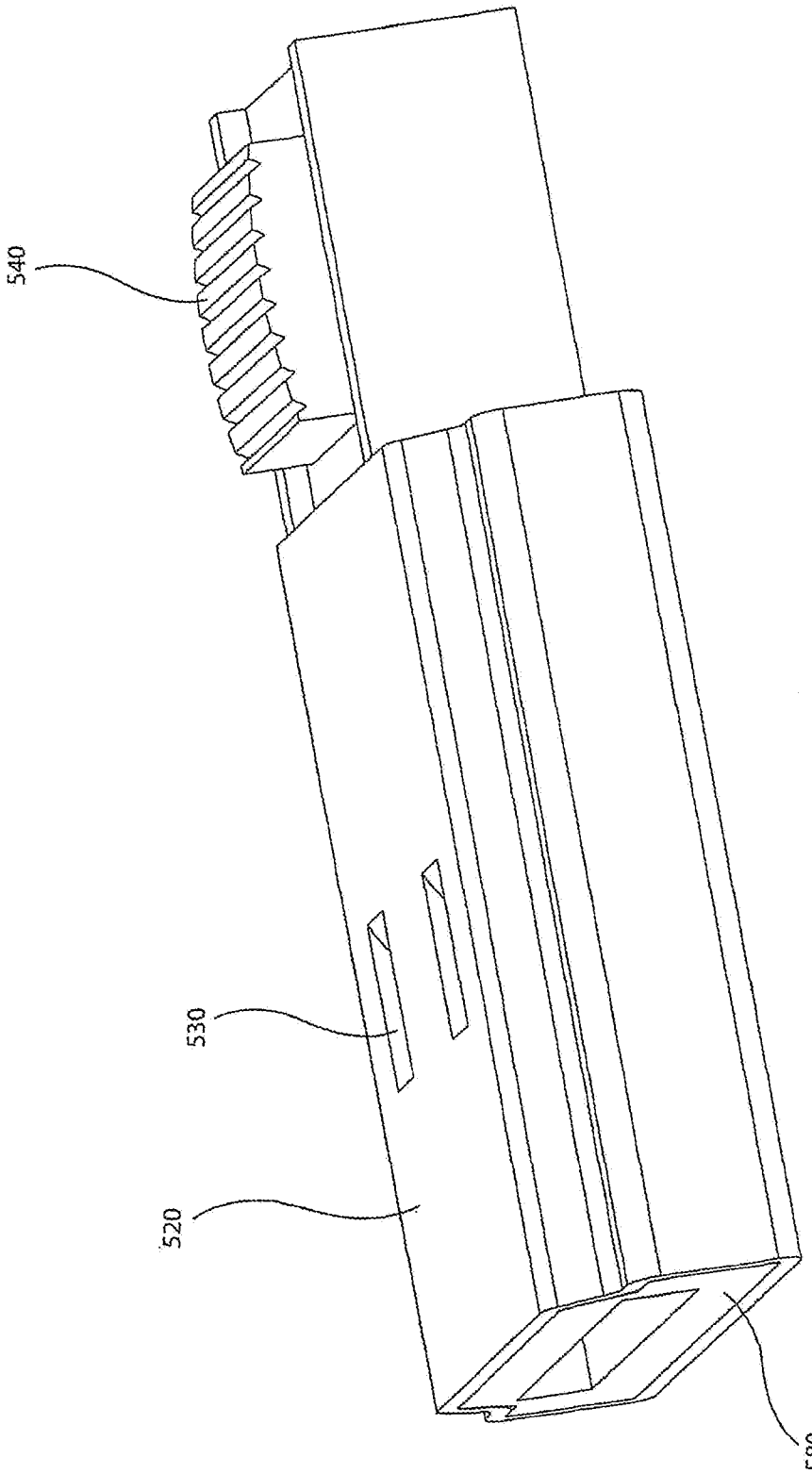


FIG. 30

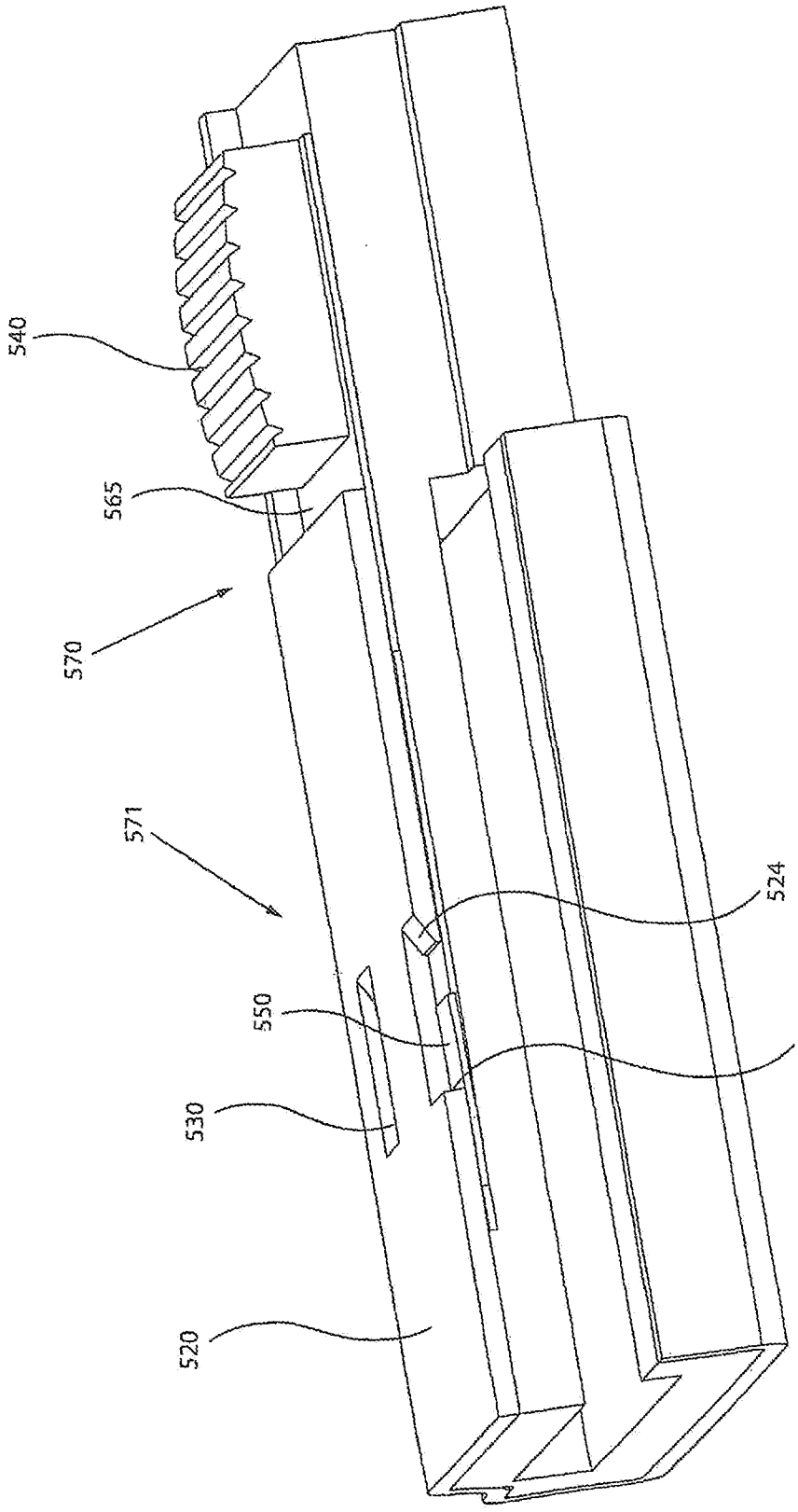


FIG. 31

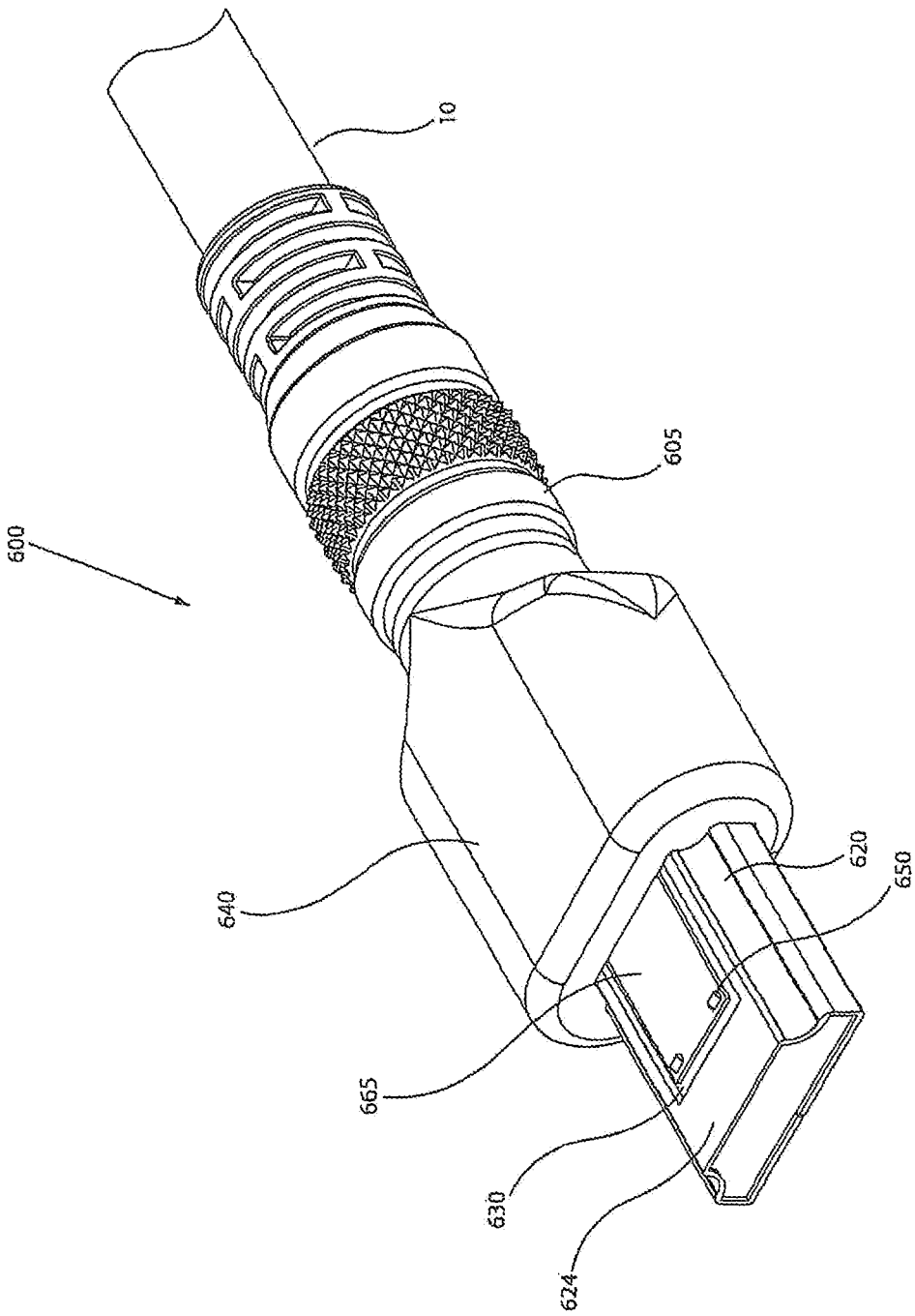


FIG. 32

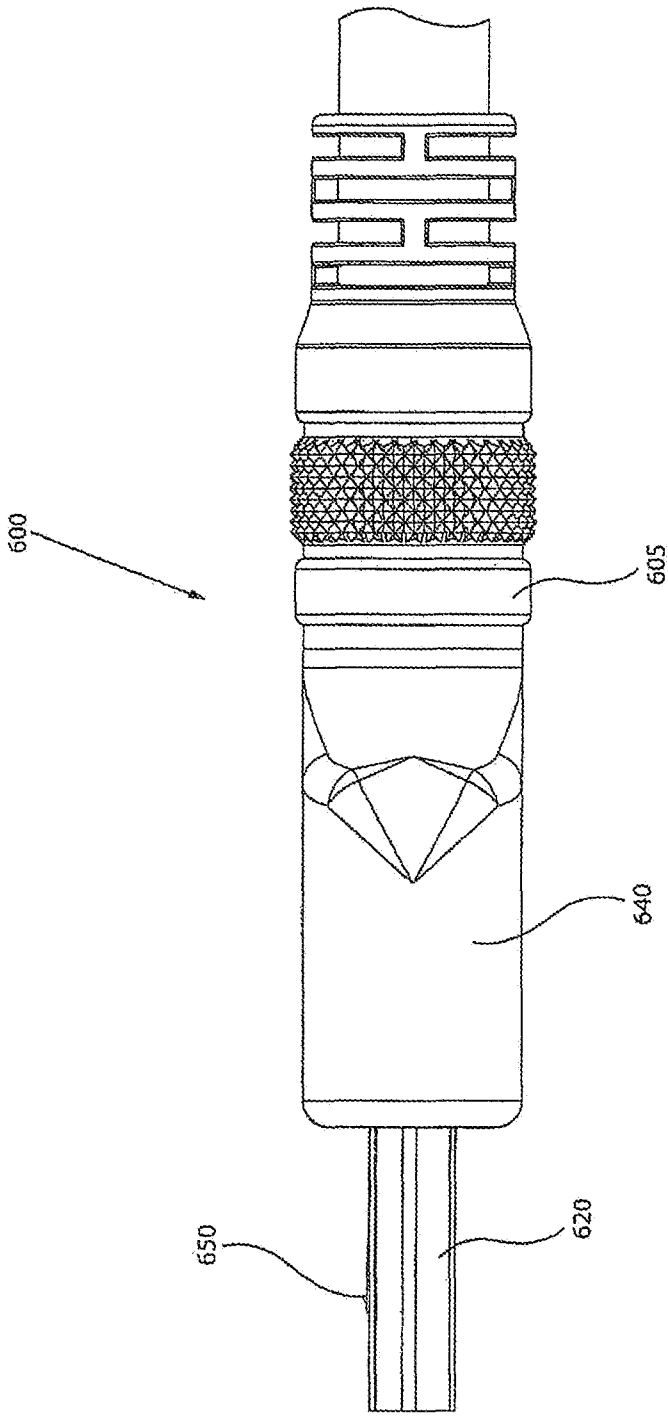


FIG. 33

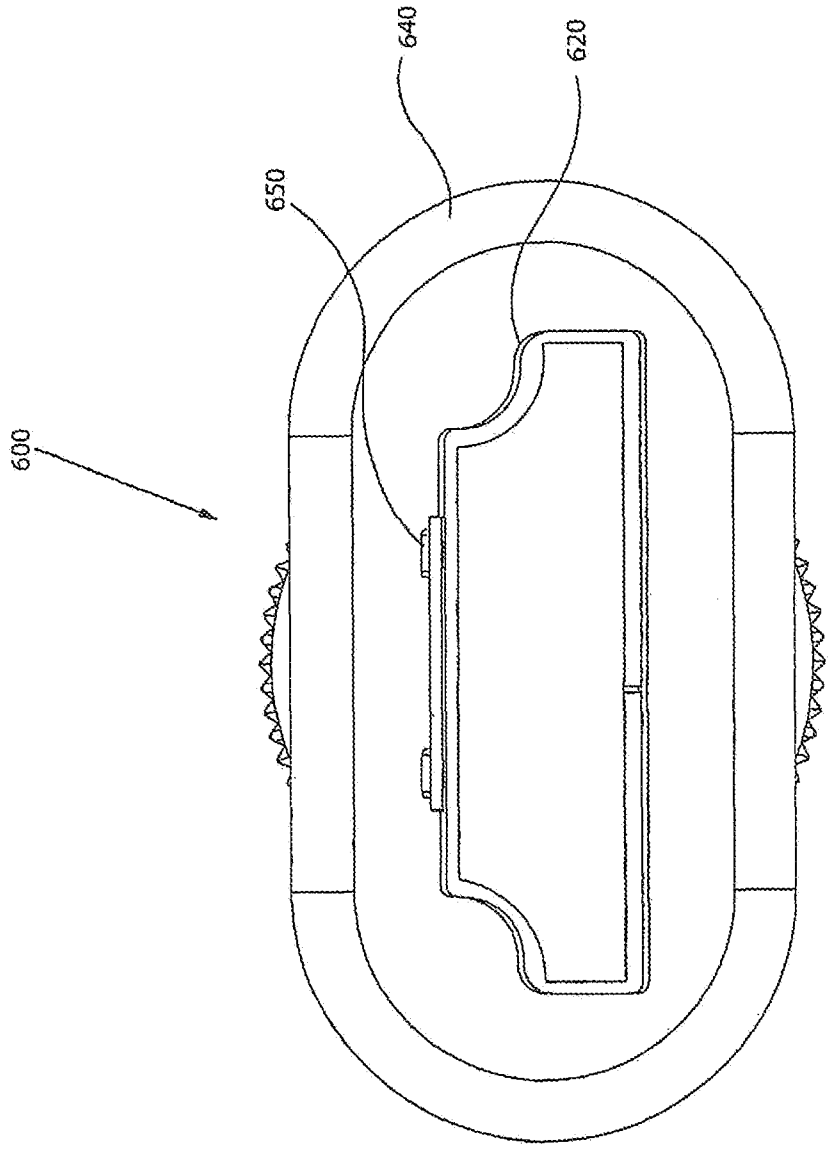


FIG. 34

