

sliding vane construction having non-deformable components including a housing having a central cavity forming an internal sidewall, a rotor eccentrically positioned within said cavity and said rotor having a plurality of radially aligned slots at said rotor's periphery, vanes slideably positioned in said slots to slide in and out of said slots so as to seal with the cavity's internal sidewall creating vane chambers that pump dialysate through said dialysate flow path; and a third pump including a third pump motor and a third pump actuator connected to said blood flow path for pumping blood through said blood flow path, said third pump actuator including a sliding vane construction having non-deformable components including a housing having a central cavity forming an internal sidewall, a rotor eccentrically positioned within said cavity and said rotor having a plurality of radially aligned slots at said rotor's periphery, vanes slideably positioned in said slots to slide in and out of said slots so as to seal with the cavity's internal sidewall creating vane chambers that pump blood through said blood flow path; a processor connected to said first, second and third pump motors for controlling operation of said pump motors; and a reusable dialysis machine and a disposable cartridge wherein said disposable cartridge is connectable and disconnectable to said reusable dialysis machine; and said first, second and third pump motors are positioned with said reusable dialysis machine and said first, second and third pump actuators are positioned with said disposable cartridge .

[017] According to embodiments of the invention, a hemodialysis system is provided including an arterial blood line for connecting to a patient's artery for collecting blood from a patient, a venous blood line for connecting to a patient's vein for returning blood to a patient, a reusable dialysis machine and a disposable cartridge. Embodiments of the the present invention provide for a cartridge for use in a hemodialysis machine.

[018] The arterial blood line and venous blood line may be typical constructions known to those skilled in the art. For example, the arterial blood line may be traditional flexible hollow tubing connected to a needle for collecting blood from a patient's artery. Similarly, the venous blood line may be a traditional flexible tube and needle for returning blood to a patient's vein.

internal sidewall creating vane chambers that pump dialysate through said dialysate flow path; and

a third pump including a third pump motor and a third pump actuator connected to said blood flow path for pumping blood through said blood flow path, said third pump actuator including a sliding vane construction having non-deformable components including a housing having a central cavity forming an internal sidewall, a rotor eccentrically positioned within said cavity and said rotor having a plurality of radially aligned slots at said rotor's periphery, vanes slideably positioned in said slots to slide in and out of said slots so as to seal with the cavity's internal sidewall creating vane chambers that pump blood through said blood flow path;

a processor connected to said first, second and third pump motors for controlling operation of said pump motors; and

a reusable dialysis machine and a disposable cartridge wherein said disposable cartridge is connectable and disconnectable to said reusable dialysis machine;

and said first, second and third pump motors are positioned with said reusable dialysis machine and said first, second and third pump actuators are positioned with said disposable cartridge.

2. The hemodialysis system of claim 1 further comprising at least one pressure sensor which measures pressure within the dialysate flow path and at least one pressure sensor which measures pressure within the blood flow path, and wherein said dialyzer includes a semipermeable membrane that separates said blood flow path and said dialysate flow path, and said processor monitors said pressure sensors and controls said pump motors so as to maintain a predetermined pressure differential across said semipermeable membrane.

3. The hemodialysis system of claim 2 wherein said processor maintains said pressure differential within the dialyzer of the blood flow path relative to dialysate flow path at about zero.

4. The hemodialysis system of claim 2 wherein said processor maintains said pressure differential within the dialyzer of the blood flow path relative to dialysate flow path above zero to provide ultrafiltration.
5. The hemodialysis system of claim 1 wherein said first, second and third pump motors are electric rotary motors.