CLAIMS

What is claimed is:

1. A catheter assembly (100) comprising:

a catheter tube (104) having a lumen, a distal end opening, and a proximal end attached to a distal end of a catheter hub (102), said catheter hub (102) comprising a catheter body (126) with an exterior surface and an interior surface defining an interior cavity (123) having at least one shoulder (173);

a needle (108) having a needle tip (114) at a distal end and having a proximal end attached to a needle hub (106); said needle (108) projecting through the catheter hub (102) and through the catheter tube (104) and having the needle tip (114) projecting distally of the distal end opening in a ready to use position;

a valve (120) having a valve disc (121) located in the interior cavity (123) of the catheter hub (102), the valve disc (121) comprising at least one slit (234) and at least two flaps (194), a proximally facing surface, and a distally facing surface, wherein said distally facing surface is in contact with the at least one shoulder (173);

a skirt section (250) extending from the valve disc (121), the skirt section (250) comprising a wall with an exterior surface and an interior surface defining a skirt interior and a skirt proximal end surface (290), said skirt section (250) being in contact with the interior surface of the catheter hub (102);

a valve actuator (122) located in the interior cavity (123) of the catheter hub (102), said valve actuator (122) having a nose section (150) at a distal end and a proximal section (157) proximally of the nose section (150); the nose section (150) comprising a bore for fluid flow and an actuation end (180) at a distal most end of the nose section (150) and the proximal section (157) having at least one gap for fluid flow therethrough or thereacross, the valve actuator (122) located in a proximal position within the interior cavity (123) and slidable to a distal position within the interior cavity (123) when pushed by a medical implement, wherein the nose section (150) is located at least in part inside the skirt interior in the ready to use position; and

wherein two spaced apart abutting surfaces (295, 298) are located proximally of the actuation end (180) of the valve opener (122) and proximally of the skirt proximal end surface (290) in the ready to use position, the abutting surfaces (295, 298) are sized and shaped to abut the skirt proximal end surface (290) when said valve actuator (122) is in the distal position.

2. The catheter assembly (100) of claim 1, further comprising a needle guard (130) having a protective surface located to a side of the needle (108) in the ready to use position and transitional to a position distal of the needle tip (114) in a protective position to cover the needle tip (114) from inadvertent needlestick.

3. The catheter assembly (100) of any preceding claim, wherein the skirt section comprises a ramp-shape cross-section and wherein said skirt proximal end surface (290) is located at a proximal end of said ramp-shape cross-section.

4. The catheter assembly (100) of any preceding claim, wherein the nose section (150) of the valve actuator (122) has a first slope extending into a transition section (296) and wherein the transition section (296) has a second slope and wherein the second slope and the first slope have different slope values.

5. The catheter assembly (100) of any preceding claim, wherein the valve disc (121) has a first portion (168) with a first thickness and a second portion (170) with a second thickness and wherein the first thickness is greater than the second thickness.

6. The catheter assembly (100) of claim 5, wherein the at least one slit (234) is formed through the second portion (170) of the valve (120).

7. The catheter assembly (100) of claim 2, wherein at least one stabilizing element (158) comprising a first end connected to a first plunger element (152) of the valve actuator (122) and a second end connected to a second plunger element (152) of the valve actuator (122), said stabilizing element (158) further comprising a distal edge (158a) and a proximal edge (158b).

8. The catheter assembly (100) of claim 7, wherein the needle guard (130) comprises a proximal wall (140) comprising a perimeter (192) defining an opening and at least one arm (188, 190) extending distally of the proximal wall (140), said at least one arm (188, 190) comprising an elongated arm portion (188c, 190c), a distal wall (188b, 190b), and an elbow (188a, 190a)

located between elongated arm portion and the distal wall, and wherein a single bend is located between the elongated arm portion and the distal wall to define a smooth or flat profile at the elbow where the needle guard contacts the distal edge.

9. The catheter assembly (100) of claim 8, wherein the catheter hub (102) comprises a side port (360) having an elongated body (362) with a bore (364), said elongated body (362) extending at an angle to the catheter body (126).

