

Claims

1. A downhole apparatus comprising:
a tubular body, the tubular body having first and second ports in a wall
5 thereof; and
a valve arrangement, the valve arrangement having:
a locked first configuration, in which the first port is closed and the
second port is closed;
a locked second configuration, in which the first port is open and
10 the second port is closed; and
a third configuration, in which the first port is closed and the
second port is open.
2. A valve arrangement for a downhole apparatus having a tubular body
15 having first and second ports in a wall thereof, the valve arrangement being:
configurable to be locked in a first configuration with the tubular body,
such that the first port is closed and the second port is closed;
configurable to be locked in a second configuration with the tubular body,
such that the first port is open and the second port is closed; and
20 configurable to be locked in a third configuration with the tubular body,
such that the first port is closed and the second port is open.
3. The downhole apparatus or valve arrangement of claim 1 or claim 2,
wherein the locked first configuration is an initial configuration of the valve
25 arrangement.
4. The downhole apparatus or valve arrangement of any preceding claim,
wherein the valve arrangement has a first intermediate configuration between the
locked first configuration and the locked second configuration, in which the valve
30 arrangement is unlocked and the first and second ports are closed.
5. The downhole apparatus or valve arrangement of any preceding claim,
wherein the valve arrangement has a second intermediate configuration between
the locked second configuration and the third configuration, in which the valve
35 arrangement is unlocked and the first and second ports are closed.

6. The downhole apparatus or valve arrangement of any preceding claim, wherein the third configuration is an unlocked configuration or a locked configuration.
- 5 7. The downhole apparatus or valve arrangement of any preceding claim, wherein the valve arrangement has a fourth configuration, in which the first port is closed and the second port is closed.
8. The downhole apparatus or valve arrangement of claim 7, wherein the
10 fourth configuration is reached after the valve arrangement has been moved through the first, second and third configurations.
9. The downhole apparatus or valve arrangement of claim 7 or claim 8, wherein the fourth configuration is an unlocked configuration, or a locked
15 configuration.
10. The downhole apparatus or valve arrangement of any of claims 7 to 9, wherein the fourth configuration is achieved by mechanical intervention.
- 20 11. The downhole apparatus or valve arrangement of any preceding claim, wherein the valve arrangement is a fluid pressure-responsive valve arrangement, or a hydraulically-actuated valve arrangement.
12. The downhole apparatus or valve arrangement of claim 11, wherein the
25 first configuration is associated with a first fluid pressure, the second configuration is associated with a second fluid pressure, the second fluid pressure being higher than the first fluid pressure, and the third configuration is associated with a third fluid pressure, the third fluid pressure being lower than the second fluid pressure.
- 30 13. The downhole apparatus or valve arrangement of claim 12, wherein the first fluid pressure is approximately 0psi (approx. 0bar), the second fluid pressure is between approximately 2000psi (approx. 138bar) to 4000psi (approx. 275bar) and the third fluid pressure is between approximately 0psi (approx. 0bar) and
35 350psi (approx. 24bar), or between approximately 0psi (approx. 0bar) and 800psi (approx. 55bar).

14. The downhole apparatus or valve arrangement of any of claims 5 to 13, wherein the second intermediate configuration is associated with a fluid pressure that is higher than the third fluid pressure.
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15. The downhole apparatus or valve arrangement of any of claims 5 to 14, wherein the second intermediate configuration has a fourth fluid pressure.
16. The downhole apparatus or valve arrangement of any of claims 5 to 15, wherein the second intermediate configuration is associated with a fluid pressure that is initially higher than the third fluid pressure, but decreases towards the third fluid pressure.
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17. The downhole apparatus or valve arrangement of any of claims 5 to 16, wherein the fourth fluid pressure is between approximately 400psi (approx. 28bar) to 800psi (approx. 55bar).
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18. The downhole apparatus or valve arrangement of any preceding claim, wherein the valve arrangement includes a valve member, the valve member including a first port, the first port being associated with the first port of the tubular body, and a second port, the second port being associated with the second port of the tubular body.
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19. The downhole apparatus or valve arrangement of claim 18, wherein the valve member is moveable with respect to the tubular body to open and/or close the first and second ports of the tubular body.
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20. The downhole apparatus or valve arrangement of claim 18 or claim 19, wherein the valve member is operable to:
- 30
- close the first and second ports in the first configuration;
- open the first port in the second configuration and close the second port in the second configuration;
- close the first port in the third configuration and open the second port in the third configuration;
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- close the first and second ports in the fourth configuration;
- close the first and second ports in the first intermediate configuration; and

close the first and second ports in the second intermediate configuration.

21. The downhole apparatus or valve arrangement of claim 20, wherein the downhole apparatus further comprises a biasing device, the biasing device being
5 operable to apply a biasing force to the valve member.

22. The downhole apparatus or valve arrangement of claim 21, wherein the valve member is biased by the biasing device towards a position where the second port is open.
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23. The downhole apparatus or valve arrangement of any of claims 20 to 22, wherein the valve arrangement comprises one or more locking devices, the locking devices being configured to lock the valve member in place relative to the tubular body.
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24. The downhole apparatus or valve arrangement of claim 23, wherein the one or more locking devices are releasable locking devices.