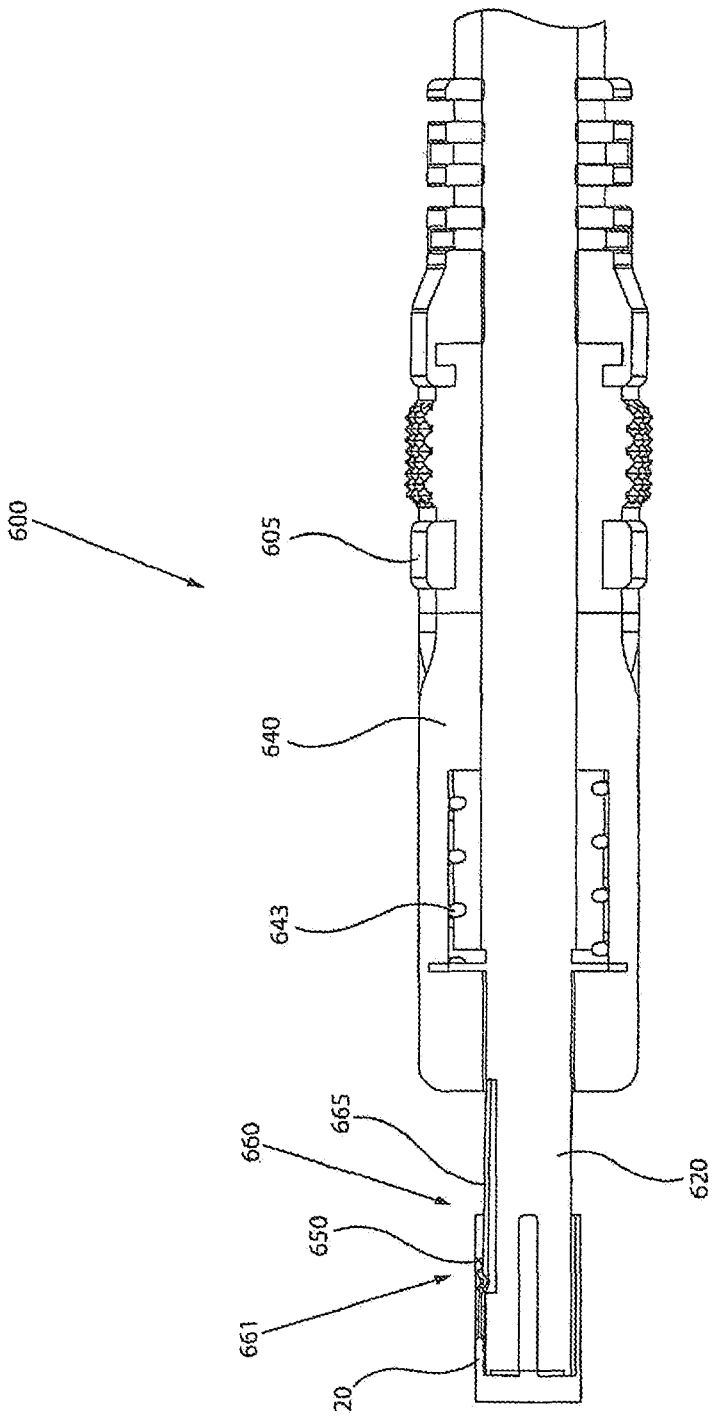


FIG. 35

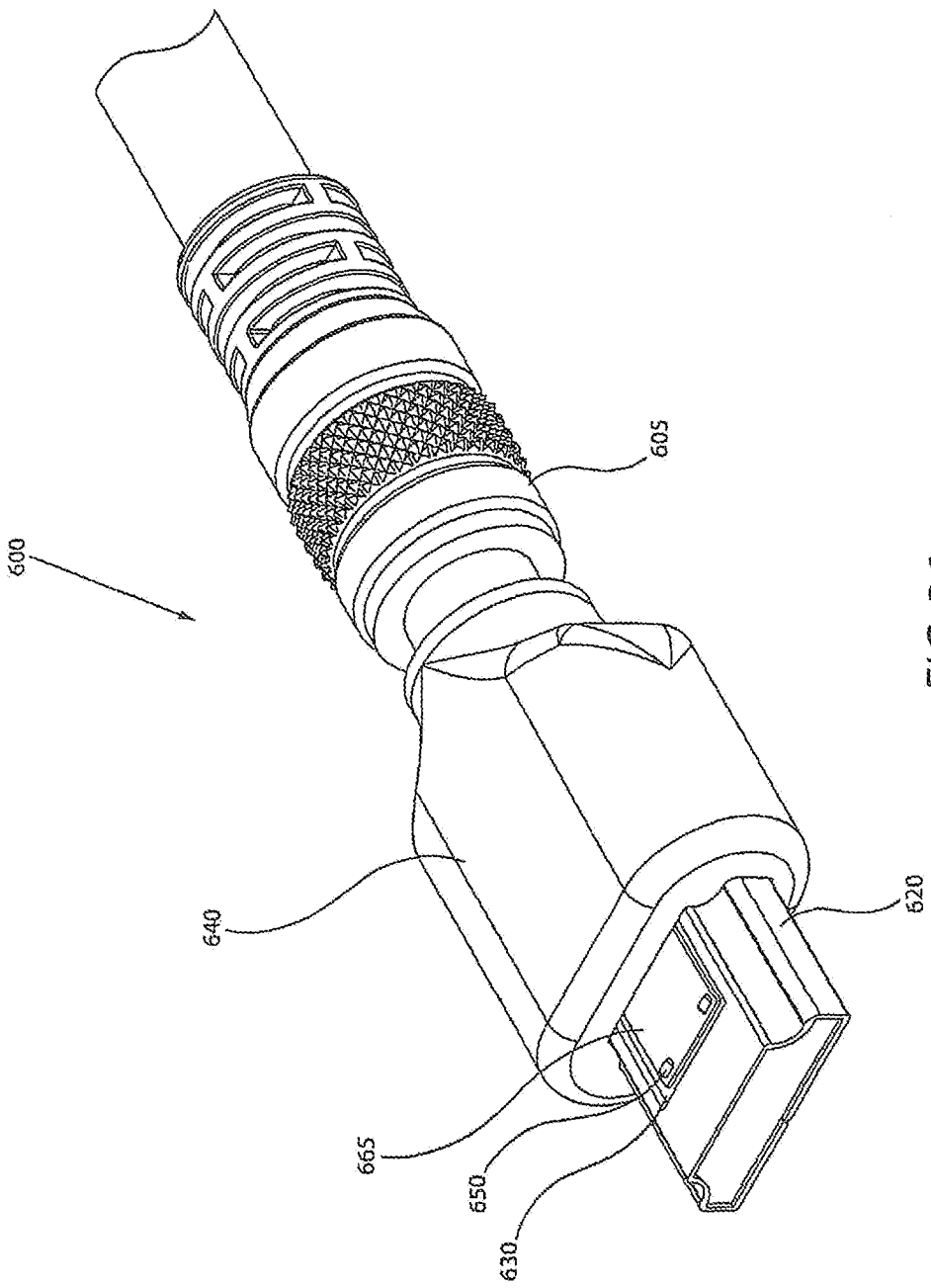


FIG. 36

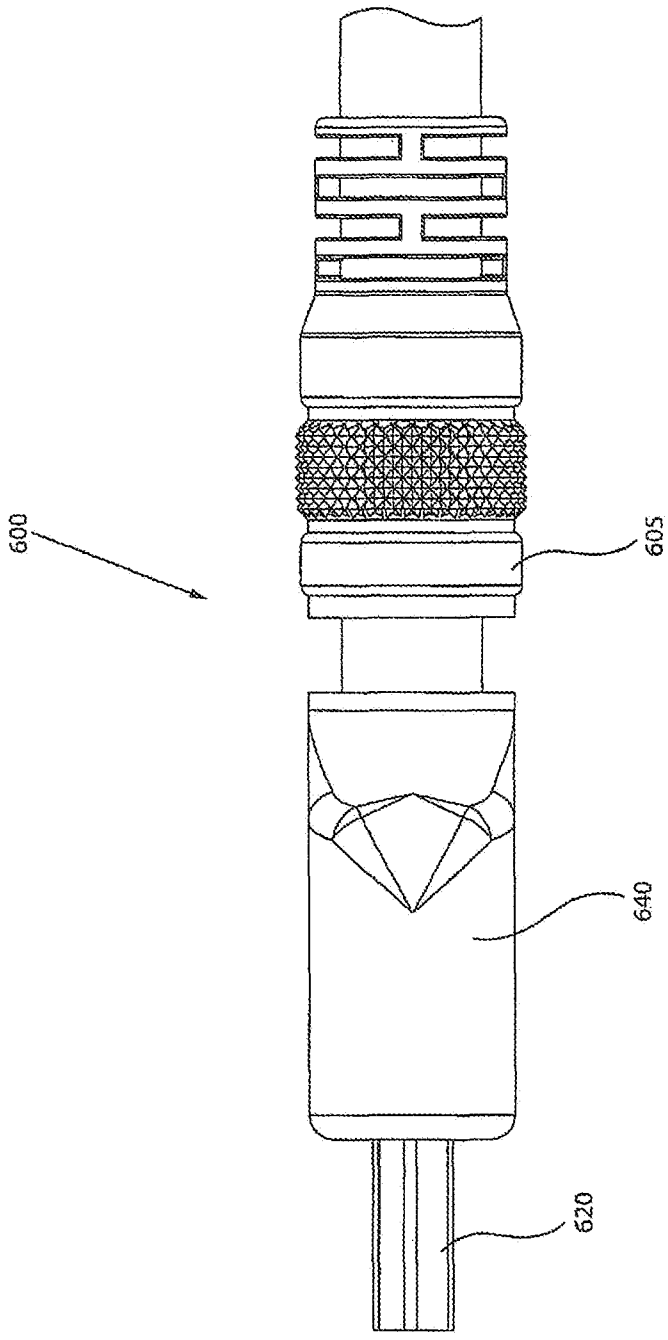


FIG. 37

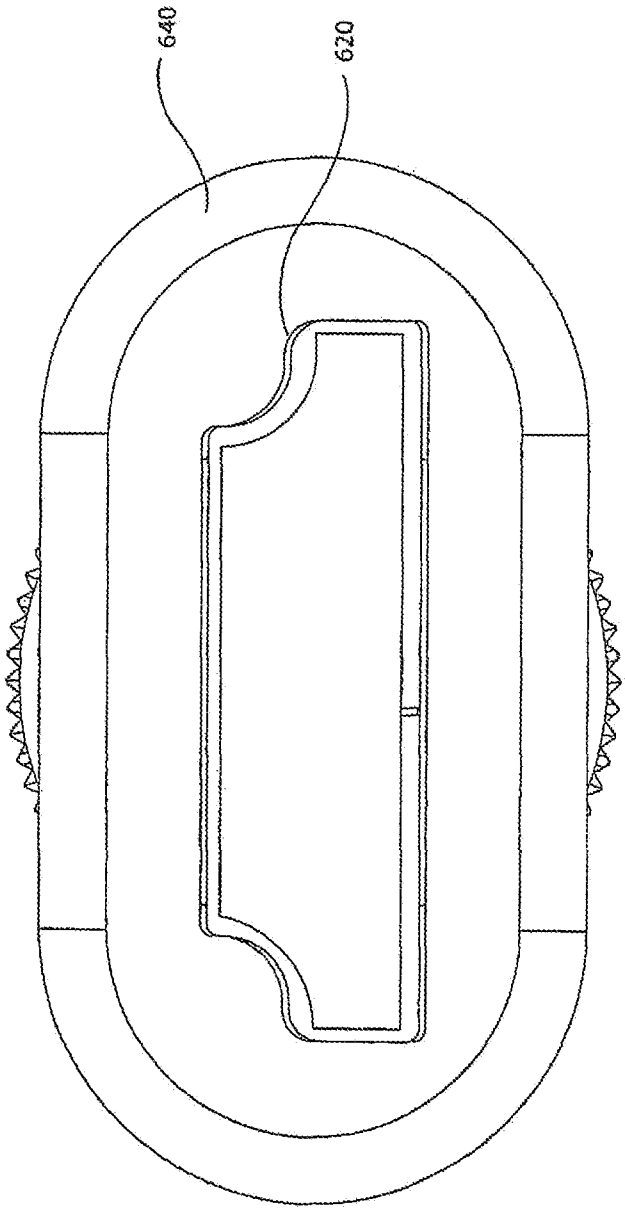


FIG. 38

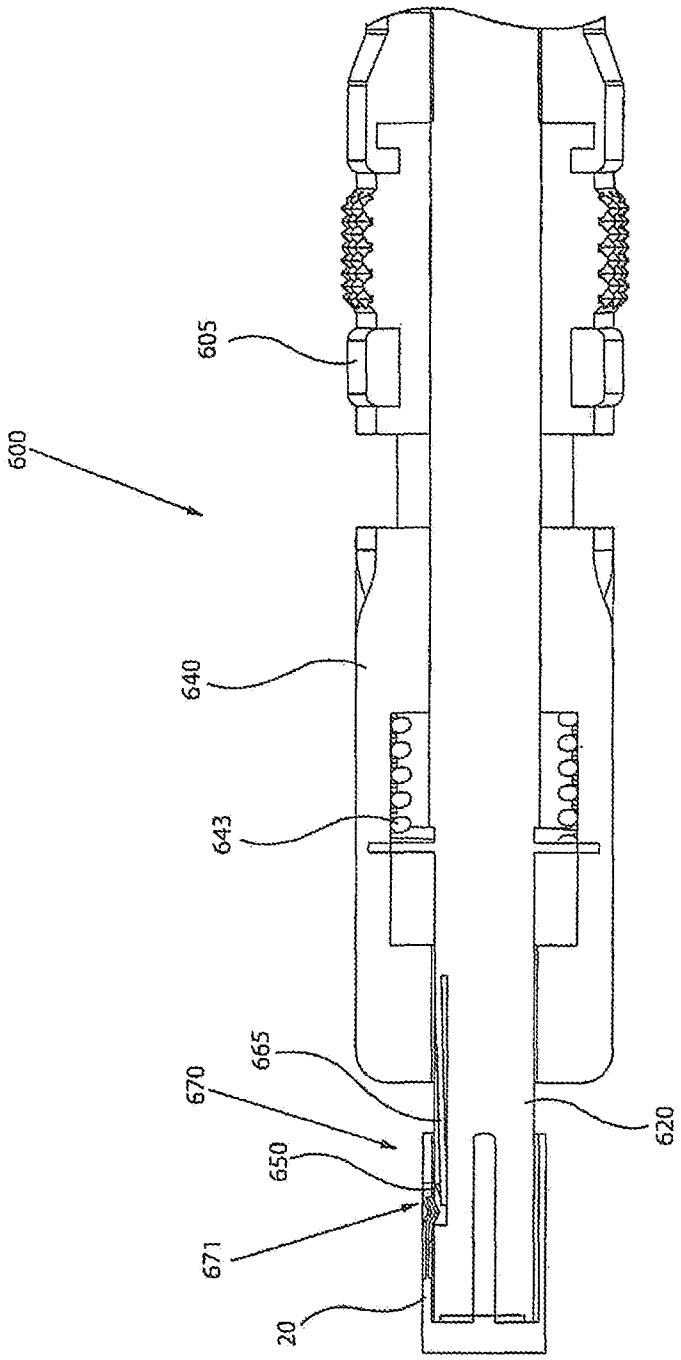


FIG. 39

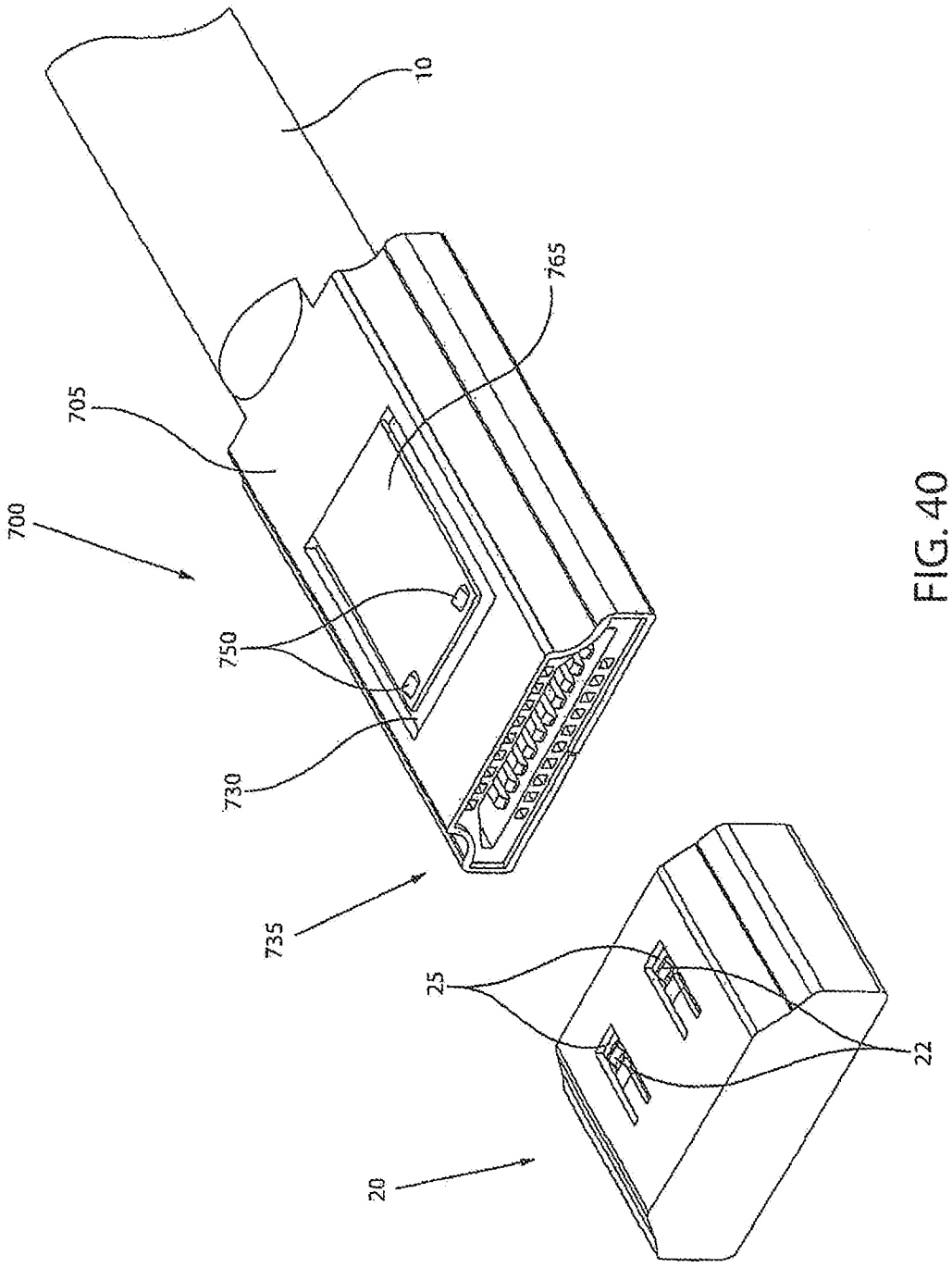


