That Which is Claimed is:

1. An apparatus for manipulating particles, the apparatus comprising:

a rotor rotatable at a speed about an axis, the rotor having an outer periphery and front and rear opposite sides;

at least one chamber mounted on the rotor, each chamber having an inlet and an opposed outlet;

an umbilical assembly rotatable about the axis, the umbilical assembly comprising:

a curvilinear guide tube connecting to a drum at the rear side of the rotor;

a flexible conduit residing in the guide tube; and

first and second elongate passageways for each chamber extending through the conduit, wherein the first passageway is in fluid communication with the inlet of a respective chamber and the second passageway is in fluid communication with the outlet of the respective chamber; and

a drive mechanism configured to rotate the umbilical assembly at about one-half the speed of the rotor;

wherein the passageways are held in a spaced-apart relationship relative to one another.

2. The apparatus of Claim 1, wherein the first and second passageways for each chamber comprise corresponding first and second flexible tubes that extend through at least a major portion of a length of the conduit, the apparatus further comprising potting material within the conduit, the potting material configured to hold the tubes in the spaced-apart relationship relative to one another and hold the tubes in a spaced-apart relationship relative to the conduit.

3. The apparatus of Claim 2, wherein the potting material is further configured to restrict movement of the tubes relative to the conduit and/or restrict movement of the tubes relative to one another.

4. The apparatus of Claim 2, wherein the umbilical assembly further comprises a flexible member extending through at least a major portion of a length of the conduit, wherein the flexible member extends substantially along a centerline of the conduit, and wherein the flexible tubes surround the flexible member.

5. The apparatus of Claim 2, wherein the conduit is corrugated flexible conduit.

6. The apparatus of Claim 1, wherein the conduit and passageways are integrated as a flexible extrusion with an outer wall and internal elongate channels that define the spaced-apart passageways.

7. The apparatus of Claim 1, wherein each chamber is a flexible translucent or transparent fluid chamber, the apparatus further comprising at least one chamber holder pivotably mounted to the front side of the rotor, wherein each chamber holder is configured to releasably enclose a respective chamber.

8. The apparatus of Claim 7, wherein each chamber holder includes a window to allow visual access to the enclosed chamber.

9. The apparatus of Claim 2, wherein each chamber comprises a substantially conical body portion with a flange extending about at least a portion of a perimeter of the conical body portion, the flange including an inlet fluid path and an outlet fluid path, and wherein the first tube connects with the flange inlet fluid path of a respective chamber and the second tube connects with the flange outlet fluid path of the respective chamber.

10. The apparatus of Claim 9, wherein the flange inlet and outlet fluid paths are substantially parallel along a segment extending from a point at which the first and second tubes connect with the flange inlet and outlet fluid paths.

11. The apparatus of Claim 6, wherein each chamber comprises a substantially conical body portion and a flange extending about at least a portion of a perimeter of the conical body portion, the flange including an inlet fluid path and an outlet fluid path, and wherein the first elongate passageway of the conduit is in fluid communication with the flange inlet fluid path and the second elongate passageway of the conduit is in fluid communication with the flange outlet fluid path.

12. The apparatus of Claim 11, further comprising a first tube connecting the first passageway and the flange inlet fluid path and a second tube connecting the second passageway and the flange outlet fluid path, wherein the flange inlet and outlet paths are substantially parallel along a segment extending from a point at which the first and second tubes connect with the flange inlet and outlet paths.

13. The apparatus of Claim 1, wherein the drive mechanism comprises gears, wherein the gears are at least partially enclosed by the drum.

14. The apparatus of Claim 1, wherein the rotor defines a substantially horizontal axis of rotation and the at least one chamber and the umbilical assembly rotate about the substantially horizontal axis.

15. The apparatus of Claim 1, wherein the curvilinear guide tube is configured to extend about the outer periphery of the rotor.

16. The apparatus of Claim 1, wherein the conduit includes proximal and distal opposite ends, wherein the conduit distal end has a polygonally shaped coupling that couples the conduit to the rotor.

17. The apparatus of Claim 1, wherein the at least one chamber comprises a plurality of chambers mounted on the rotor in a spaced-apart relationship.