25. The downhole apparatus or valve arrangement of any of claims 20 to 24, wherein the valve arrangement comprises one or more primary retaining members and one or more secondary retaining members, the primary retaining members being configured to hold the valve arrangement in the locked first configuration and the secondary retaining members being configured to hold the valve arrangement in the locked second configuration.
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26. The downhole apparatus or valve arrangement of claim 25, wherein the primary and secondary retaining members are releasable retaining members.
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27. The downhole apparatus or valve arrangement of claim 25 or claim 26, wherein the valve arrangement comprises a further retaining member, the further retaining member being configured to hold the valve member in the third configuration.
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28. The downhole apparatus or valve arrangement of any of claims 20 to 27, wherein the valve arrangement includes a piston device, the piston device being
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operable to arrange the valve arrangement in the first, second, third, fourth, first intermediate or second intermediate configurations.

29. The downhole apparatus or valve arrangement of claim 28, wherein the
5 piston device is a differential pressure piston device.

30. The downhole apparatus or valve arrangement of claim 29, wherein the
differential pressure piston is formed between the valve member and the tubular
body.
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31. The downhole apparatus or valve arrangement of any of claims 20 to 30,
wherein the first port is configured to permit fluid to flow through the port in one
direction and prevent fluid to flow through the port in an opposite direction.

32. The downhole apparatus or valve arrangement of any of claims 20 to 31,
15 wherein the first port provides fluid communication with a tool or a device.

33. The downhole apparatus or valve arrangement of claim 32, wherein the
tool or device is a sand control element having at least one fluid deformable
device.
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34. The downhole apparatus or valve arrangement of any of claims 20 to 33,
wherein the second port provides fluid communication between the interior of the
tubular body and the exterior of the tubular body, or between the exterior of the
25 tubular body and the interior of the tubular body.

35. The downhole apparatus or valve arrangement of any of claims 20 to 34,
wherein the downhole apparatus comprises two or more valve arrangements,
each valve arrangement being associated with a first port and a second port, or a
30 pair of first and second ports.

36. The downhole apparatus or valve arrangement of claim 35, wherein each
valve arrangement is associated with a respective downhole tool or device.

37. The downhole apparatus or valve arrangement of claim 35 or claim 36, wherein each valve arrangement of the downhole apparatus is operated simultaneously, independently, or sequentially.

5 38. The downhole apparatus or valve arrangement of claim 18 or claim 19, wherein the valve arrangement comprises a first valve arrangement and a second valve arrangement, the first valve arrangement being associated with the first port and the second valve arrangement being associated with the second port.

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39. The downhole apparatus or valve arrangement of claim 38, wherein the first valve arrangement and the second valve arrangement are independently or sequentially operable.

15 40. The downhole apparatus or valve arrangement of claim 38 or claim 39, wherein the first and second valve arrangement have a first configuration, in which the first and second valve arrangements are locked and the first and second ports are closed; a second configuration, in which the first and second valve arrangements are locked, the first port is open and the second port is closed; and a third configuration, in which the first valve arrangement is locked, the first port is closed and the second port is open.

20 41. The downhole apparatus or valve arrangement of claim 40, wherein the first and second valve arrangements have a first intermediate configuration between the first configuration and the second configuration, in which the first valve arrangement is unlocked, the second valve arrangement is locked and the first and second ports are closed.

25 42. The downhole apparatus or valve arrangement of claim 40 or claim 41, wherein the first and second valve arrangements have a second intermediate configuration between the second configuration and the third configuration, in which the first valve arrangement is unlocked, the second valve arrangement is locked and the first and second ports are closed.

30 43. The downhole apparatus or valve arrangement of claim 42, wherein the first and second valve arrangements have a third intermediate configuration

between the second intermediate configuration and the third configuration, in which the first valve arrangement is locked, the second valve arrangement is locked and the first and second ports are closed.

- 5 44. The downhole apparatus or valve arrangement of claim 43, wherein the first and second valve arrangements have a fourth intermediate configuration between the third intermediate configuration and the third configuration, in which the first valve arrangement is locked, the second valve arrangement is unlocked and the first and second ports are closed.

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45. The downhole apparatus or valve arrangement of any of claims 38 to 44, wherein the third configuration is an unlocked configuration, or a locked configuration.

- 15 46. The downhole apparatus or valve arrangement of any of claims 38 to 45, wherein the valve arrangement has a fourth configuration, in which the first port is closed and the second port is closed.

20 47. The downhole apparatus or valve arrangement of claim 46, wherein the fourth configuration is reached after the first and second valve arrangement have been moved through the first, second and third configurations.

25 48. The downhole apparatus or valve arrangement of claim 46 or claim 47, wherein the fourth configuration is an unlocked configuration, or a locked configuration.

49. The downhole apparatus or valve arrangement of any of claims 38 to 48, wherein the valve arrangement is a fluid pressure-responsive valve arrangement, or a hydraulically-actuated valve arrangement.

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50. The downhole apparatus or valve arrangement of claim 49, wherein the first configuration is associated with a first fluid pressure, the second configuration may be associated with a second fluid pressure, the second fluid pressure being higher than the first fluid pressure, and the third configuration may be associated with a third fluid pressure, the third fluid pressure being lower than the second fluid pressure.

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51. The downhole apparatus or valve arrangement of claim 50, wherein the third intermediate configuration is associated with a fluid pressure that is higher than the third fluid pressure.

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52. The downhole apparatus or valve arrangement of claim 50 or claim 51, wherein the third intermediate configuration is associated with a fluid pressure that is initially higher than the third fluid pressure, but decreases towards the third fluid pressure.

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53. The downhole apparatus or valve arrangement of any of claims 50 to 52, wherein the fourth intermediate configuration is associated with a fluid pressure that is higher than the first fluid pressure.

