ARTICLE 34 AMENDMENTS 2013-04-30

CLAIMS

1. A peristaltic pump for use in sterilising the lumen of an endoscope in a sterilisation compartment of a sterilisation apparatus, the pump comprising:

a flexible pump hose having an outlet end and an inlet end, and an electrically conductive fitting at each end in contact with fluid in the pump hose;

a motor-driven impeller disposed in relation to the pump hose such that when the impeller is driven it will intermittently bear against the pump hose so as to bring the internal walls of the pump hose together;

a first electrode in contact with the conductive fitting at the outlet end of the pump hose, and a second electrode in contact with the conductive fitting at the inlet end of the pump hose;

means for applying a voltage across the first and second electrodes; and

means for measuring an electrical property between the conductive fittings;

wherein when the outlet end of the pump hose is connected to one end of an endoscope having a lumen to be sterilised and immersed in a conductive sterilant liquid in the sterilisation compartment, and the inlet end of the pump hose is in connection with the sterilant liquid in the sterilisation compartment, the only conductive path that will exist between the first electrode and the second electrode when the pump is operated, apart from *via* the pump hose, will be *via* the lumen of the endoscope.

2. A pump according to claim 1, wherein the impeller is mounted for rotary motion and wherein when the impeller is rotated at least one point exists at which the pump hose is incompletely occluded so that a fluid path exists through the pump hose from the inlet end to the outlet end.

3. A pump according to claim 1 or claim 2, wherein the impeller is arranged and adapted intermittently to bring the internal walls of the pump hose together to

make a substantially fluid-tight seal.

4. A pump according to any preceding claim , further comprising means for signalling an error condition if the measured electrical property is outside a specified value range.

5. A pump according to any preceding claim, further comprising means for measuring the load current of the motor and means for determining whether a blockage is present depending on the measured load current.

6. A pump according to any preceding claim, further comprising an outlet hose for connecting the outlet end of the pump hose to an instrument to be sterilised; wherein the outlet hose is in two parts connected together by an electrically conductive connector.

7. A pump according to any preceding claim, further comprising an inlet hose connected to the inlet end of the pump hose, for immersion in a source of sterilant liquid; the inlet hose being provided with an electrically conductive fitting at its free end.

8. Sterilisation apparatus comprising a container having a sterilisation compartment for receiving an item to be sterilised, and a peristaltic pump as claimed in any preceding claim, for pumping a sterilant liquid to and from the sterilisation compartment.

9. Apparatus according to claim 8, further comprising an electronic controller for operating a drainage valve to allow fluid to drain from the sterilisation compartment after a predetermined time period; the controller being linked to the pump in a manner which permits the controller to control one or more operating modes of the pump.

10. Apparatus according to claim 9, wherein the controller is arranged and

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adapted to receive data from the pump.

11. A method of using the apparatus of any of claims 8-10 for sterilising an endoscope having a lumen, the method including the steps of:

placing the endoscope in the sterilisation compartment;

connecting the outlet end of the pump hose to one end of the endoscope to establish a fluid connection between the pump hose and the lumen;

filling the sterilisation compartment with a sterilant liquid;

providing the inlet end of the pump hose with an inlet hose, and disposing the free end of the inlet hose in the sterilant liquid within the sterilisation compartment;

operating the pump so that the impeller causes fluid to be pumped through the lumen of the endoscope and causes fluid to be drawn into the free end of the inlet hose; and

measuring an electrical property between the conductive fittings of the pump hose.

12. A method according to claim 11, further comprising the steps of:

comparing the measured electrical property with a predetermined value range; and

signalling an error condition if the measured property is outside the value range.

13. A method according to claim 11 or claim 12, further comprising measuring the load current of the motor and determining from the measured value whether:
(i) the pump is operating normally, or
(ii) a blockage is present within the endoscope or one of the hoses; or
(iii) the motor has stalled.

14. A method according to claim 13, further comprising triggering an alarm or error signal if a blockage is detected or if the motor has stalled.

15. A method according to any of claims 11-14, wherein the outlet end of the pump hose is connected to the endoscope via a Luer connection which is electrically conductive, and wherein the free end of the inlet hose is provided with a strainer to filter particulates from fluid entering the inlet hose.