18. A disposable fluid path for use with a continuous flow centrifuge comprising a rotor having an outer periphery and front and rear opposite sides, the disposable fluid path comprising:

at least one chamber mounted on the rotor, each chamber having an inlet and an opposed outlet;

a flexible conduit curving around the outer periphery of the rotor and connecting to the rotor; and

first and second elongate spaced-apart passageways for each chamber extending through the conduit, wherein the first passageway is in fluid communication with the inlet of a respective

chamber and the second passageway is in fluid communication with the outlet of the respective chamber.

19. The disposable fluid path of Claim 18, wherein the first and second passageways for each chamber comprise corresponding first and second flexible tubes that extend through at least a major portion of a length of the conduit, the disposable fluid path further comprising potting material within the conduit, the potting material configured to hold the tubes in the spaced-apart relationship relative to one another.

20. The disposable fluid path of Claim 19, wherein the potting material is further configured to restrict movement of the tubes relative to the conduit and/or to restrict movement of the tubes relative to one another.

21. The disposable fluid path of Claim 18, wherein the conduit and passageways are integrated as a flexible extrusion with an outer wall and internal elongate channels that define the spaced-apart passageways.

22. The disposable fluid path of Claim 21, further comprising a sheath around the outer wall of the flexible extrusion.

23. An umbilical assembly for use with a continuous flow centrifuge having a rotor and at least one chamber having an inlet and an opposed outlet attached to the rotor, the assembly comprising:

a substantially rigid curvilinear guide tube extending about an outer periphery of the rotor;

a flexible conduit residing in the tube, the conduit including a plurality of elongate spaced-apart passageways therein, wherein the plurality of passageways includes first and second passageways for each chamber, wherein the first passageway is in fluid communication with the inlet of the at least one chamber and the second passageway is in fluid communication with the outlet of the at least one chamber, wherein the flexible conduit comprises a solid flexible material that substantially surrounds the passageways, the solid flexible material configured to hold the passageways in the spaced-apart relationship.

24. A centrifugal fluid processing system, comprising:

a housing having an interior cavity with an access aperture extending from an external surface of the housing to the interior cavity;

a plurality of fluid chambers held in spaced apart relationship on a rotor in the interior cavity;

a flexible conduit including a plurality of elongate spaced-apart passageways therein, the flexible conduit extending from a location that is external to the housing through the access aperture and into the interior cavity, wherein the plurality of passageways includes first and second passageways for each chamber, wherein the first passageway is in fluid communication with an inlet of a respective chamber and the second passageway is in fluid communication with an opposed outlet of the respective chamber, wherein the flexible conduit comprises a solid flexible material that substantially fills an internal volume of the conduit and substantially surrounds the passageways, the solid flexible material configured to hold the passageways in the spaced-apart relationship;

a substantially rigid curvilinear guide tube holding a portion of the flexible conduit in the interior cavity; and

a drive mechanism configured to rotate the guide tube at a first speed and the rotor and the fluid chambers at a second speed, wherein the second speed is about twice the first speed.

25. The centrifugal fluid processing system of Claim 24, comprising:

a substantially funnel-shaped support with an open center passage, the support having a shape that tapers outward as it extends further into the interior cavity, wherein the support surrounds the flexible conduit with a centerline of the funnel shaped support being in line with a centerline of the access aperture.

26. The centrifugal fluid processing system of Claim 24, wherein the plurality of fluid chambers comprise a plurality of flexible translucent or transparent fluid chambers having an inlet and an opposed outlet held in spaced-apart relationship on a rotor in the interior cavity, wherein each chamber comprises a substantially conical body portion, each chamber including a flange extending about at least a portion of a perimeter of the conical body portion, the flange including an inlet fluid path and an outlet fluid path, wherein the flange inlet fluid path is in fluid

communication with the inlet of the chamber and the flange outlet fluid path is in fluid communication with the outlet of the chamber;

wherein the plurality of passageways includes first and second passageways for each chamber, and wherein the first passageway is in fluid communication with the flange inlet fluid path of a respective chamber and the second passageway is in fluid communication with the flange outlet fluid path of the respective chamber;

the system further comprising a plurality of substantially rigid chamber holders in the interior cavity, each sized and configured to releasably hold a respective flexible chamber attached to the rotor.

