

CLAIMS

We claim:

1. A catheter system, comprising:

a catheter assembly, comprising:

a catheter adapter, comprising a lumen extending through the catheter adapter;

a catheter extending distally from the catheter adapter; and

a needle assembly coupled to the catheter assembly, the needle assembly comprising:

a plug, wherein an outer surface of the plug comprises a first groove having a first surface-area-to-volume ratio and a second groove having a second surface-area-to-volume ratio, wherein the first surface-area-to-volume ratio is less than the second surface-area-to-volume ratio, wherein the first groove has a greater volume than the second groove;

an outer housing, wherein the outer housing seals a top of the first groove and a top of the second groove to prevent blood from flowing out the top of the first groove and the top of the second groove; and

an introducer needle, comprising a distal end and a proximal end, wherein the proximal end of the introducer needle is in fluid communication with the first groove and the second groove.

2. The catheter system of claim 1, wherein a depth of the first groove is greater than a depth of the second groove.
3. The catheter system of claim 1, wherein a proximal end of the first groove is vented and a proximal end of the second groove is vented.
4. The catheter system of claim 1, wherein the first groove and the second groove are disposed on a top of the plug.

5. The catheter system of claim 1, wherein the first groove and the second groove are generally aligned with a longitudinal axis of the plug.
6. The catheter system of claim 1, wherein the plug is monolithically formed as a single unit, wherein the plug is press fit within the outer housing, wherein the proximal end of the introducer needle is secured within the plug.
7. The catheter system of claim 1, wherein the outer surface of the plug comprises a cavity, wherein the proximal end of the introducer needle is disposed within the cavity, wherein a distal end of the first groove and a distal end of the second groove are proximate the cavity.
8. The catheter system of claim 1, wherein the outer surface of the plug comprises a third groove having a third surface-area-to-volume ratio, wherein the first surface-area-to-volume ratio is less than the third surface-area-to-volume ratio, wherein the first groove has a greater volume than the third groove, wherein the outer housing seals a top of the third groove to prevent blood from flowing out the top of the third groove, wherein the second groove and the third groove are disposed on opposing sides of the first groove.
9. The catheter system of claim 8, wherein the first groove and the second groove are spaced apart by a capillary effect gap, wherein the first groove and the third groove are spaced apart by another capillary effect gap.
10. The catheter system of claim 8, wherein the outer surface of the plug comprises a fourth groove having a fourth surface-area-to-volume ratio and a fifth groove having a fifth surface-area-to-volume ratio, wherein the first surface-area-to-volume ratio is less than the fourth surface-area-to-volume ratio and the fifth

surface-area-to-volume ratio, wherein the first groove has a greater volume than the fourth groove and the fifth groove, wherein the fourth groove and the fifth groove are disposed on opposing sides of the first groove and outwardly from the second groove and the third groove.

11. The catheter system of claim 1, wherein the second groove, the third groove, the fourth groove, or the fifth groove comprise a plurality of pockets extending generally perpendicular to a longitudinal axis of the plug and spaced along a length of the second groove, the third groove, the fourth groove, or the fifth groove.

12. A catheter system, comprising:

a catheter assembly, comprising:

a catheter adapter, comprising a lumen extending through the catheter adapter;

a catheter extending distally from the catheter adapter; and

a needle assembly coupled to the catheter assembly, the needle assembly comprising:

a plug, wherein an outer surface of the plug comprises a first groove having a first surface-area-to-volume ratio, a second groove having a second surface-area-to-volume ratio, and a third groove having a third surface-area-to-volume ratio, wherein the first surface-area-to-volume ratio is less than the second surface-area-to-volume ratio and the third surface-area-to-volume ratio, wherein the first groove has a greater volume than the second groove and the third groove,

an outer housing, wherein the outer housing seals a top of the first groove, a top of the second groove, and a top of the third groove to prevent blood from flowing out the top of the first groove and the top of the second groove, wherein the second groove and the third groove are disposed on opposing sides of the first groove and symmetric about the first groove; and

an introducer needle, comprising a distal end and a proximal end, wherein the proximal end of the introducer needle is in fluid communication with the first groove, the second groove, and the third groove.

13. The catheter system of claim 12, wherein a depth of the first groove is greater than a depth of the second groove and the third groove.
14. The catheter system of claim 12, wherein a proximal end of the first groove is vented, a proximal end of the second groove is vented, and a proximal end of the third groove is vented.
15. The catheter system of claim 12, wherein the first groove, the second groove, and the third groove are disposed on a top of the plug.
16. The catheter system of claim 12, wherein the first groove, the second groove, and the third groove are generally aligned with a longitudinal axis of the plug.
17. The catheter system of claim 12, wherein the outer surface of the plug comprises a cavity, wherein the proximal end of the introducer needle is disposed within the cavity, wherein a distal end of the first groove and a distal end of the second groove are proximate the cavity.
18. The catheter system of claim 12, wherein the first groove and the second groove are spaced apart by a capillary effect gap, wherein the first groove and the third groove are spaced apart by another capillary effect gap.
19. The catheter system of claim 12, wherein the outer surface of the plug comprises a fourth groove having a fourth surface-area-to-volume ratio and a fifth groove having a fifth surface-area-to-volume ratio, wherein the first surface-area-to-volume ratio is less than the fourth surface-area-to-volume ratio and the fifth

surface-area-to-volume ratio, wherein the first groove has a greater volume than the fourth groove and the fifth groove, wherein the fourth groove and the fifth groove are disposed on opposing sides of the first groove and outwardly from the second groove, wherein the second groove, the third groove, the fourth groove, and the fifth groove are symmetric about the first groove.

20. The catheter system of claim 19, wherein the second groove, the third groove, the fourth groove, or the fifth groove comprise a plurality of pockets extending generally perpendicular to a longitudinal axis of the plug and spaced along a length of the second groove, the third groove, the fourth groove, or the fifth groove.