10. The catheter assembly (100) of any preceding claim, further comprising a grip paddle (372) having a body extending laterally of an axis defined by the needle (108).

11. The catheter assembly (100) of claim 7, wherein the distal edge (158a) of the stabilizing element (158) comprises a taper edge (392) that originates closer to an exterior surface of the stabilizing element (158) and slants toward an inner surface of the stabilizing element (158).

12. A method of manufacturing a catheter assembly (100) comprising:

attaching a catheter tube (104) having a lumen, a distal end opening, and a proximal end to a distal end of a catheter hub (102), said catheter hub (102) comprising a catheter body (126) with an exterior surface and an interior surface defining an interior cavity (123) having at least one shoulder (173);

attaching a needle (108) having a needle tip (114) at a distal end and having a proximal end to a needle hub (106); said needle (108) projecting through the catheter hub (102) and through the catheter tube (104) and having the needle tip (114) projecting distally of the distal end opening in a ready to use position;

placing a valve (120) having a valve disc (121) in the interior cavity (123) of the catheter hub (102), the valve disc (121) comprising at least one slit (234) and at least two flaps (194), a proximally facing surface, and a distally facing surface, wherein said distally facing surface contacting the at least one shoulder (173);

extending a skirt section (250) from the valve disc (121), the skirt section (250) comprising a wall with an exterior surface and an interior surface defining a skirt interior and a

skirt proximal end surface (290), said skirt section (250) being in contact with the interior surface of the catheter hub (102);

placing a valve actuator (122) in the interior cavity (123) of the catheter hub (102), said valve actuator (122) having a nose section (150) at a distal end and a proximal section (157) proximally of the nose section (150); the nose section (150) comprising a bore for fluid flow and an actuation end (180) at a distal most end of the nose section (150) and the proximal section (157) having at least one gap for fluid flow therethrough or thereacross, the valve actuator (122) having a proximal position within the interior cavity (123) and slidable to a distal position within the interior cavity (123) when pushed by a medical implement, wherein the nose section (150) is located at least in part inside the skirt interior in the ready to use position; and

wherein two spaced apart abutting surfaces (295, 298) are located proximally of the actuation end (180) of the valve opener (122) and proximally of the skirt proximal end surface (290) in the ready to use position, the abutting surfaces (295, 298) are sized and shaped to abut the skirt proximal end surface (290) when said valve actuator (122) is in the distal position.

13. The method of claim 12, further comprising placing a needle guard (130) in the interior cavity (123) of the catheter hub (102), the needle guard having a protective surface located to a side of the needle (108) in the ready to use position and transitional to a position distal of the needle tip (114) in a protective position to cover the needle tip (114) from inadvertent needlestick.

14. The method of claim 13, further comprising extending a side port (360) having an elongated body (362) with a bore (364) at an angle to the catheter body (126).

15. The method of claim 13 or 14, wherein the needle guard (130) comprises a proximal wall (140) comprising a perimeter (192) defining an opening and at least one arm (188, 190) extending distally of the proximal wall (140), said at least one arm (188, 190) comprising an elongated arm portion (188c, 190c), a distal wall (188b, 190b), and an elbow (188a, 190a) located between elongated arm portion and the distal wall, and wherein a single bend is located between the elongated arm portion and the distal wall to define a smooth or flat profile at the elbow where the needle guard contacts the distal edge.

16. A catheter assembly (100) comprising:

a needle (108) attached to a needle hub (106);

a catheter tube (104) attached to a catheter hub (102);

a valve (120) and a valve actuator (122) located inside an interior (123) of the catheter hub (102), said valve (120) comprising a valve disc (121) having a plurality of valve flaps (194); and

a valve skirt (250) defining a skirt interior;

wherein the valve actuator (122) is movable into the valve (120) to deflect the plurality of valve flaps (194) in a valve opened position and movable away from the valve (120) to enable the valve flaps (194) to return to a valve closed position; and

wherein the needle (108) projects through the valve (120), the valve actuator (122), the catheter hub (102), and the catheter tube (104) in a ready to use position.

