Claims

What is claimed is:

1. A needle assembly comprising:

a needle hub with a needle having a needle shaft and a needle tip extending from a distal end of the needle hub;

a catheter hub having an interior surface defining an interior cavity;

a catheter tube attached to the catheter hub and having the needle extending through the catheter tube with the needle tip extending out a distal opening in a ready-to-use position;

a valve comprising a plurality of slits and a plurality of flaps defining an opening, said valve seated in the interior cavity of the catheter hub;

a needle guard comprising at least one arm extending from a proximal wall, said proximal wall having a perimeter defining a proximal opening;

a valve opener positioned in the interior cavity of the catheter hub and proximal of the valve in a first position, the valve opener comprising a head located distally of the needle guard and two valve opener arms extending in a proximal direction of the head and located in between the needle guard and the interior surface of the catheter hub, each of said two valve opener arms comprising a clip seat having the needle guard biased there against and having a width measured orthogonally to the needle shaft, and wherein the width of each clip seat is larger than a diameter of the needle shaft and larger than a range of diameters of needle shafts in which the diameter of the needle shaft falls into; and

wherein the head of the valve opener is axially displaceable against the valve to open the valve in a second position.

2. The needle assembly according to claim 1, wherein the needle guard, in a ready-to-use position and during needle withdrawal prior to activation of the needle guard, engages a guard engagement section formed on the interior surface of the catheter hub.

3. The needle assembly according to claim 2, wherein the guard engagement section has an inside diameter and wherein the inside diameter is generally constant across the range of diameters of needle shafts from G18 to G24.

4. The needle assembly according to claim 1, wherein the valve opener comprises a pair of guide tabs, wherein each guide tab of the pair of guide tabs is on an exterior of each respective valve opener arm.

5. The needle assembly according to claim 4, wherein each guide tab of the pair of guide tabs is located in a corresponding slot formed in the interior cavity of the catheter hub.

6. The needle assembly according to claim 4, wherein the guide tabs, the two valve opener arms, and the two clip seats are formed continuously.

7. The needle assembly according to claim 1, wherein the width of each clip seat is larger than the range of diameters of needle shafts from G18 to G24.

8. The needle assembly according to claim 1, where each of the two valve opener arms comprises a channel defining a drain.

9. The needle assembly according to claim 1, further comprising a bridge connecting the two valve opener arms.

10. The needle assembly according to claim 1, wherein the head of the valve opener comprises a frusto-conical shaped distal end.

11. A method of making a needle assembly comprising:

providing a needle hub with a needle having a needle shaft and a needle tip extending from a distal end of the needle hub;

providing a catheter hub having an interior surface defining an interior cavity;

attaching a catheter tube to the catheter hub and disposing the needle through the catheter tube with the needle tip extending out a distal opening in a ready-to-use position;

placing a valve comprising a plurality of slits and a plurality of flaps defining an opening in the interior cavity of the catheter hub;

placing a valve opener in the interior cavity of the catheter hub proximal of the valve; and placing a needle guard in contact with the valve opener, said needle guard comprising at least one arm extending from a proximal wall, said proximal wall having a perimeter defining a proximal opening;

wherein the valve opener comprises a head located distally of the needle guard and two valve opener arms extending in a proximal direction of the head and located in between the needle guard and the interior surface of the catheter hub, each of said two valve opener arms comprising a clip seat having the needle guard biased there against and having a width measured orthogonally to the needle shaft, and wherein the width of each clip seat is larger than a diameter of the needle shaft and larger than a range of diameters of needle shafts in which the diameter of the needle shaft falls into; and

wherein the head of the valve opener is axially displaceable against the valve to open the valve in a second position.

12. The method of claim 11, wherein the needle shaft has a diameter of a G18 needle.

13. The method of claim 12, wherein the needle assembly is a first needle assembly and the method comprises making a second needle assembly identical to the first needle assembly and wherein the needle shaft of the second needle assembly has a diameter of a G20 needle, G22 needle, or G24 needle.

14. The method of claim 11, wherein the needle guard, in a ready-to-use position and during needle withdrawal prior to activation of the needle guard, engages a guard engagement section formed on the interior surface of the catheter hub.

15. The method of claim 14, wherein the guard engagement section has an inside diameter and wherein the inside diameter is generally constant across the range of diameters of needle shafts from G18 to G24.

16. The method of claim 11, wherein the valve opener comprises a pair of guide tabs, wherein each guide tab of the pair of guide tabs is on an exterior of each respective valve opener arm.

17. The method of claim 16, wherein the guide tabs are located in corresponding slots formed in the interior cavity of the catheter hub.

18. The method of claim 11, where each of the two valve opener arms comprises a channel defining a drain located on each of the two valve opener arms.

19. The method of claim 11, further comprising a bridge connecting the two valve opener arms.

20. The method of claim 11, wherein the head of the valve opener comprises a frusto-conical shaped distal end.