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NEEDLE CAPTURE SAFETY INTERLOCK FOR CATHETER

Abstract

A medical device, comprising a hub or housing including a push tab disposed on an upper surface of the hub or housing and a rib disposed on the upper surface of the hub or housing, the rib including a top surface and the rib being proximal to the push tab, and a cannula directly or indirectly connected to the hub or housing, wherein the top surface of the rib includes a cradle shape for resisting rotation of the hub or housing when contacted by a finger of a user.

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Background/Summary

RELATED APPLICATIONS [0001] This application is a continuation in part of U.S. patent application Ser. No. 18/668,582 filed on May 20, 2024, which is continuation of U.S. patent application Ser. No. 18/109,118 filed on Feb. 13, 2023 (issued as U.S. Pat. No. 12,023,455), which is a continuation of U.S. patent application Ser. No. 16/995,699 filed on Aug. 17, 2020 (issued as U.S. Pat. No. 11,607,530), which is a continuation of U.S. patent application Ser. No. 15/304,375 filed on Oct. 14, 2016 (issued as U.S. Pat. No. 10,780,249), which is a U.S. national stage application under 35 U.S.C. § 371 of International Application No. PCT/US2015/026542, filed on Apr. 17, 2015, which claims the benefit under 35 U.S.C. § 119(e) of U.S. Provisional Patent Application Ser. 61/981,223, filed on Apr. 18, 2014, U.S. Provisional Application 61/981,312, filed on Apr. 18, 2014, and U.S. Provisional Patent Application Ser. No. 62/077,760, filed on Nov. 10, 2014. Each of the above applications is hereby incorporated by reference in its entirety.

FIELD
[0002] Various exemplary embodiments of the invention relate to catheters. Specifically, The present invention relates, in general, to an anti-rotation push tab for a medical device. More specifically, the anti-rotation push tab is especially adapted for use with intravenous catheters, as well as catheter introducers and guidewire introducers.
BACKGROUND
[0003] Catheter assemblies are used to place a catheter properly into the vascular system of a patient. Once in place, catheters such as intravenous catheters may be used to infuse fluids including normal saline, medicinal compounds, and/or nutritional compositions into a patient in need of such treatment. Catheters additionally enable the removal of fluids from the circulatory system and monitoring of conditions within the vascular system of the patient.
[0004] An intravenous (IV) catheter is typically mounted over an introducer needle having a sharp distal tip in order to properly insert an IV catheter into a patient. At least the distal portion of the catheter tightly engages the outer surface of the needle to facilitate insertion of the catheter into the blood vessel. The distal tip of the needle preferably extends beyond the distal tip of the catheter.
[0005] Although typical IV catheter and introducer needle assemblies generally perform their functions satisfactorily, they do have certain drawbacks. Some PIVCs have issues with stability of the catheter hub when advancing it and are prone to free spinning on the insertion needle during the insertion process. Oftentimes, the catheter hub includes a push tab to aid in advancing the catheter hub. As the catheter hub advances, in some cases, it experiences rolling where the catheter hub

spins along the axis of the insertion needle. This can cause a problem when the push tab rotates out of reach of the finger being used to advance the catheter hub.
[0006] In some cases an edge is provided on the catheter hub so that the user can advance the catheter hub regardless of its angular position. There is a concern in that the edge becomes quite uncomfortable to a patient when the catheter hub has been taped down at the insertion site thus forcing the edge against the patient's soft tissue.

SUMMARY OF THE INVENTION

[0007] It is an aspect of the present invention to provide a catheter assembly in which an improved clip and needle shield are used for needle protection. The improved arrangement is more compact, provides increased needle protection, and reduces the size and complexity of the catheter assembly. The addition of a release notch in a collar of a catheter hub and disengagement of the clip via the notch allows the needle shield to be more compact than in the prior art. In the prior art, without the notch, the clip has to travel a longer distance to disengage the catheter hub. In addition, the width of the needle shield is reduced by an improved attachment interface between the clip and the needle shield. Specifically, a spade attaches the clip to the needle shield with an outer surface of the spade exposed to an outside of the needle shield.
[0008] It is another an aspect of the present invention to provide features that oppose the rotational movement of a medical device in relation to the user's finger. In the case of an IV catheter, this can enhance the stability of the catheter during insertion, hooding, and threading. Embodiments of the present invention provide a platform that pushes on the user's finger when the catheter begins to rotate and allows the user's finger to resist the rotation and also steer the catheter back to the neutral starting position. Free spinning of the catheter hub can be prevented without making any other design compromises or increasing the cost of the design.
[0009] The foregoing and/or other aspects of the present invention can be achieved by providing a catheter assembly comprising a catheter, a needle having a sharp distal tip disposed in the catheter, a catheter hub housing the catheter and the needle, the catheter hub having a notch, a needle shield connected to the catheter hub when the needle is in a first position, and a clip disposed in the needle shield that cooperates with the needle, wherein the clip engages the collar in the first position of the needle, the clip disengages the collar via the notch when the needle is retracted to a second position to enclose at least a portion of the needle.
[0010] The foregoing and/or other aspects of the present invention can be achieved by also providing a catheter assembly comprising a catheter, a needle having a sharp distal tip disposed in the catheter, a catheter hub housing the catheter and the needle, a needle shield configured to be connected to the catheter hub, and a clip disposed in the needle shield that cooperates with the needle, the clip including a spade that attaches the clip to the needle shield, wherein an outer surface of the spade is exposed to an outside of the catheter assembly.
[0011] The foregoing and/or other aspects of the present invention are further achieved by a medical device, comprising a hub or housing having a push tab including a main portion extending radially from an upper surface of the hub or housing, and at least one anti-rotation feature for resisting rotation of the hub or housing. A cannula is directly or indirectly connected to the hub or housing. The medical device may be a catheter, the cannula may be a catheter tube, and the hub or housing may be a catheter hub or an introducer needle tip shield for the catheter.
[0012] Furthermore, the foregoing and/or other aspects of the present invention are achieved by a medical device, comprising a housing having a push tab including a main portion extending radially from an upper surface of the housing, and at least one anti-rotation feature for resisting rotation of the housing, and a cannula connected to the housing.
[0013] The foregoing and/or other aspects of the present invention can be achieved by further providing a method of operating a catheter assembly comprising disposing a needle having a sharp distal tip in a catheter, biasing a clip when the needle is in use in a first position, removing the needle from a catheter hub having a notch, releasing the clip when the needle is in a second

position to enclose at least a portion of the needle, and disengaging the clip from the collar via the notch when the needle is in the second position.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] The above aspects and features of the present invention will be more apparent from the description for the exemplary embodiments of the present invention taken with reference to the accompanying drawings, in which:

