Claims

1. An alternating tangential flow pressure device comprising:

a filter system comprising a cylinder and a sphere coupled to a distal end of the cylinder, the sphere including first and second hemispheres and a diaphragm positioned between the first and second hemispheres, wherein the cylinder contains a filter;

a pneumatic cylinder having a proximal end and a distal end, and defining a chamber therebetween, the proximal end of the pneumatic cylinder is directly connected to the first hemisphere of the filter system and wherein the proximal end of the pneumatic cylinder comprises an opening to the chamber; and

a piston connecting linkage entering the pneumatic cylinder through the distal end thereof.

2. An alternating tangential flow pumping method comprising:

directly connecting a proximal end of a pneumatic cylinder to a distal end of a filter sphere base, the proximal end comprising a center opening, the pneumatic cylinder further comprising a distal end comprising a piston, and a chamber to the filter sphere base comprising a center opening, lining up the center opening of the proximal end of the pneumatic cylinder with the center opening of the filter sphere base;

activating the piston with a linear servo; and

moving the piston in and out of the pneumatic cylinder, creating positive and negative pressure.

3. The method of claim 2, further comprising tracking the movement of the piston by an encoder connected to the linear servo.

4. An alternating tangential flow pumping system comprising:

a first filter system and a second filter system, each of the first filter system and the second filter system including a hemisphere comprising a diaphragm, the first and second filter system each containing a filter and being connected to a source of liquid;

a pneumatic cylinder having a first end and a second end, and defining a chamber therebetween, the pneumatic cylinder being directly connected to the hemisphere of the first and second filter systems, the pneumatic cylinder including openings which lead to the chamber; and

a piston connecting linkage entering the pneumatic cylinder;

wherein the piston moves to provide pressure to the first filter system, creating an equal vacuum on the second filter system.

5. The device of claim 1, wherein the piston further comprises a linear servo.

6. The device of claim 5, wherein the linear servo further comprises an encoder.

7. The device of claim 6, wherein the position of the linear servo provides information as to actions occurring within the filter system.

8. The device of claim 5, wherein the linear servo controls speed and control of the piston movement, and then a PLC or PC command algorithm controls speed and control of the piston movement.

9. The method of claim 2, wherein the linear servo controls speed and control of the piston movement, and then a PLC or PC command algorithm controls speed and control of the piston movement.

10. The system of claim 4, wherein the piston further comprises a linear servo.

11. The system of claim 10, wherein the linear servo further comprises an encoder.

12. The system of claim 11, wherein the position of the linear servo provides information as to actions occurring within the filter system.

13. The system of claim 10, wherein the linear servo controls speed and control of the piston movement, and then a PLC or PC command algorithm controls speed and control of the piston movement.