17. A catheter assembly (100) comprising:

a needle (108) attached to a needle hub (106);

a catheter tube (104) attached to a catheter hub (102);

a valve (120) and a valve actuator (122) located inside an interior (123) of the catheter hub (102), said valve (120) comprising a valve disc (121) having a plurality of valve flaps (194); and

a securement device (124) retaining the valve (120) inside the interior (123);

wherein the valve actuator (122) is movable into the valve (120) to deflect the plurality of valve flaps (194) in a valve opened position and movable away from the valve (120) to enable the valve flaps (194) to return to a valve closed position; and

wherein the needle (108) projects through the valve (120), the valve actuator (122), the catheter hub (102), and the catheter tube (104) in a ready to use position.

CLAIMS

What is claimed is:

1. A catheter assembly comprising:

a catheter tube having a lumen, a distal end opening, and a proximal end attached to a distal end of a catheter hub, said catheter hub comprising a catheter body with an exterior surface and an interior surface defining an interior cavity having at least one shoulder;

a needle having a needle tip at a distal end and having a proximal end attached to a needle hub; said needle projecting through the catheter hub and through the catheter tube and having the needle tip projecting distally of the distal end opening in a ready to use position;

a valve having a valve disc located in the interior cavity of the catheter hub, the valve disc comprising at least one slit and at least two flaps, a proximally facing surface, and a distally facing surface, wherein said distally facing surface is in contact with the at least one shoulder;

(i) a skirt section extending from the valve disc, the skirt section comprising a wall with an exterior surface and an interior surface defining a skirt interior and a skirt proximal end surface, said skirt section being in contact with the interior surface of the catheter hub; or (ii) a securing device located proximally of the valve disc , the securing device comprising a metallic ring body comprising a fluid path, a distal end, a proximal end, and at least one leaf spring having a free end extending proximally inward of the proximal end of the metallic ring body, the securing device securing the valve from proximal displacement;

a valve actuator located in the interior cavity of the catheter hub, said valve actuator having a nose section at a distal end of the valve actuator and a proximal section proximally of the nose section; the nose section comprising a bore for fluid flow and an actuation end at a distal most end of the nose section, the proximal section comprising at least one gap for fluid flow therethrough or thereacross, a first plunger element, and a second plunger element, the valve actuator being located in a proximal position within the interior cavity and slidable to a distal position within the interior cavity when pushed by a medical implement, wherein:

(a) when the skirt section is present, the nose section is located at least in part inside the skirt interior when the needle is in the ready to use position; or

(b) when the securing device is present, the nose section is located inward of the metallic ring body when the needle is in the ready to use position; and

wherein when the skirt section is present, two spaced apart abutting surfaces are aligned with and located distally of the first plunger element and the second plunger element, each of the two spaced apart abutting surfaces are located proximally of the actuation end of the valve actuator and proximally of the skirt proximal end surface when the needle is in the ready to use position, the two spaced apart abutting surfaces are sized and shaped to compress the skirt proximal end surface when said valve actuator is in the distal position to create stored energy in the valve skirt to then exert a proximally directed force against the two spaced apart abutting surfaces or, when the securing device is present, the at least one leaf spring is spaced from the nose section and biasing against the nose section when the valve actuator is in the distal position.

2. The catheter assembly of claim 1, further comprising a needle guard having a protective surface located to a side of the needle when the needle is in the ready to use position and transitional to a position distal of the needle tip in a protective position to cover the needle tip from inadvertent needlestick.

3. The catheter assembly of claim 1, wherein the skirt section comprises a ramp-shape cross-section and wherein said skirt proximal end surface is located at a proximal end of said ramp-shape cross-section.

4. The catheter assembly of claim 1, wherein the nose section of the valve actuator has a first slope extending into a transition section and wherein the transition section has a second slope and wherein the second slope and the first slope have different slope values.

5. The catheter assembly of claim 1, wherein the valve disc has a first portion with a first thickness and a second portion with a second thickness and wherein the first thickness is greater than the second thickness.