15 54. The downhole apparatus or valve arrangement of claim 53, wherein the fourth intermediate configuration is associated with a fluid pressure that is initially higher than the first fluid pressure, but decreases towards the third fluid pressure.

20 55. The downhole apparatus or valve arrangement of claim 54, wherein the fourth intermediate configuration has a fourth fluid pressure.

56. The downhole apparatus or valve arrangement of claim 55, wherein the fourth fluid pressure is higher than the second fluid pressure.

25 57. The downhole apparatus or valve arrangement of any of claims 38 to 56, wherein the first valve arrangement includes a first valve member and the second valve arrangement includes a second valve member.

30 58. The downhole apparatus or valve arrangement of claim 57, wherein the first valve member includes a first port, the first port being associated with the first port of the tubular body, and the second valve member includes a second port, the second port being associated with the second port of the tubular body.

35 59. The downhole apparatus or valve arrangement of claim 57 or claim 58, wherein the first and second valve members are moveable with respect to the tubular body to open and/or close the first and second ports of the tubular body.

60. The downhole apparatus or valve arrangement of any of claims 57 to 59,
wherein the first valve member is operable to close the first port in the first
configuration, open the first port in the second configuration, close the first port in
5 the third configuration, and close the first port in the fourth configuration.

61. The downhole apparatus or valve arrangement of any of claims 57 to 60,
wherein the first valve member is a sleeve member located within the tubular
body.

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62. The downhole apparatus or valve arrangement of any of claims 57 to 61,
wherein the downhole apparatus further comprises a biasing device, the biasing
device being operable to apply a biasing force to the first valve member.

15 63. The downhole apparatus or valve arrangement of claim 62, wherein the
first valve member is biased towards a position where the first port is closed.

64. The downhole apparatus or valve arrangement of any of claims 38 to 63,
wherein the first valve arrangement comprises one or more locking devices, the
20 locking devices being configured to lock the first valve member in place relative to
the tubular body.

65. The downhole apparatus or valve arrangement of claim 64, wherein the
locking devices are releasable locking devices.

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66. The downhole apparatus or valve arrangement of any of claims 38 to 65,
wherein the first valve arrangement comprises one or more primary retaining
members and one or more secondary retaining members, the primary retaining
members being configured to hold the first valve arrangement in the locked first
30 configuration and the secondary retaining members being configured to hold the
first valve arrangement in the locked second configuration.

67. The downhole apparatus or valve arrangement of claim 66, wherein the
primary and secondary retaining members are releasable retaining members.

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68. The downhole apparatus or valve arrangement of claim 66 or claim 67, wherein in the locked first configuration the primary retaining members are engaged with the first valve member to hold the first valve member in the locked position and the second retaining members are disengaged from the first valve member, and in the locked second configuration the primary retaining members are disengaged from the first valve member and the second retaining members are engaged with the first valve member to hold the first valve member in the locked position.
69. The downhole apparatus or valve arrangement of any of claims 66 to 68, wherein the first valve arrangement comprises a further retaining member, the further retaining member being configured to hold the first valve member in the locked third intermediate configuration.
70. The downhole apparatus or valve arrangement of any of claims 38 to 69, wherein the first valve arrangement includes a piston device, the piston device being operable to arrange the first valve arrangement in the first configuration, the second configuration, the first intermediate configuration, the second intermediate configuration, and the third intermediate configuration.
71. The downhole apparatus or valve arrangement of claim 70, wherein the piston device is a differential pressure piston device.
72. The downhole apparatus or valve arrangement of claim 71, wherein the differential piston is formed between the first valve member and the tubular body.
73. The downhole apparatus or valve arrangement of any of claims 38 to 72, wherein the first port is configured to permit fluid to flow through the port in one direction and prevent fluid to flow through the port in an opposite direction.
74. The downhole apparatus or valve arrangement of any of claims 38 to 73, wherein the first port provides fluid communication with a tool or a device.
75. The downhole apparatus or valve arrangement of claim 74, wherein the tool or device is a sand control element having at least one fluid deformable device.

76. The downhole apparatus or valve arrangement of any of claims 57 to 75, wherein the second valve member is operable to close the second port in the first configuration, close the second port in the second configuration, open the second
5 port in the third configuration, and close the second port in the fourth configuration.

77. The downhole apparatus or valve arrangement of any of claims 57 to 76, wherein the second valve member may be a sleeve member located within the
10 tubular body.

78. The downhole apparatus or valve arrangement of any of claims 57 to 77, wherein the second valve member includes a first portion and a second portion.

79. The downhole apparatus or valve arrangement of claim 78, wherein the
15 first and second portions of the second valve member are releasably lockable with respect to one another.

80. The downhole apparatus or valve arrangement of claim 79, wherein the
20 first and second portions of the second valve member are releasably lockable with respect to one another with two separate releasable locking devices.

81. The downhole apparatus or valve arrangement of any of claims 38 to 80, wherein the downhole apparatus further comprises a biasing device, the biasing
25 device being operable to apply a biasing force to the second valve member.

82. The downhole apparatus or valve arrangement of any of claims 38 to 81, wherein the second valve member is biased towards a position where the second
30 port is open.

83. The downhole apparatus or valve arrangement of any of claims 57 to 82, wherein the second valve arrangement comprises one or more locking devices, the locking devices being configured to lock the second valve member in place
35 relative to the tubular body.