27. A method of manipulating particles, comprising:

providing:

at least one chamber on a rotor having an outer periphery, each chamber having an inlet and an opposed outlet;

a flexible conduit with first and second spaced-apart passageways therein for each chamber, wherein the first passageway is in fluid communication with the inlet of a respective chamber and the second passageway is in fluid communication with the outlet of the respective chamber;

a substantially rigid curvilinear guide tube holding a portion of the conduit therein and curving around the outer periphery of the rotor;

rotating the rotor and the at least one chamber at a first speed, thereby creating a centrifugal force field;

rotating the guide tube and conduit therein at a second speed, wherein the second speed is about one-half the first speed, thereby inhibiting the first and second passageways for each chamber from fully twisting;

flowing media and particles into a respective chamber using the first passageway, wherein a continuous flow of media and particles creates a fluid force that substantially opposes the centrifugal force field, thereby immobilizing at least some of the particles in a fluidized bed in the respective chamber; and

flowing media out of the respective chamber and through the second passageway.

That Which is Claimed is:

1. An apparatus for manipulating particles, the apparatus comprising:

a rotor rotatable at a speed about an axis, the rotor having an outer periphery and front and rear opposite sides;

at least one chamber mounted on the rotor, each chamber having an inlet and an opposed outlet;

an umbilical assembly rotatable about the axis, the umbilical assembly comprising:

a curvilinear guide tube connecting to a drum at the rear side of the rotor;

a flexible conduit residing in the guide tube; and

first and second elongate passageways for each chamber extending through the conduit, wherein the first passageway is in fluid communication with the inlet of a respective chamber and the second passageway is in fluid communication with the outlet of the respective chamber; and

a drive mechanism configured to rotate the umbilical assembly at about one-half the speed of the rotor;

wherein the passageways are held in a spaced-apart relationship relative to one another.

2. The apparatus of Claim 1, wherein the first and second passageways for each chamber comprise corresponding first and second flexible tubes that extend through at least a major portion of a length of the conduit, the apparatus further comprising potting material within the conduit, the potting material configured to hold the tubes in the spaced-apart relationship relative to one another and hold the tubes in a spaced-apart relationship relative to the conduit.

3. The apparatus of Claim 2, wherein the potting material is further configured to restrict movement of the tubes relative to the conduit and/or restrict movement of the tubes relative to one another.

4. The apparatus of Claim 2, wherein the umbilical assembly further comprises a flexible member extending through at least a major portion of a length of the conduit, wherein the flexible member extends substantially along a centerline of the conduit, and wherein the flexible tubes surround the flexible member.

5. The apparatus of Claim 2, wherein the conduit is corrugated flexible conduit.

6. The apparatus of Claim 1, wherein the conduit and passageways are integrated as a flexible extrusion with an outer wall and internal elongate channels that define the spaced-apart passageways.

7. The apparatus of Claim 1, wherein each chamber is a flexible translucent or transparent fluid chamber, the apparatus further comprising at least one chamber holder pivotably mounted to the front side of the rotor, wherein each chamber holder is configured to releasably enclose a respective chamber.

8. The apparatus of Claim 7, wherein each chamber holder includes a window to allow visual access to the enclosed chamber.

9. The apparatus of Claim 2, wherein each chamber comprises a substantially conical body portion with a flange extending about at least a portion of a perimeter of the conical body portion, the flange including an inlet fluid path and an outlet fluid path, and wherein the first tube connects with the flange inlet fluid path of a respective chamber and the second tube connects with the flange outlet fluid path of the respective chamber.

10. The apparatus of Claim 9, wherein the flange inlet and outlet fluid paths are substantially parallel along a segment extending from a point at which the first and second tubes connect with the flange inlet and outlet fluid paths.

