# CLAIMS

~~What is claimed:~~

1. A closed system transfer device comprising:

a first adaptor configured to attach to a first reservoir, the first adaptor defining a first passage and comprising a first septum that seals an end of the first passage;

a second adaptor configured to attach to a second reservoir; the second adaptor comprising a housing having an interior, the housing defining a second passage and comprising a second septum that seals an end of the second passage;

a carrier movable in the interior of the second adaptor, the carrier defining a chamber that contains at least a portion of the second septum; and

a needle disposed in the interior of the second adaptor, the needle having a needle opening,

the interior of the second adaptor adapted to receive the first adaptor in a telescoping manner, with the first adaptor insertable into the second adaptor,

the carrier displaceable in the interior of the second adaptor, and relative to the needle, by the first adaptor when the first adaptor is inserted into the second adaptor,

the carrier displaceable within the second adaptor between a first position, in which the first septum abuts the second septum and the needle opening is sealed inside the second passage, and a second position, in which the first septum abuts the second septum and the needle opening is in fluid communication with the first passage to connect the first adaptor and the second adaptor in a fluid path open state.

2. The closed system transfer device according to claim 1 comprising a releasable lock that locks the first adaptor inside the second adaptor after the first adaptor is inserted into the second adaptor.

3. The closed system transfer device according to claim 2, wherein the releasable lock locks the first adaptor inside the second adaptor when the carrier is displaced to the second position.

4. The closed system transfer device according to claim 2 or 3, wherein the releasable lock comprises a first locking element on the carrier and a second locking element in the housing.

5. The closed system transfer device according to any of claims 2-4, wherein the releasable lock comprises a first locking element on the first adaptor and a second locking element on the second adaptor.

6. The closed system transfer device according to any of claims 2-5, wherein the releasable lock is released by pressing at least one side of the housing radially inwardly.

7. The closed system transfer device according to claim 6, wherein the at least one side of the housing comprises at least one push button.

8. The closed system transfer device according to claim 7, wherein the at least one push button is depressible radially inwardly to disengage a portion of the carrier from a section of the housing.

~~9. The closed system transfer device according to claim 8, wherein said portion of the carrier comprises at least one locking lug and said section of the housing comprises at least one locking ramp inside the housing.~~

~~10. The closed system transfer device according to claim 7, wherein the at least one push button is depressible radially inwardly to disengage a portion of the first adaptor from a section of the second adaptor.~~

~~11. The closed system transfer device according to claim 10, wherein said portion of the first adaptor comprises at least one flange and said section of the second adaptor comprises at least one retaining clip attached to the at least one push button.~~

~~12. The closed system transfer device according to claim 2 or 3, wherein the releasable lock is released by rotating the second adaptor relative to the first adaptor.~~

913. The closed system transfer device according to any of the previous claims, wherein the second adaptor comprises a third septum that is axially spaced from the second septum.

1014. The closed system transfer device according to claim 913, wherein the needle opening is sealed between the second septum and the third septum when the carrier is in the first position.

~~15. The closed system transfer device according to claims 1-12, wherein the second septum comprises a piston having a piston head at least partially contained in the carrier and a collapsible midsection.~~

~~16. The closed system transfer device according to claim 15, wherein the collapsible midsection of the piston defines a hollow core, and the needle is at least partially contained inside the hollow core.~~

1117. The closed system transfer device according to any of the previous claims further comprising a female Luer connector ~~rotatably mounted~~connected to the housing of the second adaptor.

~~18. The closed system transfer device according to claim 17, wherein the female Luer connector comprises a thread configured to mate with a threaded connection on the second reservoir.~~

1219. The closed system transfer device according to any of the previous claims, wherein the housing defines ~~a~~at least one locking window configured to retain the carrier in one of the first position and the second position with at least a portion of the carrier visible through the at least one locking window to visually confirm that the carrier is in said one of the first position and the second position.

1320. The closed system transfer device according to any of claims 1-1218, wherein the first adaptor comprises a male Luer connector or a vial spike.

1421. The closed system transfer device according to any of the previous claims, wherein the first adaptor and the second adaptor are rectangular.

~~22. The closed system transfer device according to any of the previous claims, wherein the first adaptor and the second adaptor are cylindrical.~~

15~~23~~. The closed system transfer device according to claim 11~~any of the previous claims~~, wherein the needle is fixed in ~~the~~an interior of the ~~second adaptor~~female Luer connector.