[0015] FIG. **1** illustrates a top left perspective view of a catheter assembly in accordance with an embodiment of the present invention;

[0016] FIG. **2** illustrates a side left perspective view of a catheter assembly;

[0017] FIG. **3** illustrates an alternate side left perspective view of a catheter assembly;

[0018] FIG. **4** illustrates a top plan view of the catheter assembly;

[0019] FIG. **5** illustrates a right side elevation view of the catheter assembly;

[0020] FIG. **6** illustrates a bottom plan view of the catheter assembly;

[0021] FIG. **7** illustrates a left perspective view of the assembled catheter hub, needle shield, and needle of the catheter assembly;

[0022] FIG. **8** illustrates a right perspective view of the assembled catheter hub, needle shield, and needle of the catheter assembly;

[0023] FIG. **9** illustrates a right side elevation view of the assembled catheter hub, needle shield, and needle of the catheter assembly;

[0024] FIG. **10** illustrates a bottom plan view of the assembled catheter hub, needle shield, and needle of the catheter assembly;

[0025] FIG. **11** illustrates a bottom plan view of the assembled catheter hub, needle shield, and needle of the catheter assembly;

[0026] FIG. **12** illustrates a top plan view of the assembled catheter hub, needle shield, and needle of the catheter assembly;

[0027] FIG. **13** illustrates a cross sectional view of a right side elevation view of the assembled catheter hub, needle shield, and needle of the catheter assembly;

[0028] FIG. **14** illustrates a left perspective view of the separated catheter hub, needle shield, and needle of the catheter assembly;

[0029] FIG. **15** illustrates a right perspective view of the separated catheter hub, needle shield, and needle of the catheter assembly;

[0030] FIG. **16** illustrates a right side elevation view of the separated catheter hub, needle shield, and needle of the catheter assembly;

[0031] FIG. **17** illustrates a second right side elevation view of the separated catheter hub, needle shield, and needle of the catheter assembly;

[0032] FIG. **18** illustrates a bottom plan view of the separated catheter hub, needle shield, and needle of the catheter assembly;

[0033] FIG. **19** illustrates a top plan view of the separated catheter hub, needle shield, and needle of the catheter assembly;

[0034] FIG. **20** illustrates a cross sectional view of a right side elevation view of the separated catheter hub, needle shield, and needle of the catheter assembly;

[0035] FIG. **21** is a right perspective view of the catheter hub of the catheter assembly;

[0036] FIG. **22** is a top plan view of the catheter hub of the catheter assembly;

[0037] FIG. **23** is a left perspective view of the catheter hub of the catheter assembly;

[0038] FIG. **24** is a front side view of the catheter hub of the catheter assembly;

[0039] FIG. **25** is a right side view of the catheter hub of the catheter assembly;

[0040] FIG. **26** is a rear side view of the catheter hub of the catheter assembly;
[0041] FIG. **27** is a left perspective view of the catheter hub of the catheter assembly;
[0042] FIG. **28** is a bottom plan view of the catheter hub of the catheter assembly;
[0043] FIG. **29** is a right perspective view of the catheter hub of the catheter assembly;
[0044] FIG. **30** illustrates a right perspective view of the needle shield outer housing of the catheter assembly;
[0045] FIG. **31** illustrates a left perspective view of the needle shield outer housing of the catheter assembly;
[0046] FIG. **32** illustrates a second left perspective view of the needle shield outer housing of the catheter assembly;
[0047] FIG. **33** illustrates a second right perspective view of the needle shield outer housing of the catheter assembly;
[0048] FIG. **34** illustrates a front side elevation view of the needle shield outer housing of the catheter assembly;
[0049] FIG. **35** illustrates a rear side elevation view of the needle shield outer housing of the catheter assembly;
[0050] FIG. **36** illustrates a right side elevation view of the needle shield outer housing of the catheter assembly;
[0051] FIG. **37** illustrates a right side elevation view of the needle shield outer housing of the catheter assembly;
[0052] FIG. **38** illustrates a top plan view of the needle shield outer housing of the catheter assembly;
[0053] FIG. **39** illustrates a bottom plan view of the needle shield outer housing of the catheter assembly;
[0054] FIG. **40** illustrates a left perspective view of the V-shaped metal clip of the catheter assembly;
[0055] FIG. **41** illustrates a right perspective view of the V-shaped metal clip of the catheter assembly;
[0056] FIG. **42** illustrates a second right perspective view of the V-shaped metal clip of the catheter assembly;
[0057] FIG. **43** illustrates a front elevation view of the V-shaped metal clip of the catheter assembly;
[0058] FIG. **44** illustrates a rear elevation view of the V-shaped metal clip of the catheter assembly;
[0059] FIG. **45** illustrates a left side elevation view of the V-shaped metal clip of the catheter assembly;
[0060] FIG. **46** illustrates a right side elevation view of the V-shaped metal clip of the catheter assembly;
[0061] FIG. **47** illustrates a top plan view of the V-shaped metal clip of the catheter assembly;
[0062] FIG. **48** illustrates a bottom plan view of the V-shaped metal clip of the catheter assembly;
[0063] FIG. **49** illustrates a right perspective view of the washer of the catheter assembly;
[0064] FIG. **50** illustrates a left perspective view of the washer of the catheter assembly;
[0065] FIG. **51** illustrates a front elevation view of the washer of the catheter assembly;
[0066] FIG. **52** illustrates a bottom plan view of the washer of the catheter assembly;
[0067] FIG. **53** illustrates a cross sectional view of a left side elevation view of the washer of the catheter assembly;
[0068] FIG. **54** illustrates a right perspective view of an alternative catheter hub with wings;
[0069] FIG. **55** illustrates a top plan view of the catheter hub with wings;
[0070] FIG. **56** illustrates a left perspective view of the catheter hub with wings;
[0071] FIG. **57** illustrates a front view of the catheter hub with wings;
[0072] FIG. **58** illustrates a left side elevation view of the catheter hub with wings;