84. The downhole apparatus or valve arrangement of claim 83, wherein the locking devices are releasable locking devices.

85. The downhole apparatus or valve arrangement of any of claims 57 to 84,
5 wherein the second valve arrangement comprises one or more primary retaining members, the primary retaining members being configured to hold the second valve member in a first position relative to the tubular body.

86. The downhole apparatus or valve arrangement of claim 85, wherein the
10 primary retaining members are releasable retaining members.

87. The downhole apparatus or valve arrangement of any of claims 38 to 86,
wherein the second valve arrangement includes a piston device, the piston device being operable to arrange the second valve arrangement in the first
15 configuration, the second configuration, the third configuration, the first intermediate configuration, the second intermediate configuration, the third intermediate configuration or the fourth intermediate configuration.

88. The downhole apparatus or valve arrangement of claim 87, wherein the
20 piston device is a differential pressure piston device.

89. The downhole apparatus or valve arrangement of claim 88, wherein the differential piston is formed between the second valve member and the tubular body.

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90. The downhole apparatus or valve arrangement of any of claims 38 to 89,
wherein the second port provides fluid communication between the interior of the tubular body and the exterior of the tubular body, or between the exterior of the tubular body and the interior of the tubular body.

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91. The downhole apparatus or valve arrangement of any of claims 38 to 90,
wherein the downhole apparatus comprises two or more first and second valve arrangements, each first and second valve arrangement being associated with a first port and a second port.

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92. The downhole apparatus or valve arrangement of claim 91, wherein each first and second valve arrangement is associated with a respective downhole tool or device.

5 93. The downhole apparatus or valve arrangement of claim 91 or claim 92, wherein each first and second valve arrangement of the downhole apparatus are operable independently, or sequentially.

94. A downhole apparatus comprising:
10 a tubular body, the tubular body having first and second ports in a wall thereof;
a first valve arrangement associated with the first port;
a second valve arrangement associated with the second port; and
a sand control element, the sand control element being operable to move
15 between a first deactivated state to a second activated state,
wherein the sand control element is in fluid communication with the first port of the tubular body.

95. The downhole apparatus of claim 94, wherein the first valve arrangement
20 and the second valve arrangement are independently, or sequentially operable.

96. The downhole apparatus of claim 94 or claim 95, wherein the first valve arrangement and the second valve arrangement are located adjacent one another or spaced from one another within the tubular body.

25 97. The downhole apparatus of any of claims 94 to 96, wherein in use, the first valve arrangement is configured to move the sand control element from a first position in which the sand control element is spaced from the surface of a subterranean formation to a second position in which the sand control element is
30 in contact with the surface of the subterranean formation.

98. The downhole apparatus of any of claims 94 to 97, wherein the second port of the tubular body is configured such that, in use, fluids may flow from a subterranean formation through the sand control element and into the downhole
35 apparatus, or from the downhole apparatus through the sand control element into a subterranean formation.

99. The downhole apparatus of any of claims 94 to 98, wherein the first valve arrangement is an activation valve arrangement and the second valve arrangement is a production valve arrangement.

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100. The downhole apparatus of any of claims 94 to 99, wherein the first and second valve arrangement have:

a first configuration, in which the first and second valve arrangements are locked and the first and second ports are closed;

10 a second configuration, in which the first and second valve arrangements are locked, the first port is open and the second port is closed; and

a third configuration, in which the first valve arrangement is locked, the first port is closed and the second port is open.

15 101. A downhole apparatus comprising:

a tubular body, the tubular body having two or more pairs of first and second ports in a wall thereof; and

20 two or more valve arrangements, each valve arrangement being associated with a pair of first and second ports, and wherein each valve arrangement has:

a locked first configuration, in which the first port is closed and the second port is closed;

a locked second configuration, in which the first port is open and the second port is closed; and

25 a third configuration, in which the first port is closed and the second port is open.

102. A method of operating a valve arrangement of a downhole apparatus comprising a tubular body having first and second ports in a wall thereof, the method comprising the steps of:

30 operating the valve arrangement from a locked first configuration, in which the first port is closed and the second port is closed, to a locked second configuration, in which the first port is open and the second port is closed; and

operating the valve arrangement from the locked second configuration to

35 a third configuration, in which the first port is closed and the second port is open.

103. The method of claim 102, wherein the locked first configuration is an initial configuration of the valve arrangement.

104. The method of claim 102 or claim 103, wherein the locked first
5 configuration is followed by the locked second configuration and the locked second configuration is followed by the third configuration.

105. The method of any of claims 102 to 104, wherein the method comprises an initial step of running the downhole apparatus into a bore hole, the apparatus
10 being in the locked first configuration in this step.

106. The method of any of claims 102 to 105, wherein the method comprises the further step of unlocking the valve arrangement from the locked first configuration and moving the valve arrangement to a first intermediate
15 configuration between the locked first configuration and the locked second configuration, in which the valve arrangement is unlocked and the first and second ports are closed.

107. The method of claim 106, wherein the method comprises the further step
20 of unlocking the valve arrangement from the locked second configuration and moving the valve arrangement to a second intermediate configuration between the locked second configuration and the third configuration, in which the valve arrangement is unlocked and the first and second ports are closed.

108. The method of any of claims 102 to 107, wherein the method comprises
25 the further step of locking the valve arrangement in the third configuration.

109. The method of any of claims 102 to 108, wherein the method may
30 comprise the further step of operating the valve arrangement from the third configuration to a fourth configuration, in which the first port is closed and the second port is closed.

