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(54) Title: Multi-Use Blood Control Safety Catheter Assembly

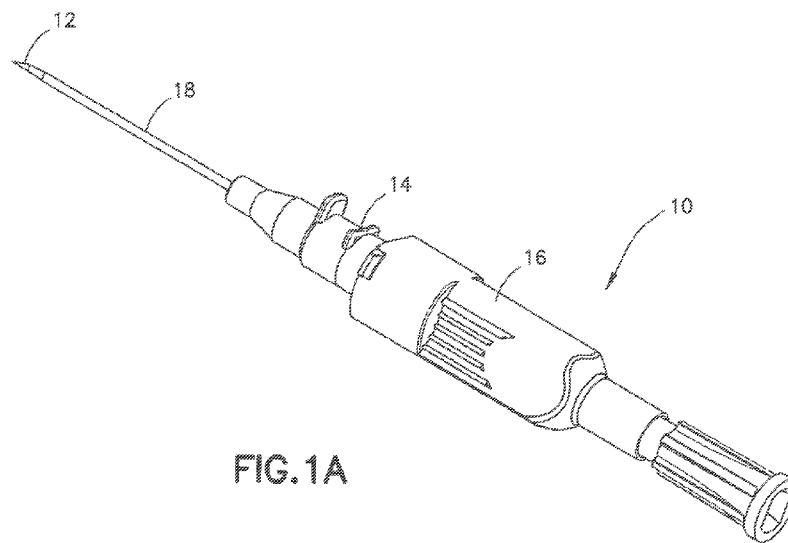
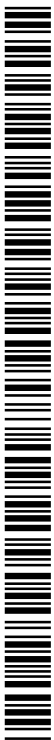


FIG. 1A

(57) Abstract: A valve actuator that moves in a catheter assembly between a first position where a valve is closed and a second position where the valve is open, the valve actuator including a shaft portion at a distal end of the valve actuator that is configured to pierce the valve, a mating portion at a proximal end of the valve actuator that is configured to engage a Luer device, a diameter reduction region that connects the shaft portion and the mating portion, and a plurality of windows that extend through the valve actuator for flushing fluid, the plurality of windows being disposed in the diameter reduction region, wherein each of the plurality of windows does not extend a full length of the diameter reduction region.



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AMENDED CLAIMS

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1. A valve actuator that moves in a catheter assembly between a first position where a valve is closed and a second position where the valve is open, the valve actuator comprising:
 - a shaft portion at a distal end of the valve actuator that is configured to pierce the valve;
 - a mating portion at a proximal end of the valve actuator that is configured to engage a Luer device;
 - a diameter reduction region that connects the shaft portion and the mating portion;
 - and
 - a plurality of windows that extend through the valve actuator for flushing fluid, the plurality of windows being disposed in the diameter reduction region, wherein each of the plurality of windows does not extend a full length of the diameter reduction region.
2. The valve actuator of claim 1, wherein the plurality of windows extends to a length of approximately half of the length of the diameter reduction region from a proximal end of the diameter reduction region.
3. The valve actuator of claim 1, wherein the plurality of windows extends to a length of approximately a third of the length of the diameter reduction region from a proximal end of the diameter reduction region.
4. The valve actuator of claim 1, wherein the plurality of windows extends to a length of approximately .0125 inches.

5. The valve actuator of claim 1, further comprising one or more openings that extends through the valve actuator, wherein the one or more openings is disposed in the shaft portion.
6. A valve actuator that moves in a catheter assembly between a first position where a valve is closed and a second position where the valve is open, the valve actuator comprising:
 - a shaft portion at a distal end of the valve actuator that is configured to pierce the valve;
 - a mating portion at a proximal end of the valve actuator that is configured to engage a Luer device;
 - a diameter reduction region that connects the shaft portion and the mating portion;
 - and
 - a plurality of windows that extends through the valve actuator for flushing fluid, wherein the plurality of windows is disposed outside the diameter reduction region.
7. The valve actuator of claim 6, wherein the plurality of windows is adjacent to a proximal end of the diameter reduction region.
8. The valve actuator of claim 6, wherein the plurality of windows extends to a length of approximately .0125 inches.
9. The catheter assembly of claim 6, wherein the valve actuator further includes one or more openings that extends through the valve actuator, and the openings are disposed in the shaft portion.

