

In the ready position, the needle shaft extends through the valve assembly. The second valve member preferably seals around the shaft of the needle in the ready position, more preferably in a manner that allows gas to vent through the second valve member in the proximal direction, but prevents blood from passing the second valve member. In embodiments in which the second valve member comprises a disc having one or more slits therein, this can be achieved by appropriate arrangement of the or each slit, such that, in the ready position, the or each slit is held open by the needle shaft a sufficient amount to allow the passage of gas but prevent the passage of blood therethrough.

The second valve member may open under the action of a difference in fluid pressure across the valve member. In particular, the second valve member may open under the action of an increased fluid pressure on the proximal side of the valve, to allow fluid to be infused into the catheter and vein of the patient. Similarly, the second valve member may open under the action of a reduced pressure on the proximal side of the valve, to allow fluid to be withdrawn from the catheter and the vein.

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In one embodiment, the catheter assembly further comprises a valve opener disposed within the chamber in the catheter hub. The valve opener is disposed within the internal chamber of the catheter hub proximally of the valve assembly. The valve opener is moveable between a closed position, in which the second valve member is closed, and an open position in which the second valve member is open. The valve opener is moved in the proximal-distal direction to the open position by the insertion of a device into the proximal end of the catheter hub, such as a syringe or other male fitting. The valve opener is urged into the closed position by the action of the second valve member closing, for example by the resilience of the valve disc. The valve opener

preferably has a passage extending longitudinally therethrough and/or around for the passage of fluid.

5 Movement of the valve opener in the distal direction is limited by the valve assembly. Preferably, means are provided to limit the movement of the valve opener in the proximal direction. In one embodiment, the inner surface of the catheter hub is provided with one or more protrusions to engage with the valve opener.

10 In the ready position, the needle shaft extends through the valve opener. One preferred form of valve opener comprises a stem, having a passage therethrough, and a head portion at the distal end of the stem, having a passage therethrough. In use, a device inserted into the proximal end of the catheter hub contacts the stem of the valve opener, urging the valve opener from the closed position into the open position. As the valve
15 opener is moved ~~proximally~~ distally into the open position, the head portion is urged into contact with the second valve member, opening the valve assembly.

The stem may comprise a tube, with the needle extending through the tube in the ready position. Alternatively, the stem may comprise one or more legs extending
20 proximally from the head portion. In one embodiment the region of the head portion contacting the second valve member is generally domed or frusto-conical.

In a preferred embodiment, the catheter device of the present invention is a safety device and comprises a needle guard assembly. The needle guard assembly
25 acts to cover and block the sharpened needle tip as the needle is withdrawn from the catheter in the proximal direction and moved from the ready position into a protected position. In this way, the risk of a needle stick injury occurring is reduced or avoided.

Figure 5 is a cross-sectional view of the device of Figure 4 in a protected position;

5 Figure 5a is an enlarged cross-sectional view of the needle guard assembly of the device of Figure 5a;

Figure 6 is a cross-sectional view of a device according to a third embodiment of the present invention in a ready position;

10 Figure 7a is a cross-sectional view of a valve assembly for use in the devices of any of Figures 1 to 6;

15 Figure 7b is a proximal end view of one embodiment of the valve assembly of Figure 7a;

Figure 7c is a proximal end of a second embodiment of the valve assembly of Figure 7a; and

20 Figure 8 is a perspective view of one embodiment of needle guard for use in the catheter assembly of the present invention.

25 Referring to Figures 1 and 2, there is shown a device according to a first embodiment of the present invention, generally indicated as 2. The device 2 is shown in Figures 1 and 2 in a ready position. The device is shown in Figure 3 in a retracted position, that is with the needle withdrawn in the proximal direction.

30 The device 2 comprises a catheter hub 4 having a distal end 6 and a proximal end 8. An elongate, hollow, tubular catheter 10 is connected to the

In order to ensure a distally directed infusion towards the hollow catheter tubing, the proximal end of the tube 80 may be further stiffened by inserting a hard ring at the proximal end of the tube 80 just distal of the disc 76 or a flange can be extended from disc 76 that is held in a groove in the
 5 inside surface of the catheter hub.

Turning to Figures 4 and 5, there is shown an alternative embodiment of the device of the present invention. The device of this embodiment, generally indicated as 102, comprises a catheter hub, catheter, needle hub
 10 and needle, valve assembly and valve opener, and extension tube of the same general configuration as the embodiment of Figures 1 and 2 and described above. Features of the embodiment of Figures 3 and 4 common to the embodiment of Figures 1 and 2 are indicated using the same reference numerals.

15 The embodiment of Figures 3 and 4 comprises a needle guard assembly disposed between the distal end of the needle hub 20 and the proximal end of the catheter hub 4, when the device is in the ready position, as shown in Figure 3. The needle guard assembly, generally indicated as
 20 120, is shown in the ready position in greater detail in Figure 4a.

There can be some overlapping of the proximal end of the needle guard and the distal end of the needle hub and/or overlapping of the distal end of the needle guard and the proximal end of the catheter hub.

25 Referring to Figure 4a, the needle guard assembly ~~102-120~~ comprises a generally cylindrical needle guard housing 122 having a proximal end 124 and a distal end 126. Alternative shapes for the needle guard housing include a generally rectangular cross-section. The distal end portion is conical in form and provided with a standard taper, in particular a standard male Luer taper.
 30 In the ready position shown in Figure 3, the conical distal end 126 of the

needle guard housing 122 extends within the female Luer taper in the proximal end 8 of the catheter hub 4.

5 The needle guard housing 122 comprises an internal chamber 128 open at the distal end 126 and closed at the proximal end 124 by a proximal wall 130. In the ready position, the needle shaft 34 extends through the internal chamber 128 of the needle guard housing 122 and the proximal wall 130, as shown in Figures 4 and 4a.

10 A needle guard 140 is disposed within the needle guard housing 122 and comprises a needle trap 142 having lateral or side members 144 extending proximally from the needle trap 142. The needle trap further comprises a retaining member 146. When the needle 30 is retracted to the protected position shown in Figure 5, the side members 144 and retaining
15 member 146 prevent the needle trap 142 moving laterally relative to the needle and exposing the needle tip.

The needle guard 140 further comprises a resilient arm 150 pivotally connected at a first end 152 to the needle trap and bearing on the inner
20 surface of the needle guard housing 122 at a second end 154.

The needle guard 140 further comprises a coupling arm 160 pivotally connected at a first end to the needle trap 142 at a position opposite to the connection between the needle trap and the resilient arm 150. The coupling
25 arm 160 extends from the needle trap 142 across the internal chamber 128 and through an opening 162 in the needle guard housing 122. The coupling arm 160 is provided with a hook 164 at its free end outside the needle guard housing 122, which engages with a flange 166 on the exterior of the proximal end 8 of the catheter hub 4, as shown in Figure 4. An opening 168 is
30 provided in the coupling arm 150, through which the needle shaft 34 extends in the ready position, as shown in Figure 4a.