110. The method of claim 109, wherein the fourth configuration is reached after
35 the valve arrangement has been moved through the first, second and third configurations.

111. The method of claim 109 or claim 110, wherein the method comprises the further step of locking the valve arrangement in the fourth configuration.

112. The method of any of claims 102 to 111, wherein the valve arrangement
5 is a fluid pressure-responsive valve arrangement, or a hydraulically-actuated valve arrangement.

113. The method of claim 112, wherein the first configuration is associated with a first fluid pressure, the second configuration is associated with a second fluid
10 pressure, the second fluid pressure being higher than the first fluid pressure, and the third configuration is associated with a third fluid pressure, the third fluid pressure being lower than the second fluid pressure.

114. The method of claim 113, wherein the first fluid pressure is approximately
15 0psi (approx. 0bar), the second fluid pressure is between approximately 2000psi (approx. 138bar) to 4000psi (approx. 275bar) and the third fluid pressure is between approximately 0psi (approx. 0bar) and 350psi (approx. 24bar), or between approximately 0psi (approx. 0bar) and 800psi (approx. 55bar).

20 115. The method of claim 113 or claim 114, wherein the second intermediate configuration is associated with a fluid pressure that is higher than the third fluid pressure.

25 116. The method of any of claims 113 to 115, wherein the second intermediate configuration has a fourth fluid pressure.

117. The method of any of claims 113 to 116, wherein the second intermediate configuration is associated with a fluid pressure that is initially higher than the third fluid pressure, but decreases towards the third fluid pressure.

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118. The method of claim 116 or claim 117, wherein the fourth fluid pressure is between approximately 400psi (approx. 28bar) to 800psi (approx. 55bar).

119. The method of any of claims 112 to 118, wherein the method comprises
35 the step of applying fluid pressure to the valve arrangement to move the valve

arrangement from the locked first configuration to the locked second configuration.

120. The method of any of claims 112 to 119, wherein the method comprises
5 the step of unlocking the valve arrangement from the locked first configuration and moving the valve arrangement to the first intermediate configuration.

121. The method of claim 120, wherein the method comprises the further step
of reducing the fluid pressure to move the valve arrangement to the locked
10 second configuration.

122. The method of claim 121, wherein the method comprises the step of
applying fluid pressure to the valve arrangement to move the valve arrangement
from the locked second configuration to the third configuration.

15 123. The method of any of claims 107 to 122, wherein the method comprises the further step of unlocking the valve arrangement from the locked second configuration and moving the valve arrangement to the second intermediate configuration.

20 124. The method of claim 122 or claim 123, wherein the method comprises the further step of reducing the fluid pressure to move the valve arrangement to the third configuration.

25 125. The method of any of claims 102 to 124, wherein the valve arrangement includes a valve member, the valve member including a first port, the first port being associated with the first port of the tubular body, and a second port, the second port being associated with the second port of the tubular body.

30 126. The method of claim 125, wherein the valve member is moveable with respect to the tubular body to open and/or close the first and second ports of the tubular body.

127. The method of any of claims 102 to 126, wherein the method comprises
35 the step of operating the valve member to:

close the first and second ports in the locked first configuration;

open the first port and close the second port in the locked second configuration;

close the first port and open the second port in the third configuration;

close the first and second ports in the fourth configuration;

- 5 close the first and second ports in the first intermediate configuration; and
close the first and second ports in the second intermediate configuration.

128. The method of claim 127, wherein the method comprises the step of
applying a biasing force to the valve member to move the valve member to a
10 position where the second port is open.

129. The method of claim 127 or claim 128, wherein the valve arrangement
comprises one or more locking devices, the locking devices being configured to
lock the valve member in place relative to the tubular body.

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130. The method of claim 129, wherein the one or more locking devices are
releasable locking devices.

131. The method of any of claims 102 to 130, wherein the valve arrangement
20 comprises one or more primary retaining members and one or more secondary
retaining members, the primary retaining members being configured to hold the
valve arrangement in the locked first configuration and the secondary retaining
members being configured to hold the valve arrangement in the locked second
configuration.

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132. The method of claim 131, wherein the method comprises the step of
engaging the second retaining members with the valve member when the valve
member is in the locked second configuration.

30 133. The method of claim 131 or claim 132, wherein the primary and
secondary retaining members are releasable retaining members.

134. The method of any of claims 125 to 133, wherein the valve arrangement
comprises a further retaining member and the method comprises the step of
35 locking the valve member in the third configuration with the further retaining
member.

135. The method of any of claims 102 to 134, wherein the valve arrangement includes a piston device, the piston device being operable to arrange the valve arrangement in the first, second, third, fourth, first intermediate or second
5 intermediate configurations.

136. The method of claim 135, wherein the method comprises the step of operating the piston device to arrange the valve arrangement in the first, second, third, fourth, first intermediate or second intermediate configurations.

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137. The method of claim 135 or claim 136, wherein the method comprises the step of operating the piston device by controlling the internal tubular body fluid pressure to arrange the valve arrangement in the first, second, third, fourth, first intermediate or second intermediate configurations.

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138. The method of any of claims 102 to 137, wherein the first port is configured to permit fluid to flow through the port in one direction and prevent fluid to flow through the port in an opposite direction and the method comprises the step of communicating fluid through the first port.

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139. The method of any of claims 102 to 138, wherein the first port provides fluid communication with a tool or a device and the method comprises the step of communicating fluid through the first port to the tool or device.

25 140. The method of claim 139, wherein the tool or device is a sand control element having at least one fluid deformable device and the method comprises the step of communicating fluid through the first port to the fluid deformable chamber to activate the sand control element.