[0073] FIG. **59** illustrates a rear elevation view of the catheter hub with wings;
[0074] FIG. **60** illustrates a left perspective view of the catheter hub with wings;
[0075] FIG. **61** illustrates a bottom plan view of the catheter hub with wings;
[0076] FIG. **62** illustrates a second right perspective view of the catheter hub with wings;
[0077] FIG. **63** illustrates a right perspective view of an alternative side port catheter hub;
[0078] FIG. **64** illustrates a top plan view of the side port catheter hub;
[0079] FIG. **65** illustrates a left perspective view of the side port catheter hub;
[0080] FIG. **66** illustrates a front elevation view of the side port catheter hub;
[0081] FIG. **67** illustrates a right side elevation view of the side port catheter hub;
[0082] FIG. **68** illustrates a rear elevation view of the side port catheter hub;
[0083] FIG. **69** illustrates a second left perspective view of the side port catheter hub;
[0084] FIG. **70** illustrates a bottom plan view of the side port catheter hub;
[0085] FIG. **71** illustrates a second right perspective view of the side port catheter hub;
[0086] FIG. **72** illustrates a left perspective view of the alternative side port catheter hub assembly with a needle shield and needle hub;
[0087] FIG. **73** illustrates a right perspective view of the alternative side port catheter hub assembly with a needle shield and needle hub;
[0088] FIG. **74** illustrates a top plan view of the alternative side port catheter hub assembly with a needle shield and needle hub;
[0089] FIG. **75** illustrates a right side view of the alternative side port catheter hub assembly with a needle shield and needle hub;
[0090] FIG. **76** illustrates a bottom plan view of the alternative side port catheter hub assembly with a needle shield and needle hub;
[0091] FIG. **77** illustrates a cross sectional view of the catheter assembly of FIGS. **1-12** as the introducer needle is being withdrawn;
[0092] FIG. **78** illustrates a second cross sectional view of the catheter assembly of FIGS. **1-12** as the introducer needle is being withdrawn;
[0093] FIG. **79** illustrates a cross sectional view of the catheter assembly of FIGS. **1-16** as the introducer needle is moved past the V-shaped metal clip and the needle shield is separated from the catheter hub;
[0094] FIG. **80** illustrates a second cross sectional view of the catheter assembly of FIGS. **1-16** as the introducer needle is moved past the V-shaped metal clip and the needle shield is separated from the catheter hub;
[0095] FIG. **81** illustrates a latch of the V-shaped metal clip engaged with the catheter hub
[0096] FIG. **82** illustrates the latch of the V-shaped metal clip disengaged from the catheter hub;
[0097] FIG. **83** illustrates the latch of the V-shaped metal clip disengaged from the catheter hub and separated;
[0098] FIG. **84** illustrates a view of the V-shaped metal clip blocking the needle;
[0099] FIG. **85** illustrates a view of the V-shaped metal clip in the closed position;
[0100] FIG. **86** illustrates a schematic view of the working envelope of the V-shaped metal clip and catheter hub collar without a notch;
[0101] FIG. **87** illustrates a schematic view of the working envelope of the V-shaped metal clip and catheter hub collar without the notch;
[0102] FIG. **88** illustrates a schematic view of the working envelope of the V-shaped metal clip and notched catheter hub collar;
[0103] FIG. **89** illustrates a schematic view of the working envelope of the V-shaped metal clip and notched catheter hub collar;
[0104] FIG. **90** illustrates the operation of the catheter hub valve actuator in a free state;
[0105] FIG. **91** illustrates the operation of the catheter hub valve actuator in a compressed state;
[0106] FIG. **92** illustrates the operation of a second embodiment of a catheter hub valve actuator in

a free state;
[0107] FIG. **93** illustrates the operation of the second embodiment of the catheter hub valve actuator in the compressed state;
[0108] FIG. **94** illustrates another embodiment of the catheter hub valve actuator;
[0109] FIG. **95** illustrates an exemplary blood flashback feature of the catheter assembly;
[0110] FIG. **96** illustrates the needle of the blood flashback feature of the catheter assembly of FIG. **95**;
[0111] FIG. **97** illustrates a second exemplary blood flashback feature of the catheter assembly;
[0112] FIG. **98** illustrates the second exemplary blood flashback feature of the catheter assembly of FIG. **97** with blood flashback in two places;
[0113] FIG. **99** illustrates a third exemplary blood flashback features of the catheter assembly with blood flashback in three places;
[0114] FIG. **100** illustrates a right side view of the exemplary embodiment of the actuator of FIG. **94**;
[0115] FIG. **101**A illustrates a cross sectional view of the actuator of FIG. **100** in a catheter hub assembly;
[0116] FIG. **101**B illustrates the cross sectional view of the catheter hub assembly of FIG. **101**A when penetrating a septum;
[0117] FIG. **101**C illustrates a left perspective cross sectional view of the catheter hub assembly of FIG. **101**A when penetrating a septum;
[0118] FIG. **102**A illustrates a cross sectional view of another exemplary embodiment of a catheter hub assembly;
[0119] FIG. **102**B illustrates the cross sectional view of the catheter hub assembly of FIG. **102**A when penetrating a septum; and
[0120] FIG. **102**C illustrates a left perspective cross sectional view of the catheter hub assembly of FIG. **102**A when penetrating a septum.
[0121] FIG. **103** illustrates a catheter hub incorporating an anti-rotation push tab;
[0122] FIG. **104** illustrates a catheter hub incorporating a sculpted anti-rotation push tab;
[0123] FIG. **105** illustrates a catheter hub incorporating a sculpted anti-rotation push tab including ribs;
[0124] FIG. **106** illustrates a catheter hub incorporating an extended anti-rotation push tab;
[0125] FIG. **107** illustrates a catheter hub incorporating a deep sculpted anti-rotation push tab;
[0126] FIG. **108** illustrates a catheter hub incorporating an anti-rotation push tab according to another embodiment of the invention;
[0127] FIG. **109** illustrates a catheter hub incorporating an anti-rotation push tab according to still another embodiment of the invention; and
[0128] FIGS. **110** and **111** illustrate a catheter hub incorporating an anti-rotation push tab according to yet another embodiment of the invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0129] The catheter assembly disclosed herein is an improvement over that disclosed in commonly owned U.S. Patent Application Publication No. 2014/0364809, which is incorporated herein by reference.
[0130] FIGS. **1**-**12** illustrate a catheter assembly **10** includes a hollow metal introducer needle **12**, a catheter hub **14**, a needle hub **16**, and a needle shield **20**. The needle **12** has a sharpened and beveled distal end and initially extends through the needle shield **20** and the catheter hub **14**. A flexible catheter tube **22** extends from the distal end of the catheter hub **14**, with the introducer needle **12** passing through the catheter tube **22**. Initially, the needle **12** is inserted into a patient's vein. The catheter tube **22** is carried by the needle **12** into the vein. After the catheter tube **22** is inserted, the needle **12** is removed from the patient's vein and the catheter hub **14**. The needle shield **20** encloses the tip of the needle **12** and provides protection from being stuck by the needle

