

We claim:

1. A manifold body comprising:
first and second valve segments each comprising an annular upper perimeter wall portion defining a valve cavity and a lower base portion defining first and second flow ports, wherein the upper perimeter wall of the second valve segment includes a portion that is fused with an adjacent portion of the upper perimeter wall of the second valve segment; and
a conduit segment defining a fluid flow path including a first leg flow path portion defining a conduit end portion and a second leg flow path portion extending from the first leg flow path portion to one of the first and second flow ports of the first valve segment.
2. The manifold body of claim 1, wherein the conduit end portion defines a tubular portion spaced apart from a remainder of the manifold body.
3. The manifold body of any of claims 1 and 2, wherein the lower base portion of at least one of the first and second valve segments has an outer diameter that is smaller than an outer diameter of the corresponding upper perimeter wall portion.
4. The manifold body of any of claims 1-3, wherein the second leg flow path portion of the conduit segment is at least partially laterally aligned with the valve cavity of at least one of the first and second valve segments.
5. The manifold body of any of claims 1-4, further comprising at least one aperture mounting boss that is fused with an adjacent portion of the upper perimeter wall of one of the first and second valve segments.
6. The manifold body of any of claims 1-4, further comprising a lower plate joined with the lower base portions of the first and second valve segments, the lower plate being sized to be secured with an open end of a cylindrical canister.
7. The manifold body of claim 6, wherein at least one of the first and second flow ports of at least one of the first and second valve segments extends through the lower plate for fluid communication with an internal cavity of a canister when the lower plate is secured with an open end of the canister.

8. The manifold body of any of claims 1-7, further comprising a second conduit segment comprising a first leg flow path portion defining a conduit end portion and a second leg flow path portion extending from the first leg flow path portion to one of the first and second flow ports of the second valve segment.
9. The manifold body of any of claims 1-8, further comprising a third valve segment comprising an annular upper perimeter wall portion defining a valve cavity and a lower base portion defining first and second flow ports, wherein the upper perimeter wall of the third valve segment includes a portion that is fused with an adjacent portion of the upper perimeter wall of at least one of the first and second valve segments.
10. The manifold body of any of claims 1-9, wherein the fluid flow path includes one or more discontinuities adapted to provide increases in one or more of flow shear, flow compression, and flow incidence when the fluid flow path is treated with an abrasive laden fluid.
11. The manifold body of any of claims 1-10, wherein the flow path has a first cross-sectional shape at a first cross-sectional plane of the fluid flow path and a second cross-sectional shape different from the first cross-sectional shape at a second cross-sectional plane of the fluid flow path.
12. The manifold body of claim 11, wherein the first cross-sectional shape is circular and the second cross-sectional shape is teardrop shaped.
13. The manifold body of any of claims 11 and 12, wherein the first cross-sectional plane is disposed in the first leg flow path portion and the second cross-sectional plane is disposed in the second leg flow path portion.
14. The manifold body of any of claims 11 and 12, wherein the first cross-sectional plane and the second cross-sectional plane are both disposed in the same one of the first leg flow path portion and the second leg flow path portion.

15. The manifold body of any of claims 1-14, wherein the flow path has a first cross-sectional area at a first cross-sectional plane of the fluid flow path and a second cross-sectional area smaller than the first cross-sectional area at a second cross-sectional plane of the fluid flow path.
16. The manifold body of claim 15, wherein the first cross-sectional plane is disposed in the first leg flow path portion and the second cross-sectional plane is disposed in the second leg flow path portion.
17. The manifold body of claim 15, wherein the first cross-sectional plane and the second cross-sectional plane are both disposed in the same one of the first leg flow path portion and the second leg flow path portion.
18. The manifold body of any of claims 1-17, wherein at least one of the first leg flow path portion and the second leg flow path portion includes internal surfaces that are tapered radially inward.
19. The manifold body of claim 18, wherein the internal surfaces of the at least one of the first leg flow path portion and the second leg flow path portion are tapered between approximately 15% and approximately 30% per inch of port length of the at least one of the first leg flow path portion and the second leg flow path portion.
20. The manifold body of claim 19, wherein the tapered internal surfaces of the at least one of the first leg flow path portion and the second leg flow path portion are stepped.
21. The manifold body of any of claims 1-20, wherein one of the first leg flow path portion and the second leg flow path portion has a first cross-sectional center line at a first cross-sectional plane and a second cross-sectional center-line non-coaxial with the first cross-sectional center line at a second cross-sectional plane.
22. The manifold body of claim 21, wherein the other of the first leg flow path portion and the second leg flow path portion has a first cross-sectional center line at a first cross-sectional plane and a second cross-sectional center-line non-coaxial with the first cross-sectional center line at a second cross-sectional plane.