11. The apparatus of Claim 6, wherein each chamber comprises a substantially conical body portion and a flange extending about at least a portion of a perimeter of the conical body portion, the flange including an inlet fluid path and an outlet fluid path, and wherein the first elongate passageway of the conduit is in fluid communication with the flange inlet fluid path and the second elongate passageway of the conduit is in fluid communication with the flange outlet fluid path.

12. The apparatus of Claim 11, further comprising a first tube connecting the first passageway and the flange inlet fluid path and a second tube connecting the second passageway and the flange outlet fluid path, wherein the flange inlet and outlet paths are

substantially parallel along a segment extending from a point at which the first and second tubes connect with the flange inlet and outlet paths.

13. The apparatus of Claim 1, wherein the drive mechanism comprises gears, wherein the gears are at least partially enclosed by the drum.

14. The apparatus of Claim 1, wherein the rotor defines a substantially horizontal axis of rotation and the at least one chamber and the umbilical assembly rotate about the substantially horizontal axis.

15. The apparatus of Claim 1, wherein the curvilinear guide tube is configured to extend about the outer periphery of the rotor.

16. The apparatus of Claim 1, wherein the conduit includes proximal and distal opposite ends, wherein the conduit distal end has a polygonally shaped coupling that couples the conduit to the rotor.

17. The apparatus of any one of Claims 1-16, wherein the at least one chamber comprises a plurality of chambers mounted on the rotor in a spaced-apart relationship.

18. A disposable fluid path for use with a continuous flow centrifuge comprising a rotor having an outer periphery and front and rear opposite sides, the disposable fluid path comprising:

at least one chamber mounted on the rotor, each chamber having an inlet and an opposed outlet;

a flexible conduit curving around the outer periphery of the rotor and connecting to the rotor; and

first and second elongate spaced-apart passageways for each chamber extending through the conduit, wherein the first passageway is in fluid communication with the inlet of a respective chamber and the second passageway is in fluid communication with the outlet of the respective chamber.

19. The disposable fluid path of Claim 18, wherein the first and second passageways for each chamber comprise corresponding first and second flexible tubes that

extend through at least a major portion of a length of the conduit, the disposable fluid path further comprising potting material within the conduit, the potting material configured to hold the tubes in the spaced-apart relationship relative to one another.

20. The disposable fluid path of Claim 19, wherein the potting material is further configured to restrict movement of the tubes relative to the conduit and/or to restrict movement of the tubes relative to one another.

21. The disposable fluid path of Claim 18, wherein the conduit and passageways are integrated as a flexible extrusion with an outer wall and internal elongate channels that define the spaced-apart passageways.

22. The disposable fluid path of Claim 21, further comprising a sheath around the outer wall of the flexible extrusion.

23. An umbilical assembly for use with a continuous flow centrifuge having a rotor and at least one chamber having an inlet and an opposed outlet attached to the rotor, the assembly comprising:

a substantially rigid curvilinear guide tube extending about an outer periphery of the rotor;

a flexible conduit residing in the tube, the conduit including a plurality of elongate spaced-apart passageways therein, wherein the plurality of passageways includes first and second passageways for each chamber, wherein the first passageway is in fluid communication with the inlet of the at least one chamber and the second passageway is in fluid communication with the outlet of the at least one chamber, wherein the flexible conduit comprises a solid flexible material that substantially surrounds the passageways, the solid flexible material configured to hold the passageways in the spaced-apart relationship.

24. A disposable fluid path for use with a continuous flow centrifuge having a rotor, the disposable fluid path comprising:

a first disposable section including:

at least one chamber configured to be held on the rotor, wherein each chamber has an inlet and an opposed outlet;

a flexible conduit curving around an outer periphery of the rotor and connecting to the rotor; and

first and second elongate spaced-apart passageways for each chamber extending through the conduit, wherein the first passageway is configured to be in fluid communication with the inlet of a respective chamber and the second passageway is configured to be in fluid communication with the outlet of the respective chamber; and

a second disposable section including:

tubing in fluid communication with at least one container, wherein the tubing is configured pass through at least one valve.

25. The disposable fluid path of Claim 24, wherein the first disposable section includes return tubing in fluid communication with the at least one container.

26. The disposable fluid path of Claim 24, wherein the second disposable section includes return tubing in fluid communication with the at least one container.