12 during and after the needle's retraction from the catheter hub **14**. The needle shield **20** can be used with a variety of different catheters.
[0131] As illustrated in FIGS. **12-20**, the catheter assembly includes the catheter hub **14** and the flexible catheter tube **22** extending from the catheter hub **14**. A metal wedge **24** is positioned in the catheter hub **14** to retain the catheter tube **22**. A resilient septum **26** is positioned to control fluid flow through the catheter hub **14**. An actuator **28** is moveably positioned in the catheter hub **14** to engage the septum **26**. A biasing member **30** engages the actuator **28** to bias the actuator **28** in the proximal direction.
[0132] The resilient septum **26** has one or more pre-formed slits which are normally closed to selectively prevent unwanted fluid flow through the septum **26**. For example, the septum **26** can have three slits forming three triangular flaps that open when engaged by the actuator **28**. The septum **26** is made from an elastic material, for example silicone rubber, that provides the resilient closing force for the slits. Other septum **26** configurations may be used as would be understood by one of ordinary skill in the art.
[0133] The actuator **28** and the biasing member **30**, for example a metal or plastic compression spring, are positioned in the catheter hub **14**. The actuator **28** engages the septum **26** to open the slits and permit fluid flow through the catheter hub **14**. The biasing member **30** is capable of returning the actuator **28** to a position that allows the slits to close, preventing fluid flow through the catheter hub **14**.
[0134] As best shown in the exemplary embodiment of FIGS. **21-29**, the catheter hub **14** includes a proximal end having external Luer thread **32** and a notched collar **34**. The collar **34** extends around at least a portion of the catheter hub **14** and is preferably disposed at a proximal end of the catheter hub **14**. The collar **34** has a break, opening or notch **36** separating first and second ends of the collar **34**.
[0135] A portion of the collar **34** includes an outer diameter that is greater than a portion of an outer diameter of the catheter hub **14** adjacent to the collar **34**. Specifically, a portion of the outer diameter of the collar **34** is elevated with respect to the adjacent outer diameter surface of the catheter hub **14**. Additionally, the opening **36** of the collar **34** has an outer diameter substantially equal to or greater than a portion of an outer diameter of the catheter hub **14** adjacent to the collar **34**.
[0136] In an exemplary embodiment, the needle shield **20** includes an outer housing **38**, a resilient clip **40**, and a washer **42**. The outer housing **38** includes an aperture having a distal opening **44** and a proximal opening **46** to receive the needle **12**. The outer housing **38** connects to the catheter hub **14** and surrounds the clip **40** and the washer **42**. As best shown in FIGS. **30-39**, the distal end of the outer housing **38** includes a nose **48**, a top flange **50**, and a base **52**. When the needle shield **20** is connected to the catheter hub **14**, the nose **48** extends into the interior of the catheter hub **14**.
[0137] In an exemplary embodiment, the nose **48** is sized to be slightly smaller than the interior of the catheter hub **14** so as to fit with a loose tolerance. The top flange **50** is spaced from the base **52** by a pair of side recesses that receive the Luer threads **32** and prevent rotation of the catheter hub **14** with respect to the needle shield **20** when assembled. The base **52** includes a projection **54** having a curved top surface and curved cut-out portion **56**. The projection **54** is sized to fit in the opening **36** of the collar **34** and the cut-out portion **56** is sized to allow the collar **34** to pass therethrough.
[0138] According to an exemplary embodiment illustrated in FIGS. **40-48**, the clip **40** is a substantially V-shaped resilient clip **40** having a first leg **60** and a second leg **62** connected by an angled or curved V section **64**. The first leg **60** includes a substantially U-shaped spade **66** having an angled lead-in portion **68**. The spade **66** includes an outer wall **70** and an inner wall **72** connected by a bottom **74**. A pair of barbs **76** extends outwardly from the inner wall **72** of the spade **66**. A first flag **78** extends from the second leg **62** toward the first leg **60** and a second flag **80** extends from the first leg **60** toward the second leg **62**. A foot **82** extends outwardly from the first

flag **78** away from the first and second legs **60**, **62**, and a latch **84** extends upwardly from the foot **84** and is positioned between the first and second legs **60**, **62**. Specifically, the latch **84** is disposed between a plane representing the first leg **60** and a plane representing the second let **62**. Such a configuration is desired to create a more compact clip **40**. An optional stiffener **86** can extend downwardly from the foot **82**.

[0139] The clip **40** is connected to the outer housing **38** with the spade **66** being positioned around an exterior wall of the outer housing **38**. The spade **66** is attached to the exterior wall of the outer housing **38** so that the outer wall **70** of the spade **66** is exposed to the outside of the needle shield **20**. This configuration advantageously reduces the width of the needle shield **20**, compared to an arrangement wherein the spade **66** is received within an internal cavity of the outer housing **38** such that the outer wall **70** is not exposed to the outside of the outer housing **38**. As best shown in FIGS. **79-85**, the inner wall **72** of the spade **66** is positioned in a recess and the two barbs **76** extend away from the inner wall **72** to engage a pair of projections **89** in the needle shield **20**. The two barbs **76** aid in securely fastening the clip **40** to an inner surface of the needle shield **20**. The clip **40** may be formed from a metal, elastomer, polymer, or composite material. In various exemplary embodiments, the clip **40** is formed from a thin piece of resilient metal, such as stainless steel.

[0140] According to an exemplary embodiment illustrated in FIGS. **49-53**, the washer **42** includes a base **88** and a side wall **90** connected together in a substantially L-shape. The side wall **90** includes a funnel **92** and an opening **94**. The needle **12** includes a deformation **96**, for example a crimp or protrusion formed near the distal end of the needle **12**. The opening **94** in the washer **42** is sized to allow passage of the needle shaft, but not the deformation **96**. The funnel **92** makes it easier for the proximal end of the needle **12** to be initially inserted through the washer **42** during assembly.