6. The catheter assembly of claim 5, wherein the at least one slit is formed through the second portion of the valve disc.

7. The catheter assembly of claim 2, wherein at least one stabilizing element comprising a first end connected to the first plunger element and a second end connected to the second plunger element, said at least one stabilizing element further comprising a distal edge and a proximal edge.

8. The catheter assembly of claim 7, wherein the needle guard comprises a proximal wall comprising a perimeter defining an opening and at least one arm extending distally of the proximal wall, said at least one arm comprising an elongated arm portion, a distal wall, and an elbow located between the elongated arm portion and the distal wall, and wherein a single bend is located between the elongated arm portion and the distal wall to define a smooth or flat profile at the elbow where the needle guard contacts the distal edge of the at least one stabilizing element.

9. The catheter assembly of claim 8, wherein the catheter hub comprises a side port having an elongated body with a bore, said elongated body extending at an angle to the catheter body.

10. The catheter assembly of claim 1, further comprising a grip paddle having a body extending laterally of an axis defined by the needle.

11. The catheter assembly of claim 7, wherein the distal edge of the at least one stabilizing element comprises a taper edge that originates closer to an exterior surface of the at least one stabilizing element and slants toward an inner surface of the at least one stabilizing element.

12. A method of manufacturing a catheter assembly comprising:

attaching a catheter tube having a lumen, a distal end opening, and a proximal end to a distal end of a catheter hub, said catheter hub comprising a catheter body with an exterior surface and an interior surface defining an interior cavity having at least one shoulder;

attaching a needle to a needle hub; said needle having a needle tip at a distal end and having a proximal end, said needle projecting through the catheter hub and through the catheter tube and having the needle tip projecting distally of the distal end opening in a ready to use position;

placing a valve having a valve disc in the interior cavity of the catheter hub, the valve disc comprising at least one slit and at least two flaps, a proximally facing surface, and a distally facing surface, wherein said distally facing surface contacting the at least one shoulder;

(i) extending a skirt section from the valve disc, the skirt section comprising a wall with an exterior surface and an interior surface defining a skirt interior and a skirt proximal end surface, said skirt section being in contact with the interior surface of the catheter hub; or

(ii) placing a securing device in the interior cavity of the catheter hub and proximally of the valve disc, the securing device comprising a metallic ring body comprising a fluid path, a distal end, a proximal end, and at least one leaf spring having a free end extending proximally inward of the proximal end of the metallic ring body, the securing device securing the valve from proximal displacement;

placing a valve actuator in the interior cavity of the catheter hub, said valve actuator having a nose section at a distal end of the valve actuator and a proximal section proximally of the nose section; the nose section comprising a bore for fluid flow and an actuation end at a distal most end of the nose section, the proximal section comprising at least one gap for fluid flow therethrough or thereacross, a first plunger element, and a second plunger element, the valve actuator having a proximal position within the interior cavity and slidable to a distal position within the interior cavity when pushed by a medical implement, wherein:

(a) when the skirt section is present, the nose section is located at least in part inside the skirt interior when the needle is in the ready to use position; or

(b) when the securing device is present, the nose section is located inward of the metallic ring body when the needle is in the ready to use position; and

wherein when the skirt section is present, two spaced apart abutting surfaces are aligned with and located distally of the first plunger element and the second plunger element, the two spaced apart abutting surfaces are located proximally of the actuation end of the valve actuator and proximally of the skirt proximal end surface when the needle is in the ready to use position, the two spaced apart abutting surfaces are sized and shaped to compress the skirt proximal end surface when said valve actuator is in the distal position to create stored energy in the valve skirt to then exert a proximally directed force against the two spaced apart abutting surfaces or, when the securing device is present, the at least one leaf spring is spaced from the nose section and biasing against the nose section when the valve actuator is in the distal position.

13. The method of claim 12, further comprising placing a needle guard in the interior cavity of the catheter hub, the needle guard having a protective surface located to a side of the needle when

the needle is in the ready to use position and transitional to a position distal of the needle tip in a protective position to cover the needle tip from inadvertent needlestick.

