

What is claimed is:

1. A syringe comprising:

a substantially cylindrically shaped barrel having an open proximal end, a distal end of the barrel and an inner sidewall, from the distal end of the barrel having a needleless connector, a lumen extending through the needleless connector, the lumen being in fluid communication with a cavity of the barrel, the cavity being defined by the open proximal end, the distal end and the inner sidewall;

a plunger disposed within the barrel having a plunger rod and a distal end, the distal end of the plunger including a connection feature extending distally from the distal end of the plunger;

a first stopper disposed proximal to a second stopper, the first stopper comprising a proximal end, a distal end and an outer surface, the proximal end of the first stopper including an aperture configured to receive the connection feature of the distal end of the plunger rod;

the second stopper disposed proximal to the distal end of the barrel, the second stopper comprising a proximal end, a distal end and an outer surface;

a first variable volume, the first variable volume being disposed between the first stopper and the second stopper;

a second variable volume, the second variable volume being between the second stopper and the distal end of the barrel; and

a flow path structure disposed at the distal end of the barrel, the flow path structure extending from the lumen of the needleless connector along the inner sidewall of the barrel, characterized in that

the first stopper further comprising a first plurality of radial ribs disposed on the outer surface of the first stopper, the second stopper further comprising a second plurality of radial ribs disposed on the outer surface of the second stopper,

the flow path structure having a first uniform cross-sectional thickness profile extending proximally away from the frustoconical shaped distal end along the inner sidewall of the barrel and a second uniform cross-sectional thickness profile extending along an entire length of the frustoconical shaped distal end, wherein the first uniform cross-sectional thickness profile of the flow path structure is greater than the second uniform cross-sectional

thickness profile of the flow path structure, the flow path structure is a protrusion extending from the inner sidewall of the barrel to cause deformation of the second stopper and the flow path structure extends at least a length of the second stopper, thereby creating a flow path between the second stopper and the inner sidewall of the barrel and creating a flow path from the first variable volume to the lumen of the needleless connector when the second stopper abuts the distal end of the barrel.

2. The syringe of claim 1, the protrusion having a semicircular cross-sectional shape.

3. The syringe of claim 1, the protrusion having a convex cross-sectional shape.

4. The syringe of claim 1, the protrusion having a concave cross-sectional shape.

5. The syringe of claim 1, wherein the flow path structure is a unitary body molded into the inner sidewall of the barrel.

6. The syringe of claim 1, wherein the flow path structure is a non-unitary body assembled into the inner sidewall of the barrel.

7. The syringe of claim 1, wherein the proximal end of the second stopper has an inwardly conical shape configured to receive the distal end of the first stopper.

8. The syringe of claim 1, wherein the distal end of the second stopper has an outwardly conical shape configured to conform and to be received by the distal end of the barrel.

9. The syringe of claim 1, wherein the connection feature comprises a plurality of threads for engaging a plurality of female threads integral to the aperture of the first stopper.

10. The syringe of claim 1, wherein the needleless connector is integral with the distal end of the barrel.

11. The syringe of claim 1, wherein advancement of the second stopper against the distal end of the barrel causes deformation of the second stopper due to the flow path structure interfering with the second stopper.

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12. The syringe of claim 11, wherein advancement of the second stopper against the distal end of the barrel causes a flow path between the second stopper and the barrel.

13. The syringe of claim 1, wherein the distal end of the barrel has a frustoconical shape.

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14. The syringe of claim 13, wherein the flow path structure follows the frustoconical shape of the distal end of the barrel.

15. The syringe of claim 14, wherein the flow path structure extends to the lumen of the
15 needleless connector.

16. The syringe of claim 1, wherein the flow path structure has a sloped proximal end, thereby allowing less restrictive advancement of the second stopper against the flow path structure.

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17. The syringe of claim 1, wherein the flow path structure has a first thickness profile TP1 along the inner sidewall of the barrel and a second thickness profile TP2 along the distal end of the barrel.

18. The syringe of claim 17, wherein the first thickness profile TP1 is greater than the
25 second thickness profile TP2.

19. The syringe of claim 1, the syringe being in an initial state, an intermediate state and a
30 final state.

20. The syringe of claim 19, wherein the initial state is defined by the plunger being in a fully retracted position in the cavity, and the first stopper and the second stopper are separated within the cavity by the first variable volume, and the second stopper and the distal end of the barrel are separated within the cavity by the second variable volume.

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21. The syringe of claim 19, wherein the intermediate state is defined by the plunger being in a partially advanced position in the cavity, and the second stopper has been fully advanced against the distal end of the barrel, the advancement of the second stopper causing expulsion of contents of the second variable volume through the lumen, thereby essentially eliminating the second variable volume.

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22. The syringe of claim 19, wherein the final state is defined by the plunger being in a fully advanced position in the cavity, and the distal end of the first stopper abuts the proximal end of the second stopper, thereby eliminating the first variable volume.