[0141] FIGS. **54-62** depict an alternative exemplary catheter hub **214** having a pair of stabilization wings **216**. FIGS. **63-76** depict another alternative exemplary side port catheter hub **314** having a pair of stabilization wings **316** and a side port **318**. The side port communicates with an internal tubular valve (not shown) as described in U.S. Pat. No. 4,231,367, which is incorporated herein by reference. The alternative catheter hubs **214**, **314** each have a collar **234**, **334** with an opening **236**, **336** to receive the latch **84** of the needle shield **20**.

[0142] The catheter assemblies can include a plug **320** that is initially attached to the needle hub **16**. After the needle hub **16** and needle shield **20** have been removed from the catheter hub, the plug **320** can be removed from the needle hub **16** and attached to the open, proximal end of the catheter hub. Although depicted with only the side port catheter **314**, the plug **320** can be used with any of the catheter hubs **14**, **214**, **314**.

[0143] FIGS. **77-85** depict the catheter assembly **10** of FIGS. **1-12** during operation. Initially, the needle shield **20** is connected to the catheter hub **14** and the introducer needle **12** passes through the catheter hub **14** and the needle shield **20**. The nose **48** of the needle shield **20** (labeled in FIG. **30**) may or may not extend into the catheter hub **14** when the needle **12** is in use (first position). The needle **12** cooperates with the clip **40** by biasing the clip **40** into a locked position via pressing the first and second arms **60**, **62** toward one another. In the locked position, the latch **84** engages the collar **34**, preventing removal of the needle shield **20** from the catheter hub **14**, as best shown in FIG. **81**. At the same time, in the locked position, the latch **84** is offset from the collar opening **36**. The position of the latch **84** is off-center with respect to the needle **12**. The clip **40** is also in an open position, allowing the needle **12** to traverse through the clip **40**.

[0144] As the needle **12** is withdrawn from the catheter hub **14** and into the needle shield **20**, the tip of the needle **12** clears the clip **40**, and the clip **40** is allowed to resiliently expand, causing the second arm **62** to move away from the first arm **60**. As the clip **40** expands laterally, the primary and secondary flags **78**, **80** block the distal opening **44** of the outer housing **38** aperture, preventing the tip of the needle **12** from exiting the distal end of the outer housing **38**.

[0145] Movement of the second leg **62** moves the latch **84** laterally from engagement with the collar **34** to a position aligned with the collar opening **36**, allowing the needle shield **20** to be

disengaged or unlocked from the catheter hub **14**. The direction in which the latch **84** moves is lateral with respect to a centerline of the needle **12**. The latch **84** movement is not radial toward or away from the needle **12**. Moreover, as the latch **84** is adjusted, the latch **84** moves to a centered position and then ultimately moves off-center with respect to the needle **12**. The off-center positions of the latch **84** in the first and second positions of the needle **12** are symmetrically opposite each other.

[0146] In the position when the flags **78**, **80** block the needle **12**, the clip **40** moves to a closed position. At the same time, the needle **12** enters into a second position that is retracted from the first needle position, which prevents further use of the needle **12**. The first position, as described above, is understood as, for example, all positions of the needle **12** prior to entering the second position.

[0147] As the needle **12** is pulled further in the proximal direction, the shaft of the needle **12** slides through the needle shield **20** until the deformation **96** formed near the distal end of the needle **12** cooperates with and engages the washer **42**, as shown in FIG. **80**. The opening in the washer **42** is sized to allow passage of the needle shaft, but not the deformation **96**. Thus, the washer **42** prevents the distal tip of the needle **12** and the deformation **96** from exiting the needle shield **20** when the needle **12** is in the second position. The combination of the washer **42** and the needle shield **20** enclose the distal tip of the needle **12** in this second position. Further proximal movement of the needle **12** results in the needle shield **20** being pulled away from the catheter hub **14**.

[0148] The combination of the clip **40** and the washer **42** act as an exemplary needle tip protection mechanism. This needle tip protection mechanism encloses the distal needle tip and the deformation **96** and prevents these portions of the needle **12** from exiting the needle shield **20**.

[0149] More information regarding needle tip protection mechanisms of the type used in this embodiment can be found in U.S. Pat. Nos. 6,749,588 and 7,604,616, and U.S. Patent Application Publication No. 2014/0364809, the contents of which are hereby incorporated by reference. The features described in this embodiment, including the needle protection features, can be used in combination with the features described throughout this application.

[0150] As depicted in FIGS. **86**-**89**, the use of the clip **40** and the notched collar **34** allows for a smaller, more compact design. Without the collar opening **36**, the latch **84** would have to move a distance B**1** to clear the collar and allow disengagement of the needle shield **20**. With the collar opening **36**, the latch **84** does not have to clear the entire catheter hub **14** and only needs to move a distance B**2** which is less than B**1**.

[0151] FIGS. **90** and **91** depict the use of the catheter valve actuator **28**. The introducer needle **12** initially extends through the actuator **28**, the septum **26**, the wedge **24**, and the catheter tube **22**. After the introducer needle **12** and the catheter tube **22** are inserted into a patient, the needle **12** is withdrawn, closing the septum **26**. As a male Luer connector **98** is inserted into the catheter hub **14**, the Luer connector **98** abuts and moves the actuator **28** in the distal direction, compressing the biasing member **30**. Further insertion of the Luer connector **98** moves the actuator **28** through the septum **26**, opening the slits and allowing fluid to flow through the catheter hub **14**.

[0152] When the Luer connector **98** is removed, the biasing member **30** moves the actuator **28** in the opposite direction, removing it from the septum **26**, closing the slits, and preventing fluid from flowing therethrough. This allows the catheter to be reused while in the patient's vein, as opposed to a single-use catheter where the actuator would remain in the septum after a Luer connector **98** is removed. However, a single-use catheter can also be used with the needle shield **20** described herein.

[0153] The actuator **28** has an actuator barrel **100** surrounding an internal passage. The actuator barrel **100** is a substantially tubular member and the internal passage is substantially cylindrical. A first end of the actuator barrel **100** has a nose with a chamfered outer surface to engage the septum **26**. The tubular member has one or more openings **102** to permit fluid flow through and around the actuator barrel **100**. The actuator **28** includes a rear portion for engaging a male Luer connector.