30 141. The method of any of claims 102 to 140, wherein the second port provides fluid communication between the interior of the tubular body and the exterior of the tubular body, or between the exterior of the tubular body and the interior of the tubular body, and the method comprises the step of communicating fluid through the second port.

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142. The method of claim 140 or claim 141, wherein the method comprises the further step of communicating fluid from subterranean formation through the sand control element and into the downhole apparatus; or from the downhole apparatus through the sand control element into the subterranean formation.

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143. The method of any of claims 102 to 142, wherein the downhole apparatus comprises two or more valve arrangements, each valve arrangement being associated with a first port and a second port, or a pair of first and second ports and the method comprises the step of operating each valve arrangement.

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144. The method of claim 143, wherein the method comprises the step of operating each valve arrangement simultaneously, independently or sequentially.

145. The method of any of claims 102 to 144, wherein the valve arrangement comprises a first valve arrangement and a second valve arrangement, the first valve arrangement being associated with the first port and the second valve arrangement being associated with the second port, and the method comprises the step of operating the first valve arrangement and the second valve arrangement.

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146. The method of claim 145, wherein the method comprises the step of operating the first valve arrangement and the second valve arrangement independently, or sequentially.

147. The method of claim 145 or claim 146, wherein the first and second valve arrangement have a first configuration, in which the first and second valve arrangements are locked and the first and second ports are closed; a second configuration, in which the first and second valve arrangements are locked, the first port is open and the second port is closed; and a third configuration, in which the first valve arrangement is locked, the first port is closed and the second port is open.

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148. The method of claim 147, wherein the locked first configuration is an initial configuration of the valve arrangement.

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149. The method of claim 147 or claim 148, wherein the method comprises the steps of operating the first and second valve arrangements from the locked first configuration to the locked second configuration, and the locked second configuration to the third configuration.

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150. The method of any of claims 147 to 149, wherein the locked first configuration is followed by the locked second configuration and the locked second configuration is followed by the third configuration.

10 151. The method of any of claims 147 to 150, wherein the method comprises an initial step of running the downhole apparatus into a bore hole of a subterranean formation, the apparatus being in the locked first configuration in this step.

15 152. The method of any of claims 147 to 151, wherein the method comprises the further step of unlocking the first valve arrangement from the locked first configuration and moving the first valve arrangement to a first intermediate configuration between the first configuration and the second configuration, in which the first valve arrangement is unlocked, the second valve arrangement is
20 locked and the first and second ports are closed.

153. The method of any of claims 174 to 152, wherein the method comprises the further step of unlocking the first valve arrangement from the locked second configuration and moving the first valve arrangement to a second intermediate
25 configuration between the second configuration and the third configuration, in which the first valve arrangement is unlocked, the second valve arrangement is locked and the first and second ports are closed.

154. The method of claim 153, wherein the method comprises the further step
30 of locking the first valve arrangement in the second intermediate configuration.

155. The method of claim 153 or claim 154, wherein the method comprises the further step of unlocking the second valve arrangement from the second intermediate configuration.

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156. The method of any of claims 147 to 155, wherein the method comprises the further step of locking the first and second valve arrangements in the third configuration.

5 157. The method of any of claims 147 to 156, wherein the method may comprise the further step of operating the first and second valve arrangements from the third configuration to a fourth configuration, in which the first port is closed and the second port is closed.

10 158. The method of claim 157, wherein the fourth configuration is reached after the first and second valve arrangements has been moved through the first, second and third configurations.

15 159. The method of claim 157 or claim 158, wherein the method comprises the further step of locking the first and second valve arrangements in the fourth configuration.

20 160. The method of any of claims 145 to 159, wherein the valve arrangement is a fluid pressure-responsive valve arrangement, or a hydraulically-actuated valve arrangement.

25 161. The method of any of claims 147 to 160, wherein the first configuration is associated with a first fluid pressure, the second configuration is associated with a second fluid pressure, the second fluid pressure being higher than the first fluid pressure, and the third configuration is associated with a third fluid pressure, the third fluid pressure being lower than the second fluid pressure.

30 162. The method of any of claims 147 to 161, wherein the method comprises the further step of moving the first valve arrangement to a third intermediate configuration between the second intermediate configuration and the third configuration, in which the first valve arrangement is locked, the second valve arrangement is locked and the first and second ports are closed.

35 163. The method of claim 162, wherein the third intermediate configuration is associated with a fluid pressure that is higher than the third fluid pressure.

164. The method of claim 162 or claim 163, wherein the third intermediate configuration is associated with a fluid pressure that is initially higher than the third fluid pressure, but decreases towards the third fluid pressure.

5 165. The method of any of claims 174 to 164, wherein the method comprises the further step of unlocking the second valve arrangement from the locked third intermediate configuration and moving the second valve arrangement to a fourth intermediate configuration between the third intermediate configuration and the third configuration, in which the first valve arrangement is locked, the second
10 valve arrangement is unlocked and the first and second ports are closed.

166. The method of claim 165, wherein the fourth intermediate configuration is associated with a fluid pressure that is higher than the first fluid pressure.

15 167. The method of claim 165 or claim 166, wherein the fourth intermediate configuration is associated with a fluid pressure that is initially higher than the first fluid pressure, but decreases towards the third fluid pressure.

168. The method of any of claims 165 to 167, wherein the fourth intermediate
20 configuration has a fourth fluid pressure.