FIG. 40

Pin	Signal
1	TMDS Data2+
2	TMDS Data2 Shield
3	TMDS Data2-
4	TMDS Data1+
5	TMDS Data1 Shield
6	TMDS Data1-
7	TMDS Data0+
8	TMDS Data0 Shield
9	TMDS Data0-
10	TMDS Clock+
11	TMDS Clock Shield
12	TMDS Clock-
13	CEC
14	Reserved (N.C. on Device)
15	SCL
16	SDA
17	DDC/CEC Ground
18	+ 5V
19	Hot Plug Detect

FIG. 41

Pin	Signal
1	TMDS Data2+
2	TMDS Data2 Shield
3	TMDS Data2-
4	TMDS Data1+
5	TMDS Data1 Shield
6	TMDS Data1-
7	TMDS Data0+
8	TMDS Data0 Shield
9	TMDS Data0-
10	TMDS Clock+
11	TMDS Clock Shield
12	TMDS Clock-
13	TMDS Data5+
14	TMDS Data5 Shield
15	TMDS Data5-
16	TMDS Data4+
17	TMDS Data4 Shield
18	TMDS Data4-
19	TMDS Data3+
20	TMDS Data3 Shield
21	TMDS Data3-
22	CEC
23	Reserved (N.C. on Device)
24	Reserved (N.C. on Device)
25	SCL
26	SDA
27	DDC/CEC Ground
28	+ 5V
29	Hot Plug Detect