[0154] In a first exemplary embodiment shown in FIG. **90**, the actuator **28** includes first and second

sets of openings **102** in the barrel with the first set of openings near the nose. Openings are also illustrated in the actuator **28** of FIGS. **79-80**. The rear portion of the actuator **28** of FIG. **90** also includes a set of legs **104** extending from the barrel and connected to a ring **106**. The features described in this embodiment can be used in combination with the features described throughout this application.

[0155] In a second exemplary embodiment shown in FIGS. **92-94**, the actuator **28**A includes a set of grooves **101**A and a set of openings **102**A. The grooves **101**A extend from the nose toward the back of the actuator barrel **100**A. The openings **102**A are positioned towards the rear of the barrel **100**A. When the actuator **28**A extends through the septum **26**, the grooves **101**A channel fluid to the openings **102**A which remain on the proximal side of the septum **26**. The grooves **101**A may be positioned on the side of the openings **102**A or directly in line with the openings **102**A. The rear portion of the actuator includes a set of legs **104**A extending from the barrel. As illustrated in FIG. **94**, a ring **106**A may be connected to the legs **104**A to engage a Luer connector **98** or the Luer connector **98** may directly engage the legs **104**A as illustrated in FIGS. **92** and **93**. The features described in this embodiment can be used in combination with the features described throughout this application.

[0156] In an exemplary embodiment, the biasing member **30** is a spring, for example a helical compression spring with a distal end and a proximal end. The spring may be made from metal, plastic, an elastomer, or another suitable resilient material. The distal end of the spring forms an interference fit with the inner surface of the catheter hub **14**. The interference fit may be sufficient to retain the spring, even during loading. The proximal end of the spring connects to the actuator **28**. The features described in this embodiment can be used in combination with the features described throughout this application.

[0157] FIGS. **95-99** depict various exemplary blood flashback features of the catheter assembly. Flashback is the visibility of blood that confirms the entry of the needle tip into the vein. Primary flashback **400** is seen through the catheter tubing as blood travels into the open distal end of the hollow needle **12**, out a notch or opening **402** (also visible in FIG. **13**) in the needle **12** near the needle tip, and up through the internal annular space between the needle **12** and the inside of the catheter tubing **22**. The secondary flashback **404** is seen in the needle hub/grip **16** when it comes out of the back of the needle **12** and enters a flash chamber in the needle hub/grip. Air is vented by the plug in the back of the needle hub/grip **16** by a porous membrane or micro grooves. Tertiary flashback **406** is in the catheter hub **14** when the blood from the primary flashback **400** flows into it and stops at the blood control septum **26**. Air is vented by micro grooves in the periphery of the blood control septum **26**. The features described in this embodiment can be used in combination with the features described throughout this application.

[0158] FIG. **100** illustrates the actuator of FIG. **94** in further detail. The actuator **554** can be used in the catheter assemblies illustrated in FIG. **90-93**. The actuator **554** includes a nose **558** that reduces friction when the actuator **554** penetrates into a septum **538** of a catheter hub assembly. The actuator **554** further includes openings **555** that extend through the actuator **554** in a direction perpendicular to a centerline of the actuator **554**. For example, the actuator **554** can include two rectangular shaped openings **555**, although more or less are contemplated.

[0159] The actuator **554** also includes a plurality of grooves **557** that extend axially along the distal portion of an outer surface of the actuator **554** in a plane parallel to the centerline of the actuator **554**. For example, four grooves **557**, substantially radially equidistant from each other, can be present along an external surface of the distal portion of the actuator **554**, although more or less grooves **557** are contemplated. The grooves **557** can be of varying depths into the actuator **554**. The grooves **557** are different from the openings **555** because the grooves **557** do not extend through the actuator **554**.

[0160] The openings **555** and the grooves **557** advantageously provide increased area for the fluid to move inside the catheter hub assembly. The increased area advantageously allows for fluid

flushing and to prevent coagulation of fluid in the proximal and distal ends of the septum. Additionally, the openings **555** and the plurality of grooves **557** advantageously minimize the stagnation of fluid and allow for greater mixing. The grooves **57** further prevent the septum from sealing on an outside surface of the actuator during operation. By not forming a sealing interface, the fluid is permitted to leak through the septum via the grooves **57** and provide additional flushing.

[0161] FIG. **101**A illustrates the actuator **554** of FIG. **100** in the catheter hub assembly. Similar to the embodiments described above, the catheter hub assembly further includes a catheter hub **514**, a septum **538** and a biasing member **556**. As illustrated, the openings **555** and the grooves **557** of the actuator **554** provide more area for fluid flow inside the catheter hub **514**, thus achieving the advantages described above.

[0162] FIGS. **101**B and **101**C illustrate the catheter hub assembly when the biasing member **556** is compressed and the actuator **554** penetrates the septum **538**. The catheter hub assembly may be configured such that the openings **555** and/or the grooves **557** of the actuator **554** optionally penetrates the septum **538**. In this embodiment, the openings **555** in the actuator **554** do not penetrate the septum **538**. However, the grooves **557** in the actuator **554** penetrate the septum **538**. This configuration allows for increased fluid flow from the proximal end to the distal end of the septum **38** through the grooves **557**, in addition to the advantages described above. After operation of the catheter assembly is complete, the actuator **554** is retracted from the septum **538** via the force exerted by the biasing member **556**. The catheter assembly is configured for multiple uses upon depression of the actuator **554**. The features described in this embodiment, including the actuator, can be used in combination with the features described throughout this application.

[0163] FIG. **102**A illustrates another embodiment of an actuator **664** in a catheter hub assembly. The catheter hub assembly includes a catheter hub **662** having a side port **668**. The side port **668** provides secondary access to the fluid flow in the catheter hub **662**. The intersection of the main bore of the catheter hub **662** and the side port **668** includes a sleeve **672**. The sleeve **672** provides selective fluid communication between the side port **668** and the catheter hub **662**. Specifically, when sufficient fluid pressure is applied through the side port **168**, the sleeve **672** compresses. The compression of the sleeve **672** allows for fluid to enter the catheter hub **662**. The catheter hub assembly further includes a septum **670** and a biasing member **666** that provides tension to the actuator **664**.