16~~24~~. The closed system transfer device according to claims 2 or 3, wherein the releasable lock comprises a first locking element on the carrier and a second locking element on the first adaptor.

17~~25~~. The closed system transfer device according to claim 16~~24~~, wherein the releasable lock is released by pressing at least one side of the housing radially inwardly.

18~~26~~. The closed system transfer device according to claim 17~~25~~, wherein the at least one side of the housing comprises a push button.

19. The closed system transfer device according to claim 12, wherein the at least one locking window comprises a pair of first locking windows that extend through the housing, the first locking windows configured to lockingly engage a pair of lugs on the carrier to retain the carrier in the first position.

20. The closed system transfer device according to claim 19, wherein the at least one locking window further comprises a pair of second locking windows that extend through the housing, the second locking windows configured to lockingly engage the pair of lugs on the carrier to retain the carrier in the second position.

21. The closed system transfer device according to claim 20, wherein the pair of lugs are visible through the first locking windows and the second locking windows from outside the closed system transfer device, thereby providing a visible indicator of a position of the carrier and an operating state of the closed system transfer device.

~~27. The closed system transfer device according to claim 26, wherein the push button is depressible radially inwardly to disengage a portion of the housing from a section of the carrier.~~

28. The closed system transfer device according to claim 27, wherein said section of the carrier comprises at least one locking aperture and said portion of the housing comprises at least one detent.

29. The closed system transfer device according to any one of claims 24-27, wherein the releasable lock comprises a locking arm extending through a slot in a wall of the housing.

30. The closed system transfer device according to claim 29, wherein the locking arm is pivotally mounted in the slot on at least one hinge.

31. The closed system transfer device according to claim 29, wherein the locking arm is pivotally mounted in the slot between a locking position that locks the first adaptor inside the second adaptor and a release position that permits the first adaptor to be removed from the second adaptor.

32. The closed system transfer device according to claim 31, wherein the locking arm comprises a first end that projects radially outwardly from the wall of the housing when the locking arm is in the locking position.

33. The closed system transfer device according to claim 32, wherein the first end comprises a button.

34. The closed system transfer device according to any one of claims 31-33, wherein the locking arm comprises a second end that projects radially inwardly from the wall of the housing when the locking arm is in the locking position.

35. The closed system transfer device according to claim 34, wherein the second end comprises a detent that engages the carrier when the locking arm is in the locking position.

36. The closed system transfer device according to claim 35, wherein the detent comprises a ramped surface and an abutment surface.

37. The closed system transfer device according to claim 36, wherein the carrier comprises a locking aperture adapted to receive the detent when the carrier is in the second position and when the locking arm is in the locking position.

38. The closed system transfer device according to claim 37, wherein the locking aperture comprises an abutment edge that engages the abutment surface of the detent when the carrier is in the second position and when the locking arm is in the locking position to prevent displacement of the carrier out of the second position.

39. The closed system transfer device according to any one of claims 24-38, wherein the second adaptor comprises a third septum that is axially spaced from the second septum.

40. The closed system transfer device according to claim 39, wherein the needle opening is sealed between the second septum and the third septum when the carrier is in the first position.

41. The closed system transfer device according to any one of claims 24-40, wherein the first adaptor comprises a male Luer connector or a vial spike.

42. A closed system transfer device comprising:

a first adaptor configured to attach to a first reservoir, the first adaptor defining a first passage and comprising a first septum that seals an end of the first passage;

a second adaptor configured to attach to a second reservoir; the second adaptor comprising a housing having an interior, the housing defining a second passage and comprising a second septum that seals an end of the second passage;

a carrier movable in the interior of the second adaptor and attached to the second septum; and

a needle fixed in the interior of the second adaptor, the needle having a needle opening,

the interior of the first adaptor adapted to receive the second adaptor in a telescoping manner,

the carrier displaceable in the interior of the second adaptor, and relative to the needle, by an inner portion of the first adaptor when the second adaptor is inserted into the first adaptor,

the carrier displaceable within the second adaptor between a first position, in which the first septum abuts the second septum and the needle opening is sealed inside the second passage,

and a second position, in which the first septum abuts the second septum and the needle opening is in fluid communication with the first passage to connect the first adaptor and the second adaptor in a fluid path open state.

43. The closed system transfer device according to claim 42 comprising a releasable lock that locks the second adaptor inside the first adaptor after the second adaptor is inserted into the first adaptor.

44. The closed system transfer device according to claim 43, wherein the releasable lock locks the second adaptor inside the first adaptor when the carrier is displaced to the second position.

