mixing of sludge with the fuel. The bottom of a settling tank preferably slopes towards a sludge drain, and pump suction should not be not in the vicinity of the sludge space. The temperature in settling tanks should be as high as possible, to help the solids to settle. However, the temperature should be below 75 degrees Celsius, to avoid the formation of asphaltenes, and should be no lower than 7 degrees Celsius above the "pour point" of the fuel, to ensure pumpability. The pour point is the lowest temperature at which the fuel just flows thanks to its own weight.

[0005] A service tank is a fuel tank that contains a quantity of fuel ready for immediate use. Typically, at least one service tank per fuel to be used on board, necessary for propulsion and generator systems, is provided. A service tank should preferably have capacity for sufficient fuel to enable at least eight hours of operation, at sea, and at maximum continuous rating of the propulsion plant and/or generating plant associated with that service tank.

[0006] Centrifugal separators must operate for prolonged periods of time (or constantly) to separate water from oil, due to the similar densities of the water and oil. The energy required to power the centrifugal separators of a typical large marine vessel for a year is considerable, and may for example equate to that present in approximately 300 tonnes of HFO. Furthermore, approximately 1% of HFO processed by a centrifugal separator is contained in the sludge waste product it creates. Such sludge cannot be burnt and must be disposed of in an environmentally friendly manner.

[0007] Embodiments of the present invention aim to enable sufficient decontamination of fuel for an engine of a marine vessel while addressing the aforementioned problems.

SUMMARY

[0007a] A first aspect of the present invention provides a fuel system for an engine of a marine vessel, the fuel system comprising:

a settling tank for cleaning fuel for the engine;

a service tank for storing fuel for the engine; and

a filtration system comprising a first filter, wherein the settling tank is fluidly connected to the service tank via the first filter, and wherein the first filter is configured to remove contaminants from fuel flowing from the settling tank to the service tank; and

wherein the filtration system is configured to be operable in a first mode in which the first filter removes the contaminants from fuel flowing from the settling tank to the service tank, and in a second mode in which fuel filtered by the filtration system flows through the first filter to dislodge the contaminants from the first filter.

[0008]

[0009] Optionally, the filtration system comprises a second filter for removing the dislodged contaminants from fuel that has passed through the first filter when the filtration system is operating in the second mode.

[0010] Optionally, the second filter comprises a pleated textile filter.

[0011] Optionally, the first filter is connected to the settling tank via the second filter, whereby fuel from which the second filter has removed the dislodged contaminants is returnable to the settling tank.

[0012] Optionally, the filtration system comprises a collector for collecting the contaminants removed by the second filter.

[0013] Optionally, the collector is removable from the filtration system.

[0014] Optionally, the collector comprises a cartridge that is insertable in the second filter.

[0015] Optionally, the fuel system comprises a pump for pumping fuel through the second filter. Optionally, the pump for pumping fuel through the second filter is for pumping fuel through the second filter when the filtration system is operating in the second mode.

[0016] Optionally, the filtration system is configurable to create a circuit so that the pump for pumping fuel through the second filter is able to cause fuel to be passed through the second filter and back to the pump for pumping fuel through the second filter plural times. Optionally, the circuit is isolated from the first filter, so that the filtration system is

operable in the first mode while the pump for pumping fuel through the second filter is causing fuel to be passed through the second filter and back to the pump for pumping fuel through the second filter plural times.

[0017] Optionally, the fuel system comprises a pump for pumping fuel from the service tank through the first filter when the filtration system is operating in the second mode.

[0018] Optionally, the service tank is connected to the first filter via the pump for pumping fuel from the service tank through the first filter.

[0019] Optionally, the fuel system comprises a valve through which fuel flowing from the settling tank to the first filter passes, and the valve is for controlling fuel flow from the first filter towards the settling tank.

[0020] Optionally, the filtration system is configured so that the valve is closed to prevent or hinder fuel flow from the first filter towards the settling tank, when the filtration system is operating in the second mode.

[0021] Optionally, the fuel system comprises a filtration system controller for controlling the filtration system.

[0022] Optionally, the filtration system comprises a sensor configured to detect a condition of the first filter or a parameter of fuel at a location between the first filter and the service tank, and to send a signal to the filtration system controller on the basis of the condition or parameter detected.

[0023] Optionally, the filtration system controller is configured to cause the filtration system to operate in the second mode on the basis of the signal.

[0024] A second aspect of the present invention provides a marine vessel comprising the fuel system of the first aspect of the present invention.

[0025] A third aspect of the present invention provides a method of operating a filtration system of a fuel system for an engine of a marine vessel, the method comprising: causing the filtration system to operate in a first mode whereby fuel flows from a settling tank of the fuel system to a service tank of the fuel system via a first filter of the filtration system, the first filter being for removing contaminants from the fuel; and causing the filtration system to operate in a second mode whereby fuel filtered by the filtration system flows through the first filter to dislodge the contaminants from the first filter.

[0026] Optionally, the causing the filtration system to operate in the first mode comprises causing operation of a pump to pump fuel from the settling tank to the service tank via the first filter.

[0027] Optionally, the method comprises receiving a signal indicative of a fuel pressure at a location between the first filter and the service tank.

[0028] Optionally, the method comprises receiving the signal while the filtration system is operating in the first mode.

[0029] Optionally, the method comprises causing closure of a valve to prevent or hinder fuel flow from the first filter towards the settling tank, when it is determined that the fuel pressure is less than a predetermined threshold fuel pressure.

[0030] Optionally, the causing the filtration system to operate in the second mode comprises causing operation of a pump to pump fuel from the service tank through the first filter to dislodge the contaminants from the first filter.