27. The disposable fluid path of Claim 24, wherein the first and second disposable sections are configured to be connected using a sterile tube welding process.

28. The disposable fluid path of Claim 24, wherein each chamber comprises a flexible translucent or transparent fluid chamber, wherein the chamber comprises a substantially conical body portion, the chamber including a flange extending about at least a portion of a perimeter of the conical body portion, the flange including an inlet fluid path and an outlet fluid path, and wherein the first passageway is configured to connect with the flange inlet fluid path of a respective chamber and the second passageway is configured to connect with the flange outlet fluid path of the respective chamber.

29. The disposable fluid path of Claim 28, wherein the flange inlet and outlet fluid paths are substantially parallel along a segment extending from the point at which the first and second passageways are configured to connect with the flange inlet and outlet fluid paths.

30. A centrifugal fluid processing system, comprising:

a housing having an interior cavity with an access aperture extending from an external surface of the housing to the interior cavity;

a plurality of fluid chambers held in spaced apart relationship on a rotor in the interior cavity;

a flexible conduit including a plurality of elongate spaced-apart passageways therein, the flexible conduit extending from a location that is external to the housing through the access aperture and into the interior cavity, wherein the plurality of passageways includes first and second passageways for each chamber, wherein the first passageway is in fluid communication with an inlet of a respective chamber and the second passageway is in fluid communication with an opposed outlet of the respective chamber, wherein the flexible conduit comprises a solid flexible material that substantially fills an internal volume of the conduit and substantially surrounds the passageways, the solid flexible material configured to hold the passageways in the spaced-apart relationship;

a substantially rigid curvilinear guide tube holding a portion of the flexible conduit in the interior cavity; and

a drive mechanism configured to rotate the guide tube at a first speed and the rotor and the fluid chambers at a second speed, wherein the second speed is about twice the first speed.

31. The centrifugal fluid processing system of Claim 30, comprising:

a substantially funnel-shaped support with an open center passage, the support having a shape that tapers outward as it extends further into the interior cavity, wherein the support surrounds the flexible conduit with a centerline of the funnel shaped support being in line with a centerline of the access aperture.

32. The centrifugal fluid processing system of Claim 30, wherein the plurality of fluid chambers comprise a plurality of flexible translucent or transparent fluid chambers having an inlet and an opposed outlet held in spaced-apart relationship on a rotor in the interior cavity, wherein each chamber comprises a substantially conical body portion, each chamber including a flange extending about at least a portion of a perimeter of the conical body portion, the flange including an inlet fluid path and an outlet fluid path, wherein the flange inlet fluid path is in fluid communication with the inlet of the chamber and the flange outlet fluid path is in fluid communication with the outlet of the chamber;

wherein the plurality of passageways includes first and second passageways for each chamber, and wherein the first passageway is in fluid communication with the flange inlet fluid path of a respective chamber and the second passageway is in fluid communication with the flange outlet fluid path of the respective chamber;

the system further comprising a plurality of substantially rigid chamber holders in the interior cavity, each sized and configured to releasably hold a respective flexible chamber attached to the rotor.

33. A method of manipulating particles, comprising:

providing:

at least one chamber on a rotor having an outer periphery, each chamber having an inlet and an opposed outlet;

a flexible conduit with first and second spaced-apart passageways therein for each chamber, wherein the first passageway is in fluid communication with the inlet of a respective chamber and the second passageway is in fluid communication with the outlet of the respective chamber;

a substantially rigid curvilinear guide tube holding a portion of the conduit therein and curving around the outer periphery of the rotor;

rotating the rotor and the at least one chamber at a first speed, thereby creating a centrifugal force field;

rotating the guide tube and conduit therein at a second speed, wherein the second speed is about one-half the first speed, thereby inhibiting the first and second passageways for each chamber from fully twisting;

flowing media and particles into a respective chamber using the first passageway, wherein a continuous flow of media and particles creates a fluid force that substantially opposes the centrifugal force field, thereby immobilizing at least some of the particles in a fluidized bed in the respective chamber; and

flowing media out of the respective chamber and through the second passageway.