10. A catheter assembly comprising:
- a catheter;
 - a needle having a sharp distal tip disposed within the catheter;
 - a catheter hub connected to the catheter having the needle passing therethrough, the catheter hub including:
 - a valve that selectively permits or blocks a flow of fluid through the catheter;
 - a valve actuator that moves between a first position and a second position; and
 - a return member that returns the valve actuator from the second position to the first position; and
 - a needle protection member that encloses the sharp distal tip of the needle, wherein the valve actuator includes a diameter reduction region having a plurality of windows, and
 - each of the plurality of windows does not extend a full length of the diameter reduction region.
11. A catheter assembly comprising:
- a catheter;
 - a needle having a sharp distal tip disposed within the catheter;
 - a catheter hub connected to the catheter having the needle passing therethrough, the catheter hub including:
 - a valve that selectively permits or blocks a flow of fluid through the catheter;
 - a valve actuator that moves between a first position and a second position;
 - a return member that returns the valve actuator from the second position to the first position; and
 - a needle protection member that encloses the sharp distal tip of the needle, wherein the valve actuator including
 - a diameter reduction region, and
 - a plurality of windows that extends through the valve actuator for flushing fluid, the plurality of windows being disposed outside the diameter reduction region.

12. A catheter assembly comprising:
 - a catheter;
 - a needle having a sharp distal tip disposed within the catheter;
 - a catheter hub connected to the catheter having the needle passing therethrough, the catheter hub including:
 - an inner diameter;
 - a valve that selectively permits or blocks a flow of fluid through the catheter;
 - a valve actuator that moves between a first position and a second position; and
 - a spring that returns the valve actuator from the second position to the first position, wherein
 - a clearance fit is provided between the spring and the inner diameter.
13. The catheter assembly of claim 12, wherein the inner diameter of the catheter hub includes an undercut, and the spring is retained by the undercut.
14. The catheter assembly of claim 13, wherein an outer diameter of a portion of the spring is greater than an inner diameter of the undercut.
15. The catheter assembly of claim 12, wherein the spring comprises a coil spring that surrounds the valve actuator.
16. The catheter assembly of claim 12, wherein the spring includes center coils and two or more end coils, and an outer diameter of the end coils is greater than an outer diameter of the two or more center coils.

17. The catheter assembly of claim 12, wherein an interference fit is provided between one of the end coils and the valve actuator.
18. The catheter assembly of claim 12, wherein a clearance fit is provided between center coils and an undercut.
19. The catheter assembly of claim 12, wherein an interference fit retains the valve to the inner diameter of the catheter hub.
20. The catheter assembly of claim 12, wherein the actuator does not contact the inner diameter of the catheter hub.
21. A catheter assembly comprising:
 - a catheter;
 - a needle having a sharp distal tip disposed within the catheter;
 - a catheter hub connected to the catheter having the needle passing therethrough, the catheter hub including:
 - a valve that selectively permits or blocks a flow of fluid through the catheter;
 - a valve actuator that moves between a first position and a second position; and
 - a return member that returns the valve actuator from the second position to the first position; and
 - a needle protection member that encloses the sharp distal tip of the needle, wherein the return member comprises a metallic member with a magnetic relative permeability less than 2.0.
22. The catheter assembly of claim 21, wherein the return member comprises a spring.

23. The catheter assembly of claim 21, wherein the return member is made of a material selected from the group consisting of 316L stainless steel, 316 Lvm stainless steel, titanium, beryllium, copper, magnesium and magnesium alloys.
24. The catheter assembly of claim 21, wherein the return member is made of a magnesium alloy such as Elgiloy.
25. The catheter assembly of claim 21, wherein the magnetic relative permeability is less than 2.0.
26. The catheter assembly of claim 21, wherein the magnetic relative permeability is less than 1.1.
27. The catheter assembly of claim 21, wherein the return member is plated with a diamagnetic material.
28. The catheter assembly of claim 27, wherein the diamagnetic material comprises palladium.
29. The catheter assembly of claim 21, wherein the catheter assembly can remain attached to a patient during an MRI procedure.
30. The valve actuator of claim 1, wherein the shaft portion at the distal end of the valve actuator includes a step.
31. A valve assembly including a valve and a valve actuator that moves in a catheter assembly between a first position where the valve is closed and a second position where the valve is open, the valve actuator comprising:

- a shaft portion at a distal end of the valve actuator that is configured to open the valve; and
a mating portion at a proximal end of the valve actuator that is configured to engage a Luer device;
wherein the shaft portion at the distal end of the valve actuator includes a step.
32. A valve actuator comprising:
a shaft portion at a distal end of the valve actuator that is configured to open a valve;
and
a mating portion at a proximal end of the valve actuator that is configured to engage a Luer device;
wherein the shaft portion at the distal end of the valve actuator includes a step.
33. The valve actuator of claim 32, wherein the step includes a radius.
34. The valve actuator of claim 33, wherein the radius includes:
a first radius disposed at an interface between the step and a distal surface of the valve actuator; and
a second radius disposed at an interface between the step and an outer diameter of the valve actuator.
35. The valve actuator of claim 32, wherein:
the step includes a first step and a second step; and
the first and second steps each includes a radius.
36. The valve actuator of claim 35, wherein the first and second steps are adjacent to each other.
37. The valve actuator of claim 35, wherein the first step is adjacent to a distal surface of the valve actuator.