45. The closed system transfer device according to claim 43 or 44, wherein the releasable lock comprises a first locking element on the first adaptor and a second locking element on the second adaptor.

46. The closed system transfer device according to any of claims 43-45, wherein the releasable lock is released by pressing a side of the first adaptor radially inwardly.

47. The closed system transfer device according to claim 46, wherein the side of the first adaptor comprises a push button.

48. The closed system transfer device according to claim 47, wherein the push button is depressible radially inwardly to disengage a portion of the first adaptor from a section of the housing.

49. The closed system transfer device according to claim 48, wherein said portion of the first adaptor comprises at least one locking aperture and said section of the housing comprises at least one locking ramp that extends radially outwardly from the housing.

50. The closed system transfer device according to claim 49, wherein the at least one locking ramp comprises a leading end, a trailing end and a ramped surface between the leading end and trailing end.

~~51. The closed system transfer device according to claim 50, wherein an abutment surface in the at least one locking aperture engages the trailing end of the at least one locking ramp to lock the second adaptor to the first adaptor.~~

~~52. The closed system transfer device according to claim 49 or 50, wherein the ramped surface comprises a straight section that is adjacent to the leading end and a curved section that extends between the straight section and the trailing end.~~

~~53. The closed system transfer device according to claim 52, wherein the curved section has a compound curvature which defines a concave portion and a convex portion.~~

~~54. The closed system transfer device according to any one of claims 43-53, wherein the releasable lock comprises a locking arm extending through a slot in a wall of the first adaptor.~~

~~55. The closed system transfer device according to claim 54 wherein the locking arm is pivotally mounted in the slot on at least one hinge.~~

~~56. The closed system transfer device according to claim 54 or 55, wherein the locking arm is pivotally mounted in the slot between a locking position that locks the second adaptor inside the first adaptor and a release position that permits the second adaptor to be removed from the first adaptor.~~

~~57. The closed system transfer device according to claim 56, wherein the locking arm comprises a first end that projects radially outwardly from the wall of the housing when the locking arm is in the locking position.~~

~~58. The closed system transfer device according to claim 57, wherein the first end comprises a button.~~

~~59. The closed system transfer device according to any one of claims 56-58, wherein the locking arm comprises a second end positioned in the slot when the locking arm is in the locking position.~~

60. The closed system transfer device according to claim 59, wherein the second end comprises an abutment surface that engages the housing when the locking arm is in the locking position.

61. The closed system transfer device according to any one of claims 42-60, wherein the second adaptor comprises a third septum that is axially spaced from the second septum.

62. The closed system transfer device according to claim 61, wherein the needle opening is sealed between the second septum and the third septum when the carrier is in the first position.

63. The closed system transfer device according to any one of claims 42-62, wherein the housing defines a locking window configured to retain the carrier in one of the first position and the second position with at least a portion of the carrier visible through the locking window to visually confirm that the carrier is in said one of the first position and the second position.

64. A vial spike comprising:

a housing; and

a spike connector extending from the housing,

the housing and spike connector defining a vent line and a transfer line that is separate from the vent line, and

the vent line comprising a hydrophobic filter in the housing.

65. The vial spike according to claim 64, wherein the vent line further comprises an activated carbon filter in series with the hydrophobic filter.

66. The vial spike according to claim 65, wherein the housing comprises a first housing portion having a dry break coupling fluidly connected with the transfer line.

67. The vial spike according to claim 66, wherein the dry break coupling comprises a mating element for connecting the vial spike to a first fluid reservoir.

68. The vial spike according to claim 66 or 67, wherein the housing comprises a second housing portion from which the spike connector extends.

~~69. The vial spike according to claim 68, wherein the first housing portion comprises a first cover piece and the second housing portion comprises a second cover piece configured to connect with the first cover piece and form a narrow space therebetween.~~

~~70. The vial spike according to claim 69, wherein the first cover piece comprises a ring-shaped lip portion extending at least partially around a periphery of the first cover piece, and the second cover piece comprises a ring-shaped wall portion extending at least partially around a periphery of the second cover piece, the ring-shaped wall portion adapted to the receive ring-shaped lip portion to join the first housing portion to the second housing portion in a mated arrangement.~~

~~71. The vial spike according to claim 70 wherein the ring-shaped lip portion of the first cover piece comprises a divider wall that extends into the narrow space formed by the first cover piece and second cover piece.~~