169. The method of claim 168, wherein the fourth fluid pressure is higher than the second fluid pressure.

25 170. The method of any of claims 112 to 169, wherein the method comprises the step of applying fluid pressure to the valve arrangement to move the first and second valve arrangements from the locked first configuration to the locked second configuration.

30 171. The method of claim 170, wherein the method comprises the further step of unlocking the first valve arrangement from the locked first configuration and moving the valve arrangement to the first intermediate configuration.

172. The method of claim 171, wherein the method comprises the further step
35 of reducing the fluid pressure to move the first and second valve arrangements to the locked second configuration.

173. The method of claim 172, wherein the method comprises the step of applying fluid pressure to the valve arrangement to move the first and second valve arrangements from the locked second configuration to the second
5 intermediate configuration.

174. The method of claim 172 or claim 173, wherein the method comprises the further step of unlocking the first valve arrangement from the locked second configuration and moving the first and second valve arrangements to the second
10 intermediate configuration.

175. The method of claim 174, wherein the method comprises the further step of reducing the fluid pressure to move the first and second valve arrangements to the third intermediate configuration.
15

176. The method of claim 175, wherein the method comprises the step of applying fluid pressure to the valve arrangement to move the first and second valve arrangements from the third intermediate configuration to the fourth intermediate configuration.
20

177. The method of claim 176, wherein the method comprises the further step of unlocking the second valve arrangement from the locked third intermediate configuration and moving the first and second valve arrangements to the fourth intermediate configuration.
25

178. The method of claim 177, wherein the method comprises the further step of reducing the fluid pressure to move the first and second valve arrangement to the third configuration.

30 179. The method of any of claims 145 to 178, wherein the first valve arrangement includes a first valve member and the second valve arrangement includes a second valve member.

180. The method of claim 179, wherein the first valve member includes a first
35 port, the first port being associated with the first port of the tubular body, and the

second valve member includes a second port, the second port being associated with the second port of the tubular body.

181. The method of claim 179 or claim 180, wherein the first and second valve
5 members are moveable with respect to the tubular body to open and/or close the first and second ports of the tubular body.

182. The method of any of claims 179 to 181, wherein the method may
10 comprise the step of operating the first valve member to close the first port in the locked first configuration, open the first port in the locked second configuration, close the first port in the third configuration, and close the first port in the fourth configuration.

183. The method of any of claims 179 to 182, wherein the first valve member
15 may be a sleeve member located within the tubular body.

184. The method of any of claims 179 to 183, wherein the method comprises
the step of applying a biasing force to the first valve member to move the first
20 valve member to a position where the first port is closed.

185. The method of any of claims 145 to 184, wherein the first valve
arrangement comprises one or more locking devices, the locking devices being
configured to lock the first valve member in place relative to the tubular body.

25 186. The method of claim 185, wherein the one or more locking devices are releasable locking devices.

187. The method of claim 185 or claim 186, wherein the locking devices are
configured to lock the first valve member in place relative to the tubular body.

30 188. The method of any of claims 145 to 187, wherein the first valve arrangement comprises one or more primary retaining members and one or more secondary retaining members, the primary retaining members being configured to hold the first valve arrangement in the locked first configuration and the
35 secondary retaining members being configured to hold the first valve arrangement in the locked second configuration.

189. The method of claim 188, wherein the method comprises the step of engaging the second retaining members with the first valve member when the first valve member is in the locked second configuration.

5

190. The method of claim 188 or claim 189, wherein the primary and secondary retaining members are releasable retaining members.

191. The method of any of claims 188 to 190, wherein the first valve
10 arrangement comprises a further retaining member and the method comprises the step of locking the first valve member when the first valve member is in the locked third intermediate configuration with the further retaining member.

192. The method of any of claims 145 to 191, wherein the first valve
15 arrangement includes a piston device, the piston device being operable to arrange the first valve arrangement in the first, second, fourth, first intermediate, second intermediate, or third intermediate configurations.

193. The method of claim 192, wherein the method comprises the step of
20 operating the piston device to arrange the first valve arrangement in the first, second, fourth, first intermediate, second intermediate or third intermediate configurations.

194. The method of claim 192 or claim 193, wherein the method comprises the
25 step of operating the piston device by controlling the internal tubular body fluid pressure to arrange the first valve arrangement in the first, second, fourth, first intermediate, second intermediate or third intermediate configurations.

195. The method of any of claims 145 to 194, wherein the first port is
30 configured to permit fluid to flow through the port in one direction and prevent fluid to flow through the port in an opposite direction and the method comprises the step of communicating fluid through the first port.

196. The method of any of claims 145 to 194, wherein the first port provides
35 fluid communication with a tool or a device and the method comprises the step of communicating fluid through the first port to the tool or device.

197. The method of claim 196, wherein the tool or device is a sand control element having at least one fluid deformable device and the method comprises the step of communicating fluid through the first port to the fluid deformable chamber to activate the sand control element.

198. The method of any of claims 179 to 197, wherein the method comprises the step of operating the second valve member to close the second port in the locked first configuration, close the second port in the locked second configuration, open the second port in the third configuration, and close the second port in the fourth configuration.

199. The method of any of claims 179 to 198, wherein the second valve member is a sleeve member located within the tubular body.

200. The method of any of claims 179 to 199, wherein the second valve member includes a first portion and a second portion.

201. The method of claim 200, wherein the first and second portions of the second valve member are releasably lockable with respect to one another.

202. The method of claim 201, wherein the first and second portions of the second valve member are releasably lockable with respect to one another by two separate releasable locking devices.