[0164] The actuator **664** includes a plurality of openings **665** that extend through the actuator **664** in a similar manner as described above. The actuator **664** includes two rows of four openings **665** having different sizes and similar spacing, although various quantities, sizes and spacing of the openings **665** are contemplated. As illustrated, the openings **665** provide more area for fluid flow inside the catheter hub **662**, thus achieving similar advantages described above with respect to FIGS. **100**-**101**C.

[0165] FIGS. **102**B and **102**C illustrate the catheter hub assembly when the actuator **664** penetrates the septum **670** and compresses the biasing member **666**. The catheter hub assembly is configured such that the openings **665** of the actuator **664** optionally penetrate the septum **670**. In this embodiment, the openings **665** in the actuator **664** do not penetrate the septum **670**. This configuration allows for increased fluid flow between the side port **668** and the catheter hub **662** at the proximal end of the septum **670**, in addition to the advantages described above. If the openings **665** in the actuator **664** penetrate the septum **670**, increased mixing of fluid would also take place at a distal end of the septum **670**.

[0166] When operation of the catheter assembly is complete, the actuator **664** is retracted from the septum **670** via the force exerted by the biasing member **666**. The catheter assembly is configured for multiple uses upon depression of the actuator **664**. The features described in this embodiment, such as the actuator, can be used in combination with the features described throughout this application.

[0167] In another exemplary embodiment, the collar of the catheter hub as described above can be

replaced by any other structure that defines a notch. For example, the collar may be a groove or a recess in the catheter hub. Accordingly, the groove in the catheter hub can be used to engage and disengage a clip in a similar manner as described above. The features described in this embodiment can be used in combination with the features described throughout this application.

[0168] Referring in more specific detail to FIG. **103** of the drawings, there is illustrated a medical device such as a safety IV catheter assembly **1100** incorporating a catheter hub (hub) **1102** and a flexible tube or cannula **1103**. The catheter hub **1102** is releasably engaged to a needle tip shield **1118** (housing). The catheter tube **1103** is directly or indirectly connected to the hub **1102** or housing **1118**. The material of the catheter tube **1103** may consist of, for example, polyurethane (PU), FEP or PTFE (Teflon™). For purposes of illustration, the catheter hub **1102** is shown attached to an introducer needle hub **1120** prior to insertion. The catheter hub **1102** includes a push tab **1112** and anti-rotation features in the form of extension members **1114** and **1116**. A user can engage the push tab **1112** to advance the catheter hub **1102** forward thereby advancing the catheter. As illustrated in FIG. **1**, the push tab **1112** extends radially from an upper surface of the catheter hub **1102**. The first extension **1114** extends from a first side of the push tab **1112** around the side of the upper surface of the catheter hub **1102** and the second extension **1116** extends from a second side of the push tab **1112** around the other side of the upper surface of the catheter hub **1102**. The first extension **1114** and the second extension **1116** act as anti-rotation members that counteract rotation of the catheter hub **1102**. The push tab and first and second extensions together form a substantially C-shape when viewed from above.

[0169] The push tab and first and second extensions are shaped and configured to cradle a user's finger as the push tab **1112** is advanced forward. The first extension **1114** and second extension **1116** resist angular rotation of the catheter hub **1102** relative to the user's finger and enhance stability during insertion.

[0170] In an alternate embodiment (not shown), the push tab **1112** and extension members **1114**, **1116** are similarly disposed on a top distal surface **1122** of the needle tip shield **1118**, instead of on the catheter hub **1102**. The introducer needle hub **1120** includes an opening at a top distal surface to allow the push tab **1112** and extension members **1114**, **1116** of the needle tip shield **1118** to extend upwardly and be accessible to the user. The catheter tube **1103** is directly or indirectly connected to the hub **1102** or housing **1118**. Accordingly, the user can engage the push tab **1112** on the needle tip shield **1118** to advance the catheter hub **1102** and catheter forward. After the catheter is inserted, the introducer needle hub **1120** is used to withdrawn the introducer needle of the catheter assembly **1100** from the catheter tube **1103** and the catheter hub **1102**. Subsequently, a distal end of the introducer needle is retracted and enclosed in the needle tip shield **1118**. The push tab **1112** and extension members **1114**, **1116** of the needle tip shield **1118** also aid the user to withdraw the introducer needle of the catheter assembly **1100**.

[0171] For this and other subsequently-described embodiments, all reference characters designating corresponding parts of the embodiments will be the same as in the embodiment of FIG. **103**, except that they will be in a different series, for example, in the **1200** series, or the **1300** series. The differences of the second and third embodiments with respect to the first embodiment will now be described.

[0172] FIG. **104** depicts a push tab **1212** formed on an upper surface of a catheter hub **1202** for a catheter hub **1200**. As illustrated in FIG. **104**, the push tab **1212** is a wall-like formation extending radially from an upper surface of the catheter hub **1202**. The push tab **1212** includes a raised and sculpted configuration where a distal side of the wall-like main portion **1212** is concave so as to conform to the curvature of the user's finger and allow the user to control rotation. A first extension **1214** extends from a first side of the wall-like main portion **1212** around an outer surface of the catheter hub **1202**, and a second extension **1216** extends from a second side of the main portion **1212** around the outer surface of the catheter hub **1202**. The first extension **1214** and the second extension **1216** act as anti-rotation members that counteract rotation of the catheter hub **1202**. The

sculpted configuration of the push tab **1212** provides a tactile feel for the user with regard to placement of the user's finger.

[0173] FIG. **105** provides a sculpted push tab **1312** on an upper surface of a catheter hub **1302**. The push tab **1312** includes ribs **1318** disposed on a wall-like main portion of the tab **1312**. Ribs **1318** enhance the tactile feel with regard to placement of the user's finger and assist in maintaining the user's finger on the tab **1310**.

[0174] A push tab **1412** is formed on an upper surface of the catheter hub **1402** illustrated in FIG. **106** for use with a catheter. The push tab **1412** includes a wall-like main portion extending radially from an upper surface of the catheter hub **1402**. The push tab **1412** also includes a first extension **1414** and a second extension **1416**. The first extension **1414** and second extension **1416** both extend radially from side surfaces of the catheter hub. Together with the main portion **1412**, they provide a larger circumference for the finger-engaging surface than the embodiments of FIGS. **104** and **105**. At least one rib **1418** is formed on the push tab **1412** to facilitate engagement with a user's finger and prevent rotation. The first and second extension **1414** and **1416** limit rotation of the catheter hub **1402** such that as the catheter rotates either clockwise or counterclockwise, either the first extension **1414** or the second extension **1416** will contact the skin of the patient and prevent further rotation, while the push tab **1412** is still in contact with the clinician's finger, allowing advancement.