CLAIMS

1. A peristaltic pump for use in sterilising a lumen of an endoscope in a sterilisation compartment of a sterilisation apparatus, the pump comprising:

a flexible pump hose having an outlet end and an inlet end, and an electrically conductive fitting at each end in contact with fluid in the pump hose;

a motor-driven impeller disposed in relation to the pump hose such that when the impeller is driven it will intermittently bear against the pump hose so as to bring the internal walls of the pump hose together;

a first electrode in contact with the conductive fitting at the outlet end of the pump hose, and a second electrode in contact with the conductive fitting at the inlet end of the pump hose;

circuitry for applying a voltage across the first and second electrodes; and

circuitry for measuring an electrical property between the conductive fittings;

wherein when the outlet end of the pump hose is connected to one end of the endoscope having the lumen to be sterilised and immersed in a conductive sterilant liquid in the sterilisation compartment, and the inlet end of the pump hose is in connection with the sterilant liquid in the sterilisation compartment, the only conductive path that will exist between the first electrode and the second electrode when the pump is operated, apart from *via* the pump hose, will be *via* the lumen of the endoscope.

2. The pump according to claim 1, wherein the impeller is mounted for rotary motion and wherein when the impeller is rotated at least one point exists at which the pump hose is incompletely occluded so that a fluid path exists through the pump hose from the inlet end to the outlet end.

3. The pump according to claim 1, wherein the impeller is arranged and adapted intermittently to bring the internal walls of the pump hose together to make a substantially fluid-tight seal.

4. The pump according to claim 1, further comprising circuitry for signalling an error condition if the measured electrical property is outside a specified value range.

5. The pump according to claim 1, further comprising circuitry for measuring a load current of the motor and circuitry for determining whether a blockage is present depending on the measured load current.

6. The pump according to claim 1, further comprising an outlet hose for connecting the outlet end of the pump hose to the endoscope to be sterilised; wherein the outlet hose is in two parts connected together by an electrically conductive connector.

7. The pump according to claim 1, further comprising an inlet hose connected to the inlet end of the pump hose, for immersion in a source of sterilant liquid; the inlet hose being provided with an electrically conductive fitting at its free end.

8. A sterilisation apparatus comprising the container having the sterilisation compartment for receiving the endoscope to be sterilised, and the peristaltic pump as claimed in claim 1, for pumping the sterilant liquid to and from the sterilisation compartment.

9. The apparatus according to claim 8, further comprising an electronic controller for operating a drainage valve to allow fluid to drain from the sterilisation compartment after a predetermined time period; the controller being linked to the pump in a manner which permits the controller to control one or more operating modes of the pump.

10. The apparatus according to claim 9, wherein the controller is arranged and adapted to receive data from the pump.

11. A method of using the apparatus of claim 8 for sterilising the endoscope having the lumen, the method including the steps of:

placing the endoscope in the sterilisation compartment;

connecting the outlet end of the pump hose to the one end of the endoscope to establish a fluid connection between the pump hose and the lumen;

filling the sterilisation compartment with the sterilant liquid;

providing the inlet end of the pump hose with an inlet hose, and disposing the free end of the inlet hose in the sterilant liquid within the sterilisation compartment;

operating the pump so that the impeller causes fluid to be pumped through the lumen of the endoscope and causes fluid to be drawn into the free end of the inlet hose; and

measuring the electrical property between the conductive fittings of the pump hose.

12. The method according to claim 11, further comprising the steps of:

comparing the measured electrical property with a predetermined value range; and

signalling an error condition if the measured property is outside the value range.

13. The method according to claim 11, further comprising measuring a load current of the motor and determining from the measured value whether:

(i) the pump is operating normally, or

(ii) a blockage is present within the endoscope or one of the hoses; or

(iii) the motor has stalled.

14. The method according to claim 13, further comprising triggering an alarm or error signal if the blockage is detected or if the motor has stalled.

15. The method according to claim 11, wherein the outlet end of the pump hose is connected to the endoscope via a Luer connection which is electrically conductive, and wherein the free end of the inlet hose is provided with a strainer to filter particulates from fluid entering the inlet hose.