203. The method of any of claims 179 to 202, wherein the method comprises the step of applying a biasing force to the second valve member.

204. The method of any of claims 179 to 203, wherein the method comprises the step of biasing the second valve member to a position where the second port is open.

205. The method of any of claims 145 to 204, wherein the second valve arrangement comprises one or more locking devices, the locking devices being configured to lock the second valve member in place relative to the tubular body.

206. The method of claim 205, wherein the locking devices are releasable locking devices.

207. The method of any of claims 145 to 206, wherein the second valve arrangement comprises one or more primary retaining members, the primary retaining members being configured to hold the second valve member in a first position relative to the tubular body.

208. The method of any of claims 145 to 207, wherein the second valve arrangement includes a piston device, the piston device being operable to arrange the second valve arrangement in the first configuration, the second configuration, the third configuration, the first intermediate configuration, the second intermediate configuration, the third intermediate configuration or the fourth intermediate configuration.

209. The method of claim 208, wherein the method comprises the step of operating the piston device to arrange the second valve arrangement in the first configuration, the second configuration, the third configuration, the first intermediate configuration, the second intermediate configuration, the third intermediate configuration or the fourth intermediate configuration.

210. The method of claim 208 or claim 209, wherein the method comprises the step of operating the piston device by controlling the internal tubular body fluid pressure to arrange the second valve arrangement in the first configuration, the second configuration, the third configuration, the first intermediate configuration, the second intermediate configuration, the third intermediate configuration or the fourth intermediate configuration.

211. The method of any of claims 145 to 210, wherein the second port provides fluid communication between the interior of the tubular body and the exterior of the tubular body, or between the exterior of the tubular body and the interior of the tubular body, and the method comprises the step of communicating fluid through the second port.

212. The method of any of claims 145 to 211, wherein the downhole apparatus comprises two or more first and second valve arrangements, each first and

second valve arrangement being associated with a first port and a second port, or a pair of first and second ports and the method comprises the step of operating each valve arrangement.

- 5 213. The method of any of claims 145 to 212, wherein the method comprises the step of operating each first and second valve arrangement simultaneously, independently or sequentially.

214. The method of any of claims 145 to 213, wherein the downhole apparatus
10 further comprises a sand control element, the sand control element being in fluid communication with the first port of the tubular body, and the method comprises the further steps of:

- arranging the downhole apparatus in a subterranean formation; and
 operating the valve arrangement to move the sand control element from a
15 first position in which the sand control element is spaced from the surface of the subterranean formation to a second position in which the sand control element is in contact with the surface of the subterranean formation.

215. The method of claim 214, wherein the method comprises the further step
20 of operating the valve arrangement to allow fluids to flow from the subterranean formation through the sand control element and into the downhole apparatus; or from the downhole apparatus through the sand control element into the subterranean formation.

- 25 216. A method of operating a downhole apparatus, the downhole apparatus comprising:

- a tubular body, the tubular body having first and second ports in a wall thereof;
 a valve arrangement, the valve arrangement having:
30 a locked first configuration, in which the first port is closed and the second port is closed;
 a locked second configuration, in which the first port is open and the second port is closed; and
 a third configuration, in which the first port is closed and the
35 second port is open; and

a sand control element, the sand control element being in fluid communication with the first port of the tubular body, the method comprising the steps of:

arranging the downhole apparatus in a bore of a subterranean formation;

5 and

operating the valve arrangement to move the sand control element from a first position in which the sand control element is spaced from the surface of the subterranean formation to a second position in which the sand control element is in contact with the surface of the subterranean formation.

10

217. The method of claim 216, wherein the method may comprise the further step of operating the valve arrangement to allow fluids to flow from the subterranean formation through the sand control element and into the downhole apparatus; or from the downhole apparatus through the sand control element into the subterranean formation.

15

218. The method of claim 216 or claim 217, wherein the tubular body of the downhole apparatus has two or more pairs of first and second ports in a wall thereof; and two or more valve arrangements, each valve arrangement being associated with a pair of first and second ports, and the method comprises the further step of selectively operating each valve arrangement to move the sand control element from the first position to the second position and to allow fluids to flow from the subterranean formation through the sand control element and out of the downhole apparatus.

25

219. A method of operating a downhole apparatus, the downhole apparatus comprising:

a tubular body, the tubular body having first and second ports in a wall thereof;

30

a first valve arrangement associated with the first port;

a second valve arrangement associated with the second port; and

a sand control element, the sand control element being in fluid communication with the first port of the tubular body and being operable to move between a first deactivated state to a second activated state, the method

35 comprising the steps of:

operating the first valve arrangement to move the sand control element from the first position to the second position; and

operating the second valve arrangement to open the second port of the tubular body.

5

220. The method of claim 219, wherein the method comprises the further step of operating the first and second valve arrangements independently, or sequentially.

10 221. The method of claim 219 or claim 220, wherein the method comprises the initial step of arranging the downhole apparatus in a bore of a subterranean formation and the further step of operating the first valve arrangement to move the sand control element from the first deactivated state, in which the sand control element is spaced from the surface of the subterranean formation to the
15 activated state, in which the sand control element is in contact with the surface of the subterranean formation.

222. The method of any of claims 219 to 221, wherein the method comprises the further step of operating the second valve arrangement to allow fluids to flow
20 from the subterranean formation through the sand control element and into the downhole apparatus; or from the downhole apparatus through the sand control element into the subterranean formation.