14. The method of claim 13, further comprising extending a side port having an elongated body with a bore at an angle to the catheter body.

15. The method of claim 13, wherein the needle guard comprises a proximal wall comprising a perimeter defining an opening and at least one arm extending distally of the proximal wall, said at least one arm comprising an elongated arm portion, a distal wall, and an elbow located between the elongated arm portion and the distal wall, and wherein a single bend is located between the elongated arm portion and the distal wall to define a smooth or flat profile at the elbow where the needle guard contacts a distal edge of at least one stabilizing element.

16. A catheter assembly comprising:

a needle attached to a needle hub;

a catheter tube attached to a catheter hub;

a valve and a valve actuator located inside an interior of the catheter hub, said valve comprising a valve disc having a plurality of valve flaps, a proximally facing surface, and a distally facing surface; and

a securement device comprising a body and separately formed from the catheter hub, the securement device is in contact with the interior of the catheter hub and the body is in contact with a proximal-most surface of the valve to retain the valve inside the interior of the catheter hub;

wherein the valve actuator is movable into contact with the securement device and the valve when pushed by a medical implement to deflect the plurality of valve flaps in a valve opened position and movable away from the valve and away from the securement device to enable the plurality of valve flaps to return to a valve closed position;

wherein the needle projects through the valve, the valve actuator, the catheter hub, and the catheter tube in a ready to use position; and

wherein the securement device comprises one of a leaf spring, a canted coil spring comprising a plurality of coils, or an O-ring.

17. The catheter assembly of claim 19, wherein the securement device comprises one of a leaf spring, a canted coil spring comprising a plurality of coils, or an O-ring.

18. The catheter assembly of claim 16, wherein the securement device has a ring body with an annular space and the leaf spring extends from the ring body.

19. A catheter assembly comprising:

a needle attached to a needle hub;

a catheter tube attached to a catheter hub;

a valve and a valve actuator located inside an interior of the catheter hub, said valve comprising a valve disc having a plurality of valve flaps, a proximally facing surface, and a distally facing surface; and

a securement device comprising a body and separately formed from the catheter hub, the securement device is in contact with the interior of the catheter hub and the body is in contact with a proximal-most surface of the valve to retain the valve inside the interior of the catheter hub;

wherein the valve actuator is movable into contact with the securement device and the valve when pushed by a medical implement to deflect the plurality of valve flaps in a valve opened position and movable away from the valve and away from the securement device to enable the plurality of valve flaps to return to a valve closed position;

wherein the needle projects through the valve, the valve actuator, the catheter hub, and the catheter tube in a ready to use position; and

wherein the valve actuator has a nose section and wherein the nose section is located in a skirt interior of a valve skirt when the needle is in the ready to use position and a plurality of abutting edges on the valve actuator are located proximally of the valve skirt for compressing the valve skirt.

20. The catheter assembly of claim 19, wherein the valve skirt of the valve comprises a ramp-shape cross-section and wherein a skirt proximal end surface is located at a proximal end of said ramp-shape cross-section.

21. The method of claim 12, further comprising pushing the skirt proximal end surface in a distal direction with the two spaced apart abutting surfaces.

22. The method of claim 21, wherein each of the two spaced apart abutting surfaces are angled to a surface of the nose section to define a radially outward projection.

23. The method of claim 22, wherein the two spaced apart abutting surfaces are generally parallel to one another.

24. The catheter assembly of claim 1, wherein each of the two spaced apart abutting surfaces are located at a distal end of a shoulder of the at least one shoulder.

25. The catheter assembly of claim 24, further comprising a slanted surface extending proximally of each abutting surface of the two spaced apart abutting surfaces.

26. The catheter assembly of claim 24, wherein each of the two spaced apart abutting surfaces has an edge to define two edges and the two edges are parallel to one another.

27. The catheter assembly of claim 1, wherein each of the two spaced apart abutting surfaces are angled to a surface of the nose section to define a radially outward projection.