[0175] FIG. **107** illustrates a catheter hub **1502** with a more deeply sculpted push tab **1512** formed on an upper surface of the catheter hub **1502**. The deep-sculpted push tab **1512** includes a wall-like main portion extending radially from an upper surface of the catheter hub **1502**. A first extension **1514** and a second extension **1516** extend from the wall-like main portion of the push tab **1512**. The first extension **1514** and second extension **1516** both extend proximally on the catheter hub **1502** and curve toward the main portion of the push tab **1512** to cradle a user's finger by engaging the sides of the clinician's fingers and allow the user to control lateral motion and rotation. The first extension **1514** and the second extension **1516** act as anti-rotation members that counteract rotation of the catheter hub **1502**.

[0176] Regarding FIG. **108**, a catheter hub **1602** incorporating a catheter **1620** is illustrated. A push tab **1612** is formed on an upper surface of the catheter hub **1602**. As illustrated in FIG. **108**, the push tab **1612** is configured as a wall-like main portion extending radially from an upper surface of the catheter hub **1602**. A first cradling tab **1614** extends from a first side of the push tab **1612** perpendicular to a plane of the push tab **1612**. A second cradling tab **1616** extends from a second side of the main portion **1612** perpendicular to a plane of the push tab **1612**. The push tab **1612**, first extension **1614** and second extension **1616** thereby form a cradle shape to resist catheter hub rotation where the first extension **1214** and the second extension **1216** act as anti-rotation members that counteract rotation of the catheter hub **1202**.

[0177] FIG. **109** illustrates a wing catheter hub **1702** incorporating a flexible IV catheter **1720** and wings **1730**. A push tab **1712** is formed on an upper surface of the catheter hub **1702**. As illustrated in FIG. **109**, the push tab **1712** includes a tall wall-like main portion extending radially from an upper surface of the catheter hub **1702**. Anti-rotation push tab **1712** provides a cradling effect for the user's finger to aid insertion stability.

[0178] A first rib **1714** parallel to the plane of the push tab **1712**, but shorter in height, extends from an upper surface of the catheter hub **1702** and is spaced proximally from to the push tab **1712**. A second rib **1716** and a third rib **1718**, also shorter in height than the first rib **1714**, may also extend from an upper surface of the catheter hub **1702** parallel to the plane of the push tab **1712**. The ribs **1714**, **1716**, and **1718** form a cradle shape to resist catheter hub rotation. Ribs **1714**, **1716** and **1718** also strengthen the catheter hub to prevent shrinkage which could cause leakage for any internal components of the catheter hub requiring a lengthwise seal.

[0179] FIG. **109** illustrates three ribs **1714**, **1716** and **1718**; however, a single rib **1814** may be utilized to provide the necessary anti-rotational effect as illustrated in FIGS. **110** and **111**. The rib(s)

1714, **1716**, **1718** and **1814** should be a distance from the push tab **1712**/**1812** where the rib is far enough from the push tab **1712**/**1812** to contact a user's advancing finger pad to provide stability but not so close that the finger pad does not contact the rib. The catheter hub **1802** may be manufactured with or without wings **1830** as shown in FIGS. **110** and **111**, respectively.

[0180] The foregoing detailed description of the certain exemplary embodiments has been provided for the purpose of explaining the principles of the invention and its practical application, thereby enabling others skilled in the art to understand the invention for various embodiments and with various modifications as are suited to the particular use contemplated. This description is not necessarily intended to be exhaustive or to limit the invention to the exemplary embodiments disclosed. Any of the embodiments and/or elements disclosed herein may be combined with one another to form various additional embodiments not specifically disclosed. Accordingly, additional embodiments are possible and are intended to be encompassed within this specification and the scope of the appended claims. The specification describes specific examples to accomplish a more general goal that may be accomplished in another way.

[0181] As used in this application, the terms “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 of ordinary skill to refer to reasonable ranges outside of the given value, for example, general tolerances associated with manufacturing, assembly, and use of the described embodiments.

Claims

1. A medical device, comprising: a hub or housing including: a push tab disposed on an upper surface of the hub or housing; and a rib disposed on the upper surface of the hub or housing, the rib including a top surface and the rib being proximal to the push tab; and a cannula directly or indirectly connected to the hub or housing, wherein the top surface of the rib includes a cradle shape for resisting rotation of the hub or housing when contacted by a finger of a user.

2. The medical device of claim 1, wherein the push tab extends radially from the upper surface of the hub or housing at a lower portion of the push tab, to an upper portion of the push tab.

3. The medical device of claim 1, wherein the rib extends radially from the upper surface of the hub or housing at a lower portion of the rib, to the top surface of the rib.

4. The medical device of claim 1, wherein the push tab, the rib and the hub or housing are integrally formed as a unitary structure.

5. The medical device of claim 1, wherein the cradle shape includes a concave surface.

6. The medical device of claim 1, wherein the push tab and the rib are parallel to each other.

7. The medical device of claim 1, wherein a height of the push tab is greater than a height of the rib.

8. The medical device of claim 7, wherein the height of the push tab is measured in a radial direction from the upper surface of the hub or housing to an upper portion of the push tab; and the height of the rib is measured in a radial direction from the upper surface of the hub or housing to the top surface of the rib.

9. The medical device of claim 1, wherein the cannula comprises a catheter tube of a catheter; and the hub or housing comprises a catheter hub of the catheter.

10. The medical device of claim 1, wherein the cannula comprises a catheter tube of a safety catheter; and the hub or housing comprises a tip shield for an introducer needle of the safety catheter.

11. The medical device of claim 1, wherein the hub or housing includes two wings.

12. A medical device, comprising: a hub or housing including: a push tab disposed on an upper

surface of the hub or housing; and a plurality of ribs disposed on the upper surface of the hub or housing, the plurality of ribs each including a top surface and being proximal to the push tab; and a cannula directly or indirectly connected to the hub or housing, wherein the top surface of one of the plurality of ribs includes a cradle shape for resisting rotation of the hub or housing when contacted by a finger of a user.

13. The medical device of claim 12, wherein the plurality of ribs are all of a same height.

14. The medical device of claim 12, wherein all of the plurality of ribs includes the cradle shape.