~~72. The vial spike according to claim 71, wherein the divider wall defines a first chamber in the narrow space on a first side of the divider wall, and a second chamber in the narrow space on a second side of the divider wall.~~

~~73. The vial spike according to claim 72, wherein the first chamber fluidly connects with the vent line but not the transfer line, and wherein the second chamber fluidly connects with the transfer line but not the vent line.~~

~~74. The vial spike according to claim 72 or 73, wherein the hydrophobic filter is housed in the first chamber.~~

~~75. The vial spike according to any one of claims 72-74, wherein the spike connector defines a first passage fluidly connected to the first chamber but not the second chamber, and a second passage fluidly connected to the second chamber but not the first chamber.~~

~~76. The vial spike according to claim 75, wherein the first passage extends parallel to the second passage in the spike connector.~~

~~77. The vial spike according to claim 75 or 76, wherein the transfer line comprises a particle filter.~~

78. The vial spike according to claim 77, wherein the particle filter is housed in the second chamber arranged parallel to the hydrophobic filter.

79. The vial spike according to any one of claims 66-78, wherein the housing further comprises a third housing portion that houses the activated carbon filter, the vent line passing from the first housing portion into the third housing portion and exiting to the atmosphere through an outlet formed through a wall of the third housing portion.

80. The vial spike according to claim 64, wherein the vent line further comprises a check valve.

81. The vial spike according to claim 80, wherein the housing comprises a first housing portion having a dry break coupling fluidly connected with the transfer line.

82. The vial spike according to claim 81, wherein the dry break coupling comprises a mating element for connecting the vial spike to a first fluid reservoir.

83. The vial spike according to claim 81 or 82, wherein the housing comprises a second housing portion from which the spike connector extends.

84. The vial spike according to claim 83, wherein the first housing portion comprises a first cover piece and the second housing portion comprises a second cover piece configured to connect with the first cover piece and form a narrow space therebetween.

85. The vial spike according to claim 84, wherein the first cover piece comprises a ring-shaped lip portion extending at least partially around a periphery of the first cover piece, and the second cover piece comprises a ring-shaped wall portion extending at least partially around a periphery of the second cover piece, the ring-shaped wall portion adapted to the receive ring-shaped lip portion to join the first housing portion to the second housing portion in a mated arrangement.

86. The vial spike according to claim 85, wherein the ring-shaped lip portion of the first cover piece comprises a divider wall that extends into the narrow space formed by the first cover piece and second cover piece.

87. The vial spike according to claim 86, wherein the divider wall defines a first chamber in the narrow space on a first side of the divider wall, and a second chamber in the narrow space on a second side of the divider wall.

88. The vial spike according to claim 87, wherein the first chamber fluidly connects with the vent line but not the transfer line, and wherein the second chamber fluidly connects with the transfer line but not the vent line.

89. The vial spike according to claim 87 or 88, wherein the hydrophobic filter is housed in the first chamber.

90. The vial spike according to any one of claims 87-89, wherein the spike connector defines a first passage fluidly connected to the first chamber but not the second chamber, and a second passage fluidly connected to the second chamber but not the first chamber.

91. The vial spike according to claim 90, wherein the first passage extends parallel to the second passage in the spike connector.

92. The vial spike according to any of claims 87-91, wherein the transfer line comprises a particle filter.

93. The vial spike according to claim 92, wherein the particle filter is housed in the second chamber arranged parallel to the hydrophobic filter.

94. The vial spike according to any one of claims 83-93, wherein the housing further comprises a third housing portion in fluid communication with the vent line, the third housing portion connected to a flexible membrane that forms a gas storage volume between the third housing portion and flexible membrane.

95. A vial adaptor comprising:

a vial spike according to any one of claims 64-94; and

a vial clip connectable to the vial spike.

96. The vial adaptor according to claim 95, wherein the vial clip comprises a proximal end with a fastener mechanism configured to connect to the vial spike.

~~97. The vial adaptor according to claim 96, wherein the fastener mechanism comprises a plurality of flexible arms, each flexible arm having a barbed end.~~

~~98. The vial adaptor according to claim 97, wherein the flexible arms engage a portion of the housing of the vial spike to connect the vial clip to the vial spike.~~

~~99. The vial adaptor according to any one of claims 95-98, wherein the vial clip comprises at least one arcuate flange forming a receptacle.~~

~~100. The vial adaptor according to claim 99, wherein the spike connector extends into the receptacle, and wherein the at least one arcuate flange forms a guard to protect a user from accidentally being sticked by the spike connector.~~