28. The catheter assembly of claim 27, wherein the two spaced apart abutting surfaces are generally parallel to one another.

29. The catheter assembly of claim 16, further comprising a needle guard having a protective surface located to a side of the needle when the needle is in the ready to use position and transitional to a position distal of a needle tip in a protective position to cover the needle tip from inadvertent needlestick.

30. The catheter assembly of claim 16, wherein the valve comprises a skirt section and a skirt proximal end surface, the skirt section comprising a ramp-shape cross-section and wherein the skirt proximal end surface is located at a proximal end of said ramp-shape cross-section.

31. The catheter assembly of claim 16, wherein the valve actuator comprises a nose section having a first slope extending into a transition section and wherein the transition section has a second slope and wherein the second slope and the first slope have different slope values.

32. The catheter assembly of claim 16, wherein the valve disc has a first portion with a first thickness and a second portion with a second thickness and wherein the first thickness is greater than the second thickness.

33. The catheter assembly of claim 32, wherein at least one slit is formed through the second portion of the valve disc.

34. The catheter assembly of claim 16, wherein at least one stabilizing element comprising a first end connected to a first plunger element of the valve actuator and a second end connected to a second plunger element, said at least one stabilizing element further comprising a distal edge and a proximal edge.

35. The catheter assembly of claim 29, wherein the needle guard comprises a proximal wall comprising a perimeter defining an opening and at least one arm extending distally of the proximal wall, said at least one arm comprising an elongated arm portion, a distal wall, and an elbow located between the elongated arm portion and the distal wall, and wherein a single bend is located between the elongated arm portion and the distal wall to define a smooth or flat profile at the elbow where the needle guard contacts a distal edge of at least one stabilizing element.

36. The catheter assembly of claim 16, wherein the catheter hub comprises a side port having an elongated body with a bore, said elongated body extending at an angle to a catheter body of the catheter hub.

37. The catheter assembly of claim 16, further comprising a grip paddle having a body extending laterally of an axis defined by the needle.

38. The catheter assembly of claim 34, wherein the distal edge of the at least one stabilizing element comprises a taper edge that originates closer to an exterior surface of the at least one stabilizing element and slants toward an inner surface of the at least one stabilizing element.

39. The catheter assembly of claim 19, further comprising a needle guard having a protective surface located to a side of the needle when the needle is in the ready to use position and transitional to a position distal of a needle tip in a protective position to cover the needle tip from inadvertent needlestick.

40. The catheter assembly of claim 19, wherein the nose section has a first slope extending into a transition section and wherein the transition section has a second slope and wherein the second slope and the first slope have different slope values.

41. The catheter assembly of claim 19, wherein the valve disc has a first portion with a first thickness and a second portion with a second thickness and wherein the first thickness is greater than the second thickness.

42. The catheter assembly of claim 41, wherein at least one slit is formed through the second portion of the valve disc.

43. The catheter assembly of claim 19, wherein at least one stabilizing element comprising a first end connected to a first plunger element of the valve actuator and a second end connected to a second plunger element, said at least one stabilizing element further comprising a distal edge and a proximal edge.

44. The catheter assembly of claim 39, wherein the needle guard comprises a proximal wall comprising a perimeter defining an opening and at least one arm extending distally of the proximal wall, said at least one arm comprising an elongated arm portion, a distal wall, and an elbow located

between the elongated arm portion and the distal wall, and wherein a single bend is located between the elongated arm portion and the distal wall to define a smooth or flat profile at the elbow where the needle guard contacts a distal edge of at least one stabilizing element.

45. The catheter assembly of claim 19, wherein the catheter hub comprises a side port having an elongated body with a bore, said elongated body extending at an angle to a catheter body of the catheter hub.

46. The catheter assembly of claim 19, further comprising a grip paddle having a body extending laterally of an axis defined by the needle.

47. The catheter assembly of claim 43, wherein the distal edge of the at least one stabilizing element comprises a taper edge that originates closer to an exterior surface of the at least one stabilizing element and slants toward an inner surface of the at least one stabilizing element.