CLAIMS

1. A gas recirculation system for use in an endoscopic surgical procedure, the system comprising:

a pump comprising:

a motor; and

a pump cartridge coupled to the motor, wherein the pump cartridge includes a gas input connection and a gas output connection, wherein the pump cartridge is detachable from the motor, and wherein the pump cartridge is sealed such that a gas within the pump cartridge cannot contact the motor, wherein the pump cartridge includes a first chamber in fluid communication with the gas input connection and a second chamber in fluid communication with the gas output connection, wherein a diaphragm is disposed between the first chamber and the second chamber;

a first tube in fluid communication with the gas input connection, wherein the first tube is configured to be connectable to surgical equipment that is insertable into a peritoneal cavity; and

a second tube in fluid communication with the gas output connection, wherein the second tube is configured to be connectable to surgical equipment that is insertable into a peritoneal cavity;

wherein the pump is configured to draw gas into the gas input connection from a peritoneal cavity through the first tube and to discharge gas out of the gas output connection and into a peritoneal cavity through the second tube;

a first valve in fluid communication with the gas input connection and a second valve in fluid communication with the gas output connection, wherein the first valve prevents gas exiting the pump cartridge via the gas input connection and wherein the second valve prevents gas entering the pump cartridge via the gas output connection;

wherein the diaphragm is arranged in relation to the first valve and the second valve such that movement of the diaphragm away from the first valve and the second valve opens the first valve and closes the second valve, and wherein the diaphragm is arranged in relation to the first valve and the second valve such that movement of the diaphragm towards the first valve and the second valve closes the first valve and opens the second valve.

2. The gas recirculation system of claim 1, wherein the diaphragm is operable to shift from a first position to a second position in order to draw a gas into the pump cartridge through the gas input connection and discharge gas out of the pump cartridge through the gas output connection.

3. The gas recirculation system of claim 1, wherein the pump cartridge is disposable.

4. The gas recirculation system of claim 1, further comprising a third valve in fluid communication with the gas input connection through the first tube and a fourth valve in fluid communication with the gas output connection through the second tube, wherein the third and fourth valves automatically close when disconnected.

5. The gas recirculation system of claim 1, further comprising a filter in fluid communication with the gas input connection or the gas output connection.

6. The gas recirculation system of claim 1, further comprising a fluid trap in fluid communication with the gas input connection or the gas output connection.

7. The gas recirculation system of claim 6, wherein the fluid trap is operable to absorb liquid droplets from a gas traversing the fluid trap and release moisture to the gas traversing the fluid trap.

8. The gas recirculation system of claim 7, wherein the gas traversing the fluid trap maintains a relative humidity in the range of 50% to 70%.

9. The gas recirculation system of claim 1, wherein the system is operable to achieve gas flow rates in the range of 4 and 10 liters per minute.

10. The gas recirculation system of claim 1, further comprising a controller, wherein the controller is operable to detect a fault condition based on an amount of power delivered to the motor.

11. The gas recirculation system of claim 10, wherein the fault condition is selected from the group consisting of:

a disconnection in a gas circuit within the gas recirculation system;

a blockage in a gas circuit within the gas recirculation system;

a motor fault.

12. The gas recirculation system of claim 10, further comprising a user interface connected to the controller.

13. The gas recirculation system of claim 1, configured to communicate with an insufflator.

14. The gas recirculation system of claim 13, wherein the gas recirculation system is configured to be controlled by the insufflator.

15. The gas recirculation system of claim 1, wherein the gas recirculation system is located within an insufflator and utilizes a power supply, a processor, and a user interface of the insufflator.

16. The gas recirculation system of claim 1, wherein the motor has a rotatable motor shaft, the gas recirculation system further comprising:

a coupling arm rotatably coupled to the motor shaft;

a coupling shaft extending from the coupling arm;

a locating pin extending from the coupling arm, wherein the locating pin is configured to move within a slot as the motor shaft rotates such that the coupling shaft remains within a plane as the motor shaft rotates.

17. A medical system for use in an endoscopic surgical procedure, the system comprising:

an insufflator configured to provide gas to a peritoneal cavity;

an insufflation tube in fluid communication with the insufflator, wherein the insufflation tube is configured to be connectable to surgical equipment that is insertable into a peritoneal cavity;

a gas recirculation system comprising:

a pump comprising:

a motor; and

a pump cartridge coupled to the motor, wherein the pump cartridge includes a gas input connection and a gas output connection, wherein the pump cartridge is detachable from the motor, and wherein the pump cartridge is sealed such that a gas within the pump cartridge cannot contact the motor, wherein the pump cartridge includes a first chamber in fluid communication with the gas input connection and a second chamber in fluid communication with the gas output connection, wherein a diaphragm is disposed between the first chamber and the second chamber;

a first tube in fluid communication with the gas input connection, wherein the first tube is configured to be connectable to surgical equipment that is insertable into a peritoneal cavity; and

a second tube in fluid communication with the gas output connection, wherein the second tube is configured to be connectable to surgical equipment that is insertable into a peritoneal cavity;

wherein the pump is configured to draw gas into the gas input connection from a peritoneal cavity through the first tube and to discharge gas out of the gas output connection and into a peritoneal cavity through the second tube;

a first valve in fluid communication with the gas input connection and a second valve in fluid communication with the gas output connection, wherein the first valve prevents gas exiting the pump cartridge via the gas input connection and wherein the second valve prevents gas entering the pump cartridge via the gas output connection;

wherein the diaphragm is arranged in relation to the first valve and the second valve such that movement of the diaphragm away from the first valve and the second valve opens the first valve and closes the second valve, and wherein the diaphragm is arranged in relation to the first valve and the second valve such that movement of the diaphragm towards the first valve and the second valve closes the first valve and opens the second valve;

wherein the insufflator and the gas recirculation system are configured to recirculate gas from the peritoneal cavity and to maintain a pressure within the peritoneal cavity.