

CLAIMS

What is claimed is

1. A fluid filtration assembly, comprising:
 - a filter housing having a first end for fluid connection with a fluid storage vessel;
 - a filter cartridge disposable within the filter housing; and
 - a plunger pump coupled at a second end of the filter housing, the plunger pump including a housing having a rigid portion and a flexible portion, the flexible portion having a plunger-engaging portion for coupling to the plunger of an actuator, the flexible portion selectively movable with respect to the rigid portion via the actuator.
2. The fluid filtration assembly of claim 1, wherein the flexible portion of the housing is movable between first and second positions via the actuator, wherein moving the flexible portion from the first position to the second position causes fluid in the housing to be expelled into the filter housing.
3. The fluid filtration assembly of claim 2, wherein moving the flexible portion from the second position to the first position causes fluid in the filter housing to be drawn into the housing.
4. The fluid filtration assembly of claim 1, wherein the plunger-engaging portion comprise a recess for receiving a rod portion of the actuator portion.

5. The fluid filtration assembly of claim 4, wherein the plunger-engaging portion is aligned with a center of the filter housing.
6. The fluid filtration assembly of claim 1, wherein the flexible portion is bell-shaped, accordion-shaped or bellows-shaped.
7. The fluid filtration assembly of claim 1, wherein the rigid portion and the flexible portion each have respective radially extending flanges, opposing face surfaces of the radially extending flanges contact each other and are clamped together via clamp portion.
8. The fluid filtration assembly of claim 1, wherein the flexible portion is connected to the rigid portion via overmolding of the flexible portion or by a mechanical connection.
9. The fluid filtration assembly of claim 1, wherein the actuator comprises a linear drive mechanism coupleable to the plunger pump.
10. The fluid filtration assembly of claim 1, wherein the rigid portion of the housing is integrally formed with the filter housing.
11. The fluid filtration assembly of claim 1, wherein the rigid portion of the housing is clamped to the filter housing.

12. The fluid filtration assembly of claim 1, wherein the filter cartridge is a hollow fiber filter or a membrane filter, and wherein the plunger pump is configured to generate alternating tangential flow of the fluid between the filter housing and the plunger pump.

13. A fluid filtration system, comprising:
a process vessel;
a filter housing having a first end in fluid communication with the process vessel;
a filter cartridge disposable within the filter housing; and
a plunger pump coupled at a second end of the filter housing, the plunger pump including a housing having a rigid portion and a flexible portion, the flexible portion having a plunger-engaging portion for coupling to the plunger of an actuator, the flexible portion selectively movable with respect to the rigid portion via the actuator.

14. The fluid filtration system of claim 13, wherein the flexible portion of the housing is movable between first and second positions via the actuator, wherein moving the flexible portion from the first position to the second position causes fluid in the housing to be expelled into the filter housing and the process vessel.

15. The fluid filtration system of claim 14, wherein moving the flexible portion from the second position to the first position causes fluid in the process vessel to be drawn into the filter housing.

16. The fluid filtration system of claim 13, wherein the plunger-engaging portion comprise a recess for receiving a rod portion of the actuator, the plunger-engaging portion being aligned with a center of the filter housing.
17. The fluid filtration system of claim 13, wherein the flexible portion is bell-shaped, accordion-shaped or bellows-shaped.
18. The fluid filtration system of claim 13, further comprising a linear encoder or other travel measuring device coupled to the plunger of the actuator for determining a position of the plunger.
19. The fluid filtration system of claim 18, further comprising a controller coupled to the actuator, the controller for controlling movement of the plunger of the actuator to controllably move the flexible portion of the housing.
20. The fluid filtration system of claim 19, wherein the controller comprises a processor executing instructions for controlling a stroke distance and a stroke rate of the plunger.
21. The fluid filtration system of claim 20, wherein the controller includes memory associated with the processor, the memory including predetermined stroke distance and stroke rate values associated with specific filter and pump sizes.

22. The fluid filtration system of claim 13, wherein the filter cartridge is a hollow fiber filter or a membrane filter, and wherein the plunger pump is configured to generate alternating tangential flow of the fluid between the filter housing and the plunger pump.

23. A fluid filtration system, comprising:

- first and second process vessels;
- a first filter housing having a first end in fluid communication with the first process vessel;
- a second filter housing having a first end in fluid communication with the second process vessel;
- a first plunger pump coupled to a second end of the first filter housing;
- a second plunger pump coupled to a second end of the second filter housing;
- wherein each of the first and second plunger pumps includes a housing having a rigid portion and a flexible portion, the flexible portion having a plunger-engaging portion for coupling to the plunger of an actuator, the flexible portion selectively movable with respect to the rigid portion via the actuator; and
- a controller in communication with the actuator for simultaneously actuating the first and second plunger pumps to cycle fluid between the first and second plunger pumps and the first and second process vessels.

24. The fluid filtration system of claim 23, wherein the controller comprises a processor executing instructions for controlling a stroke distance and a stroke rate of the first and second plunger pumps.

25. The fluid filtration system of claim 24, wherein the controller includes memory associated with the processor, the memory including predetermined stroke distance and stroke rate values associated with specific filter and pump sizes.
26. The fluid filtration system of claim 23, wherein the first and second plunger pumps are configured to generate alternating tangential flow of the fluid between the first and second filter housings and the first and second plunger pumps, respectively.