[0031] Optionally, the causing the filtration system to operate in the second mode comprises causing the contaminants that have been dislodged from the first filter and the fuel that has passed through the first filter when the filtration system is operating in the second mode to pass through a second filter of the filtration system, the second filter being for removing the dislodged contaminants from the fuel.

[0032] Optionally, the causing the filtration system to operate in the second mode comprises causing fuel from which the second filter has removed the dislodged contaminants to be returned to the settling tank.

[0033] A fourth aspect of the present invention provides a non-transitory computer-readable storage medium storing instructions that, if executed by a processor of a filtration system controller, cause the processor to carry out the method of the third aspect of the present invention.

[0033a] A fifth aspect of the present invention provides use of a filtration system in a fuel system for an engine of a marine vessel to, in a first mode, remove contaminants from fuel flowing from a settling tank of the fuel system to a service tank of the fuel system using a first filter of the filtration system, and, in a second mode, to dislodge the contaminants from the first filter using fuel filtered by the filtration system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

[0035] Figure 1 shows a schematic side view of an example of a marine vessel according to an embodiment of the present invention;

[0036] Figure 2 shows a schematic view of an example of a fuel system according to an embodiment of the present invention;

[0037] Figure 3 shows a schematic view of an example of a fuel system according to another embodiment of the present invention;

[0038] Figure 4 shows a flow chart illustrating an example of a method of operating a filtration system according to an embodiment of the present invention; and

[0039] Figure 5 shows a flow chart illustrating an example of another method of operating a filtration system according to an embodiment of the present invention.

CLAIMS:

1. A fuel system for an engine of a marine vessel, the fuel system comprising:

a settling tank for cleaning fuel for the engine;

a service tank for storing fuel for the engine; and

a filtration system comprising a first filter, wherein the settling tank is fluidly connected to the service tank via the first filter, and wherein the first filter is configured to remove contaminants from fuel flowing from the settling tank to the service tank; and

wherein the filtration system is configured to be operable in a first mode in which the first filter removes the contaminants from fuel flowing from the settling tank to the service tank, and in a second mode in which fuel filtered by the filtration system flows through the first filter to dislodge the contaminants from the first filter.

2. The fuel system of claim 1, comprising a backflush pump for pumping fuel through the first filter when the filtration system is operating in the second mode.

3. The fuel system of claim 2, wherein the backflush pump is upstream of the first filter when the filtration system is operating in the second mode.

4. The fuel system of any one of claims 1 to 3, wherein the first filter comprises a series of filters.

5. The fuel system of any one of claims 1 to 4, comprising a fuel pump for pumping fuel from the settling tank through the first filter to the service tank when the filtration system is operating in the first mode.

6. The fuel system of any one of claims 1 to 5, comprising a valve through which fuel flowing from the settling tank to the first filter passes in use, wherein the valve is for controlling fuel flow from the first filter towards the settling tank.

7. The fuel system of claim 6, wherein the filtration system is configured so that the valve is closed to prevent or hinder fuel flow from the first filter towards the settling tank, when the filtration system is operating in the second mode.

8. The fuel system of any one of claims 1 to 7, wherein the filtration system comprises a second filter for removing the dislodged contaminants from fuel that has passed through the first filter when the filtration system is operating in the second mode.

9. The fuel system of claim 8, wherein the filtration system comprises a collector for collecting the contaminants removed by the second filter.

10. The fuel system of claim 8 or claim 9, comprising a pump for pumping fuel through the second filter.

11. The fuel system of claim 10, wherein the filtration system is configurable to create a circuit so that the pump for pumping fuel through the second filter is able to cause fuel to be passed through the second filter and back to the pump for pumping fuel through the second filter plural times.

12. The fuel system of claim 11, wherein the circuit is isolated from the first filter, so that the filtration system is operable in the first mode while the pump for pumping fuel through the second filter is causing fuel to be passed through the second filter and back to the pump for pumping fuel through the second filter plural times.

13. The fuel system of any one of claims 1 to 12, wherein the filtration system is according to any one of claims 8 to 12, and wherein the first filter is connected to the settling tank via the second filter, whereby fuel from which the second filter has removed the dislodged contaminants is returnable to the settling tank.

14. The fuel system of claim 2 or any claim dependent thereon, wherein the service tank is connected to the first filter via the backflush pump.

15. The fuel system of any one of claims 1 to 14, comprising a filtration system controller for controlling the filtration system.

16. The fuel system of claim 15, wherein the filtration system comprises a sensor configured to detect a condition of the first filter or a parameter of fuel at a location between the first filter and the service tank and to send a signal to the filtration system controller on the basis of the condition or parameter detected, and

wherein the filtration system controller is configured to cause the filtration system to operate in the second mode on the basis of the signal.

17. A marine vessel comprising the fuel system of any one of claims 1 to 16.

18. A method of operating a filtration system of a fuel system for an engine of a marine vessel, the method comprising:

causing the filtration system to operate in a first mode whereby fuel flows from a settling tank of the fuel system to a service tank of the fuel system via a first filter of the filtration system, the first filter being for removing contaminants from the fuel; and

causing the filtration system to operate in a second mode whereby fuel filtered by the filtration system flows through the first filter to dislodge the contaminants from the first filter.

19. A non-transitory computer-readable storage medium storing instructions that, if executed by a processor of a filtration system controller, cause the processor to carry out the method of claim 18.

20. Use of a filtration system in a fuel system for an engine of a marine vessel to, in a first mode, remove contaminants from fuel flowing from a settling tank of the fuel system to a service tank of the fuel system using a first filter of the filtration system, and, in a second mode, to dislodge the contaminants from the first filter using fuel filtered by the filtration system.