23. The manifold body of any of claims 21 and 22, wherein at least one of the first leg flow path portion and the second leg flow path portion forms a continuous helical pattern.
24. The manifold body of any of claims 1-23, wherein at least a portion of the fluid flow path includes a pattern of surface discontinuities.
25. The manifold body of claim 24, wherein the pattern of surface discontinuities comprises an array of dimples.
26. The manifold body of claim 25, wherein each dimple in the array of dimples has a spherical radius of approximately $1/10^{\text{th}}$ of an effective bore diameter of the fluid flow path, and a dimple depth of approximately $1/50^{\text{th}}$ of the effective bore diameter of the fluid flow path.
27. The manifold body of any of claims 1-26, wherein the manifold body is a monolithic component.
28. The manifold body of any of claims 1-27, wherein at least a portion of the manifold body is produced using additive manufacturing techniques.
29. A valve manifold assembly including the manifold body of any of claims 1-28, a first valve subassembly installed in the valve cavity of the first valve segment, and a second valve subassembly installed in the valve cavity of the second valve segment.
30. The valve manifold assembly of claim 29, wherein the first valve subassembly is threadably engaged with a threaded portion of the perimeter wall of the first valve segment, and the second valve subassembly is threadably engaged with a threaded portion of the perimeter wall of the second valve segment.
31. A fluid component body including an extended fluid flow path having one or more discontinuities adapted to provide increases in one or more of flow shear, flow compression, and flow incidence when the fluid flow path is treated with an abrasive laden fluid, wherein the one or more discontinuities comprises at least one of: varying cross-sectional shape,

varying cross-sectional area, a non-coaxial cross-sectional center line, and one or more internal surface discontinuities.

32. The fluid component body of claim 31, wherein the flow path has a first cross-sectional shape at a first cross-sectional plane of the fluid flow path and a second cross-sectional shape different from the first cross-sectional shape at a second cross-sectional plane of the fluid flow path.

33. The fluid component body of claim 32, wherein the first cross-sectional shape is circular and the second cross-sectional shape is teardrop shaped.

34. The fluid component body of any of claims 32 and 33, wherein the first cross-sectional plane is disposed in a first leg flow path portion and the second cross-sectional plane is disposed in a second leg flow path portion.

35. The fluid component body of any of claims 32-34, wherein the first cross-sectional plane and the second cross-sectional plane are both disposed in the same one of a first leg flow path portion and a second leg flow path portion.

36. The fluid component body of any of claims 31-35, wherein the flow path has a first cross-sectional area at a first cross-sectional plane of the fluid flow path and a second cross-sectional area smaller than the first cross-sectional area at a second cross-sectional plane of the fluid flow path.

37. The fluid component body of claim 36, wherein the first cross-sectional plane is disposed in a first leg flow path portion and the second cross-sectional plane is disposed in a second leg flow path portion.

38. The fluid component body of claim 36, wherein the first cross-sectional plane and the second cross-sectional plane are both disposed in the same one of a first leg flow path portion and a second leg flow path portion.

39. The fluid component body of any of claims 31-38, wherein at least one of the first leg flow path portion and the second leg flow path portion includes internal surfaces that are tapered radially inward.
40. The fluid component body of claim 39, wherein the internal surfaces of the at least one of the first leg flow path portion and the second leg flow path portion are tapered between approximately 15% and approximately 30% per inch of port length of the at least one of the first leg flow path portion and the second leg flow path portion.
41. The fluid component body of claim 40, wherein the tapered internal surfaces of the at least one of the first leg flow path portion and the second leg flow path portion are stepped.
42. The fluid component body of any of claims 31-41, wherein a longitudinally extending portion of the fluid flow path has a first cross-sectional center line at a first cross-sectional plane and a second cross-sectional center-line non-coaxial with the first cross-sectional center line at a second cross-sectional plane.
43. The fluid component body of claim 42, wherein the longitudinally extending portion of the fluid flow path forms a continuous helical pattern.
44. The fluid component body of any of claims 31-43, wherein the fluid component body is a monolithic component.
45. The fluid component body of any of claims 31-44, wherein at least a portion of the fluid component body is produced using additive manufacturing techniques.
46. The fluid component body of any of claims 31-45, wherein the flow path includes a pattern of surface discontinuities.
47. The fluid component body of claim 46, wherein the pattern of surface discontinuities comprises an array of dimples.
48. The fluid component body of claim 47, wherein each dimple in the array of dimples has a spherical radius of approximately $1/10^{\text{th}}$ of an effective bore diameter of the fluid flow