FIG. 42

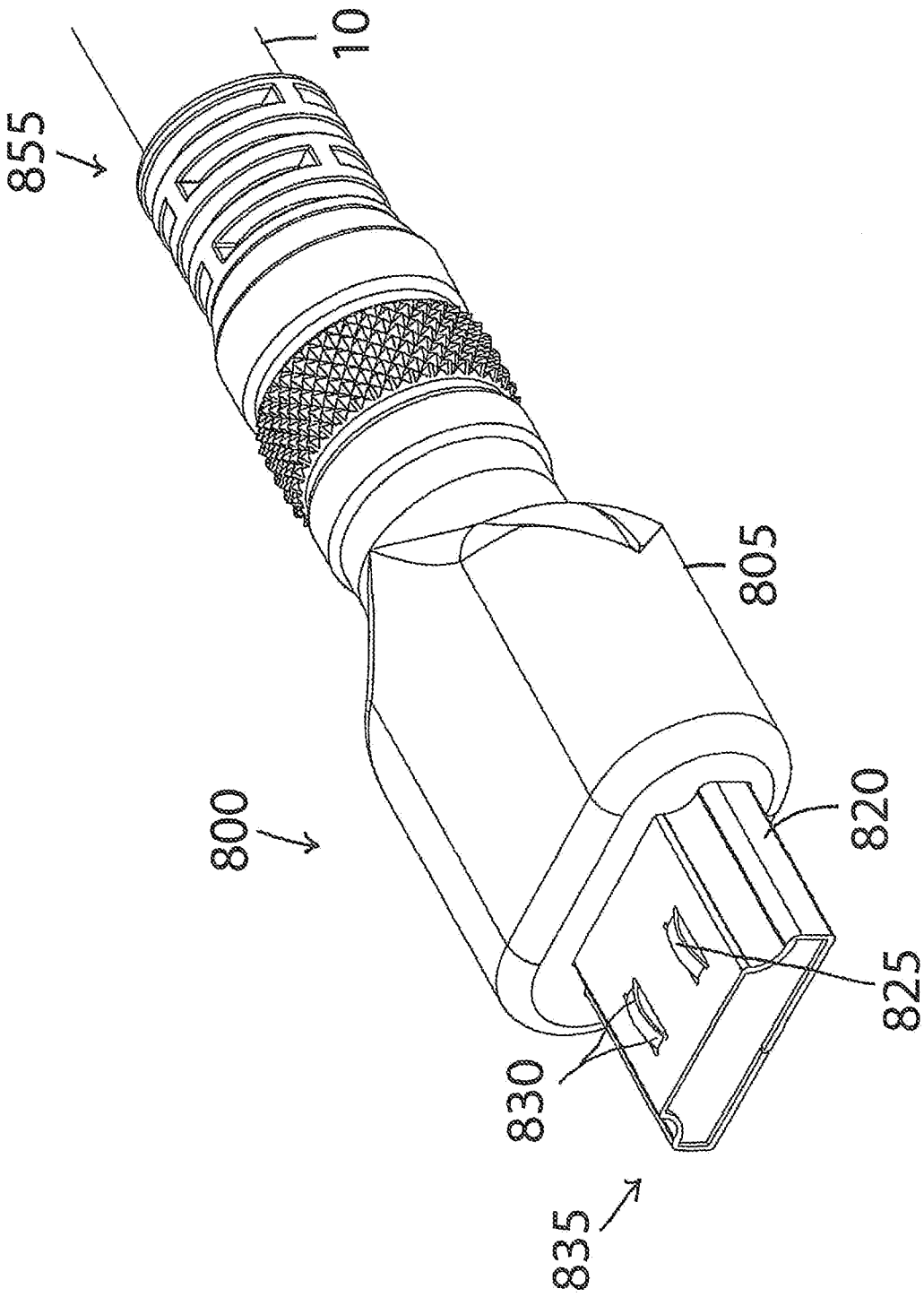


FIG. 43

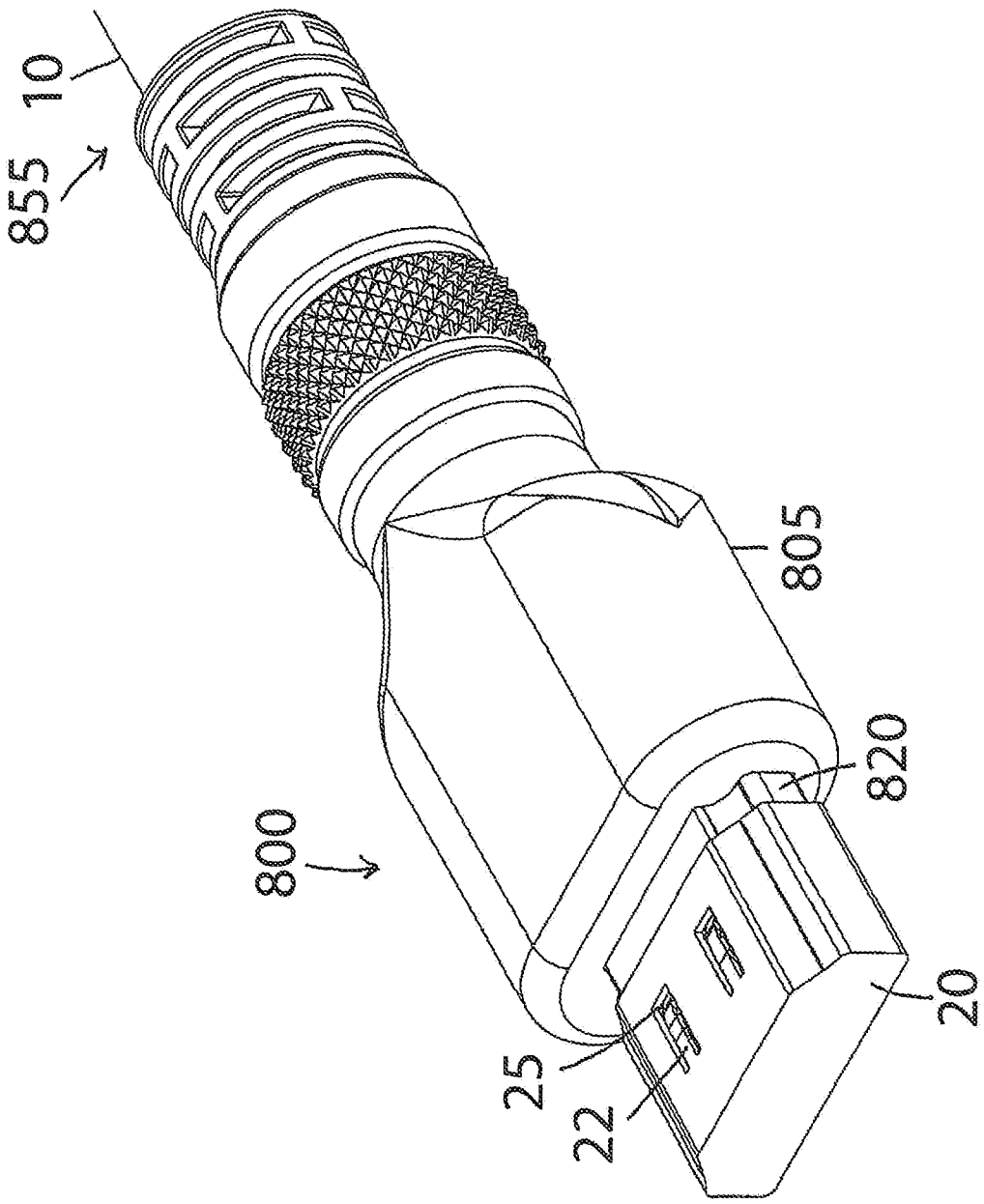


FIG. 44

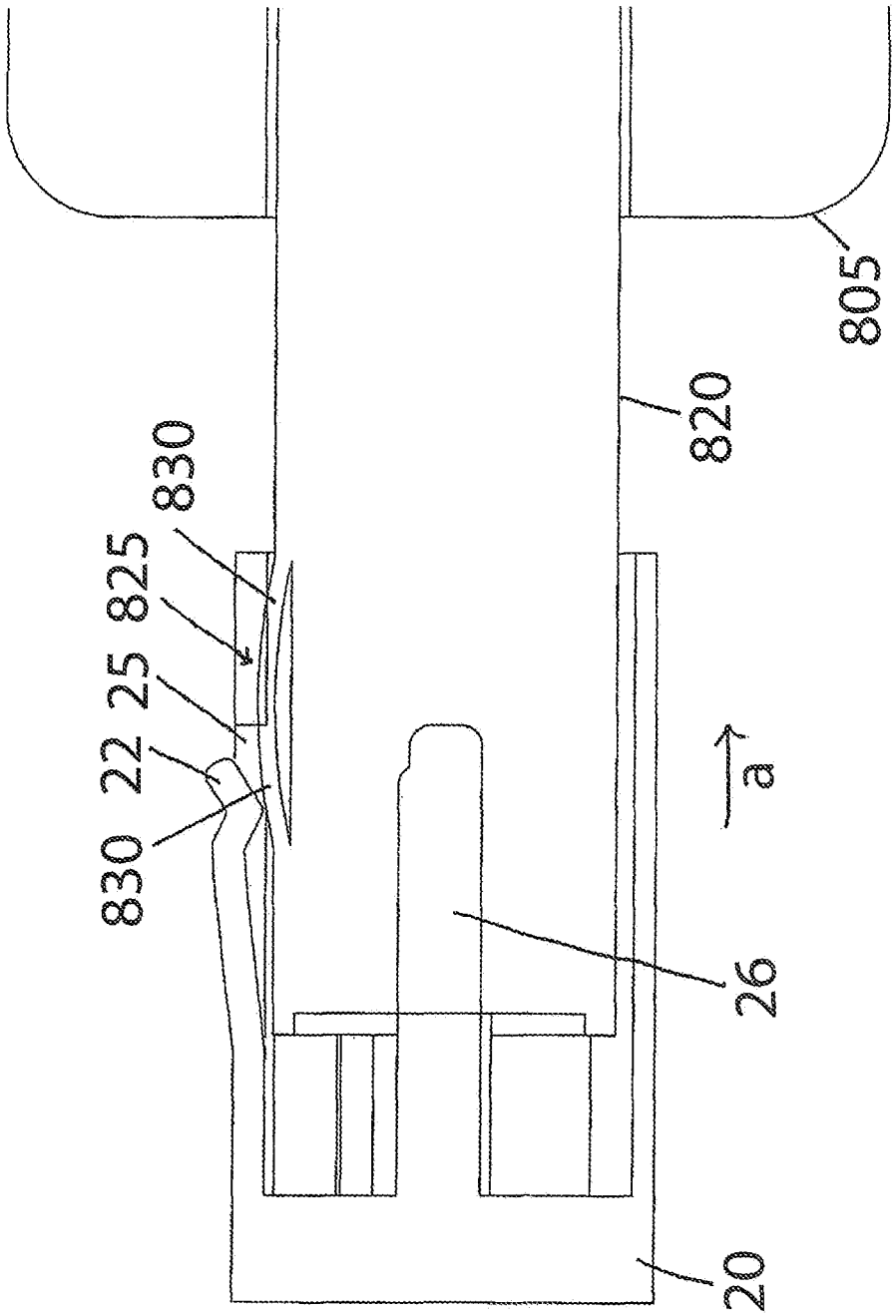


FIG. 45a

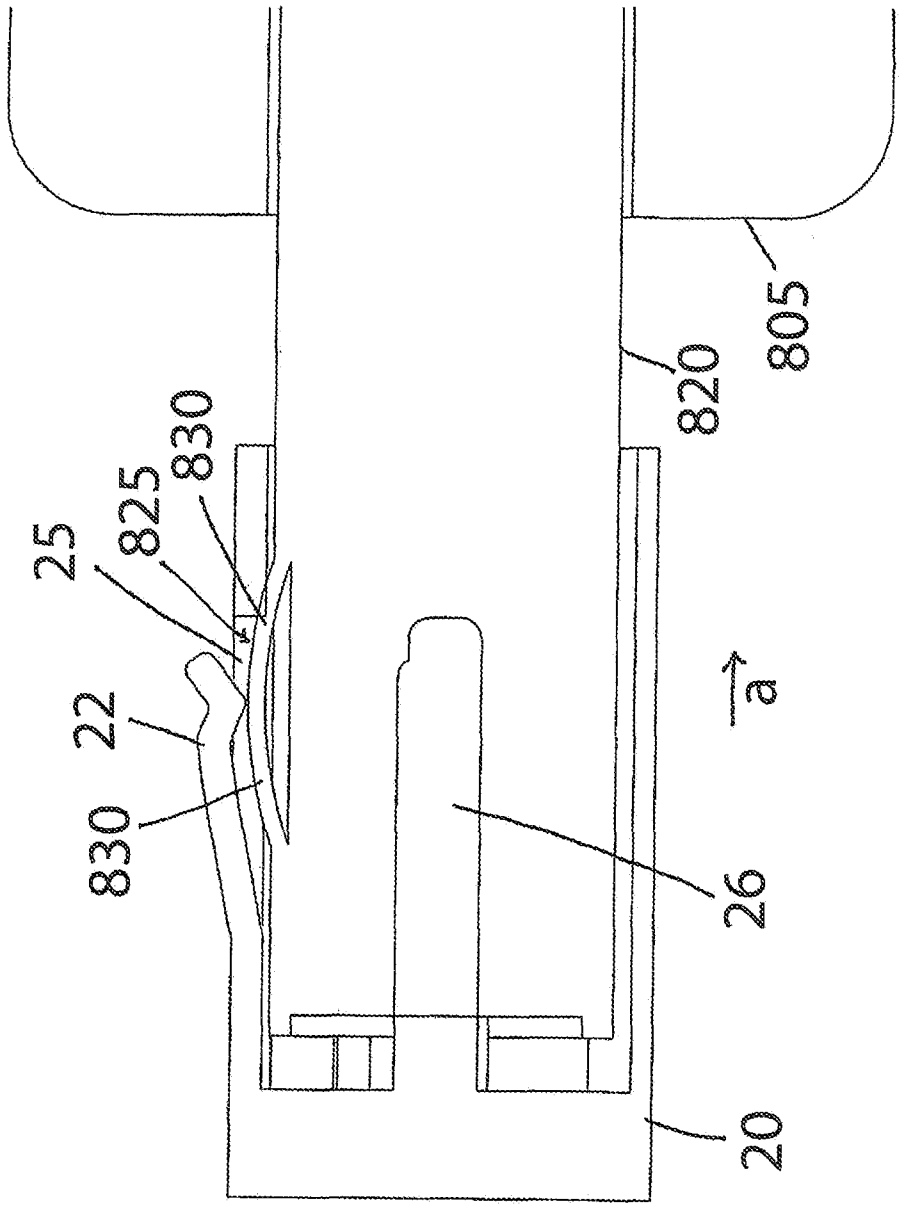


FIG. 45b

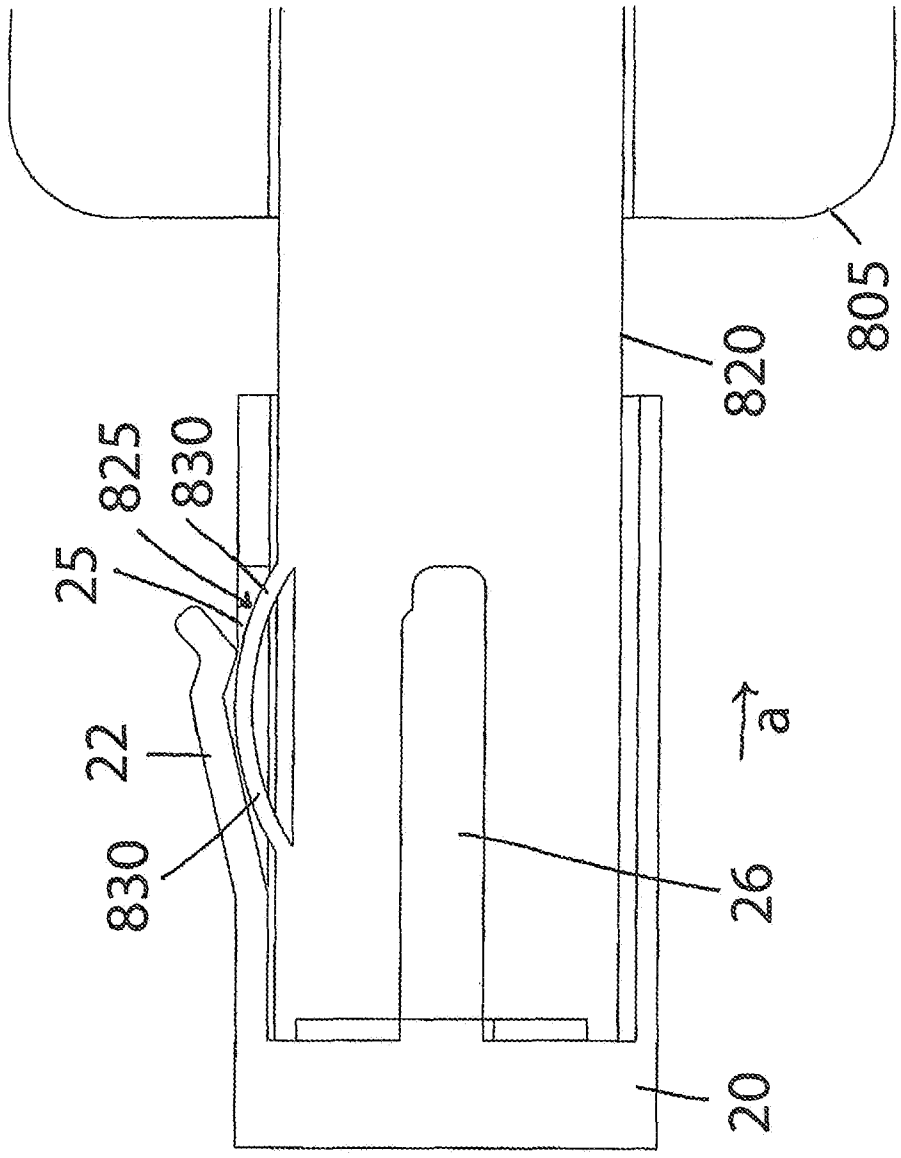


FIG. 45c

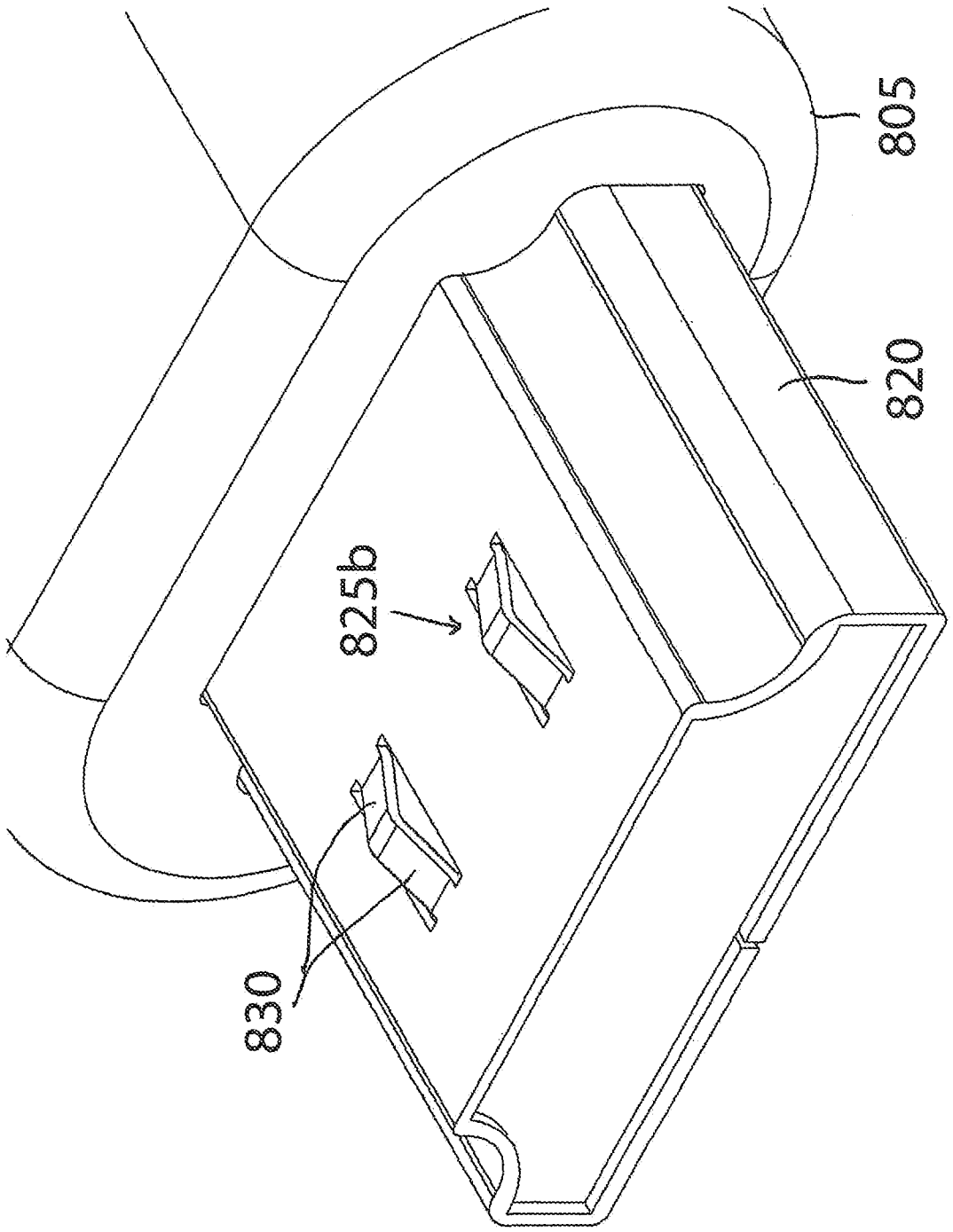


FIG. 46

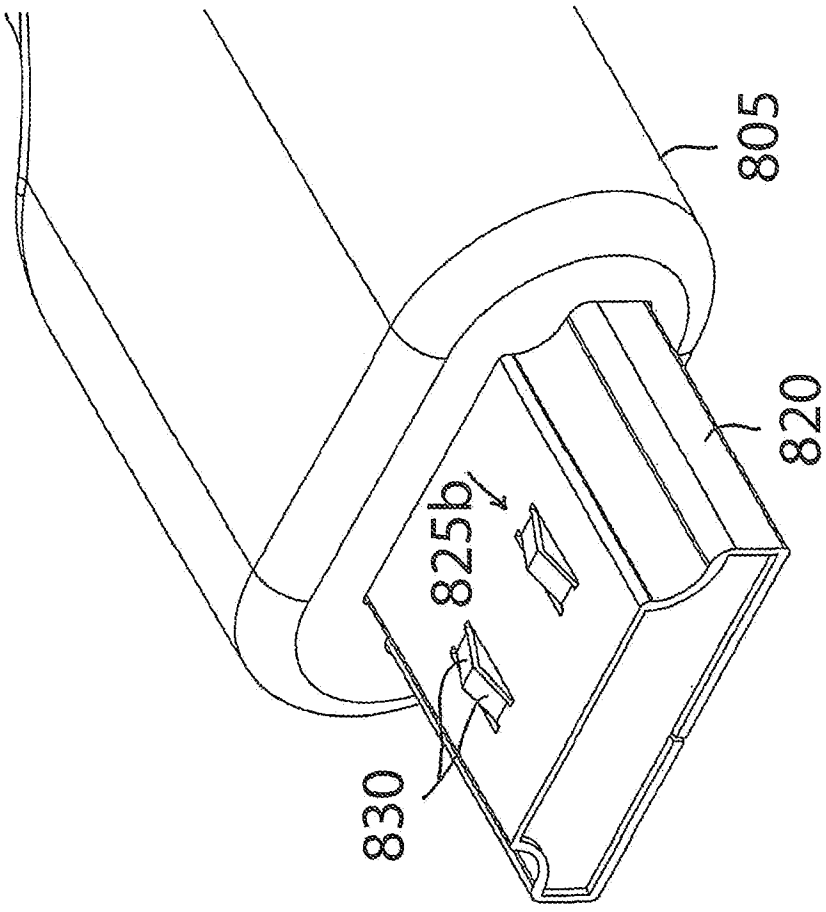


FIG. 47

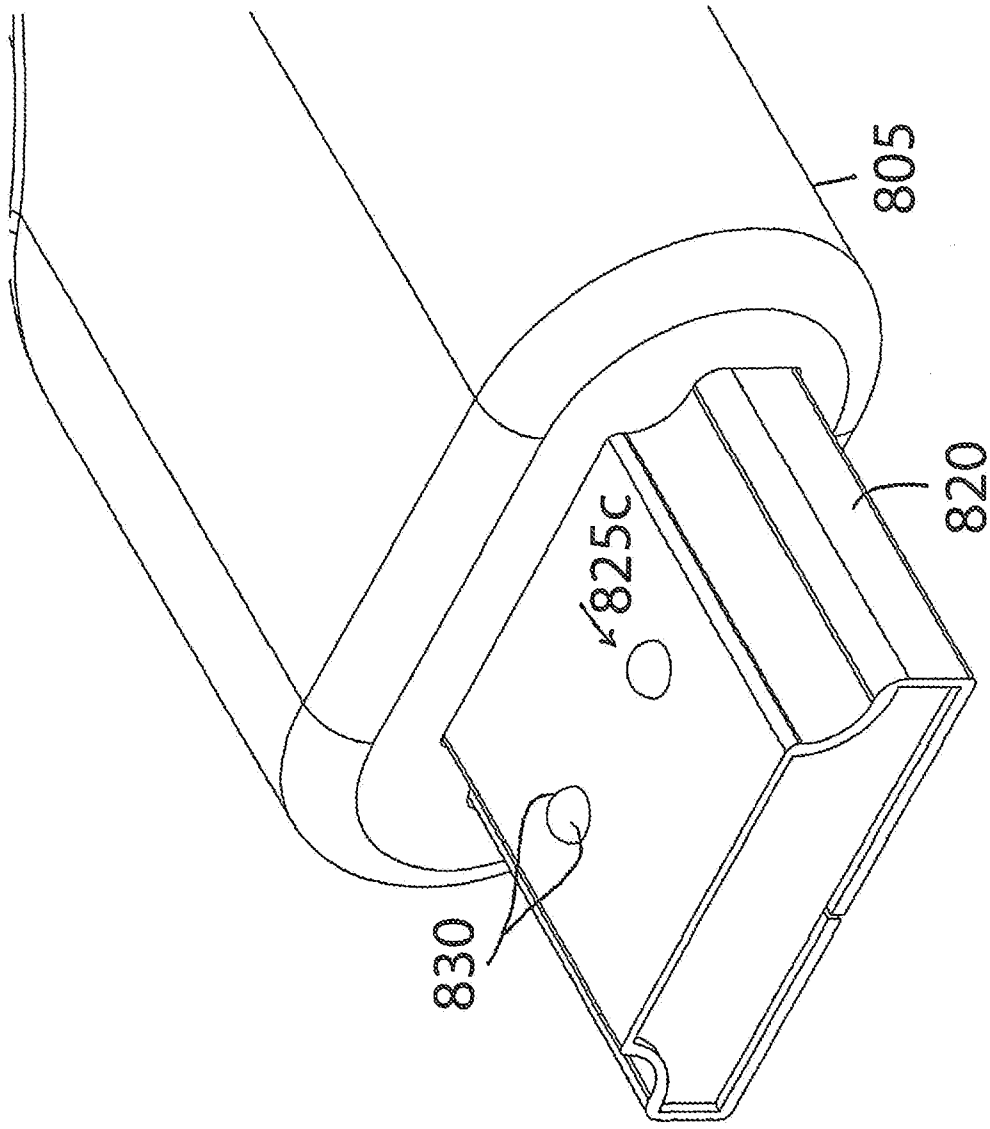


FIG. 48

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/059084

A. CLASSIFICATION OF SUBJECT MATTER

H01R 13/62(2006.01)i

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

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models since 1975

Japanese Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS(KIPO internal, Keyword: " multimedia, interface, (plug or connector), projection and the similar terms")

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6935896 B1(Tsai) 30 August 2005 See abstract; Figs 1, 5; column 3, line 26-column 4, line 55	1-17
A	US 6561847 B1(Xiang et al.) 13 May 2003 See abstract; Figs 1-2; column 2, line 52-column 3, line 26	1-17
A	US 6595801 B1(Leonard et al.) 22 July 2003 See abstract; Figs 1, 2, 4-8; column 3, line 32-column 5, line 65	1-17
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☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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