path, and a dimple depth of approximately $1/50^{\text{th}}$ of the effective bore diameter of the fluid flow path.

49. The fluid component body of any of claims 46-48, wherein the fluid component body is a monolithic component.

50. The fluid component body of any of claims 46-49, wherein at least a portion of the fluid component body is produced using additive manufacturing techniques.

51. A method of fabricating a fluid component body, the method comprising:
forming a monolithic fluid component body including a valve segment having an annular upper perimeter wall portion defining a valve cavity and a lower base portion defining first and second flow ports, and a conduit segment extending from one of the first and second flow ports and including a conduit end portion defining a tubular portion extending in a first direction and spaced apart from a remainder of the fluid component body;
and

bending the conduit end portion from the first direct to a second direction.

52. The method of claim 51, wherein the first direction is substantially vertical and the second direction is substantially horizontal.

53. The method of any of claims 51 and 52, wherein the conduit end portion has a reduced wall thickness at an axial location of the bend.

54. The method of any of claims 51-53, wherein the conduit end portion has a reduced wall thickness at a circumferential location corresponding to the direction of the bend.

55. The method of any of claims 51-54, wherein the body includes a bending limit feature on an external surface of the body sized and positioned to limit bending of the conduit end portion to a desired angle, wherein bending the conduit end portion from the first direct to a second direction comprises bending the conduit end portion until an outer surface of the conduit end portion abuts the bending limit feature.

56. The method of any of claims 51-55, wherein the conduit end portion has an oblong cross-section having a minor diameter oriented in a direction of the bend.
57. The method of any of claims 51-56, wherein forming the monolithic fluid component body comprises using additive manufacturing.
58. A method of fabricating a fluid component, the method comprising:
forming, using additive manufacturing, a conduit having first and second portions connected by a central portion;
bending the central portion of the conduit to reorient the second portion of the conduit with respect to the first portion of the conduit.
59. The method of claim 58, wherein bending the second portion of the conduit comprises orienting the second portion of the conduit substantially perpendicular to the first portion of the conduit.
60. The method of any of claims 58 and 59, wherein the conduit includes at least a first bending limit feature on an external surface of the conduit sized and positioned to limit bending of the conduit end portion to a desired angle, wherein bending the conduit end portion comprises bending the conduit end portion until the first bending limit feature abuts a portion of the conduit.
61. The method of claim 60, wherein bending the conduit end portion comprises bending the conduit end portion until the first bending limit feature abuts a second bending limit feature.
62. The method of claim 61, wherein the first and second bending limit features comprise protrusions on an outer surface of the conduit along an inner bend diameter.
63. The method of any of claims 58-62, wherein forming the conduit comprises forming the central portion with an oblong cross-section having a minor diameter oriented in a direction of the bend.

64. The method of claim 63, wherein forming the conduit further comprises forming internal supports within the oblong cross-section.
65. The method of claim 64, further comprising removing the internal supports before bending the central portion of the conduit.
66. The method of claim 64, further comprising removing the internal supports after bending the central portion of the conduit.
67. The method of any of claims 65 and 66, wherein removing the internal supports comprises removing the internal supports using abrasive flow machining.
68. The method of any of claims 58-67, wherein prior to bending, the first and second portions are substantially colinear.
69. The method of any of claims 58-68, wherein the central portion forms a U-shape.
70. The method of any of claims 58-69, further comprising securing the first and second portions in a desired bent orientation using at least one of tack-welding, adhesive, and interengaging structural features provided to effect one of a press fit, snap-fit, or mating engagement.
71. The method of any of claims 58-70, wherein bending the central portion of the conduit comprises overbending beyond a desired orientation and allowing the material to spring back to the desired orientation.