

FUELING APPARATUS

BACKGROUND OF THE INVENTION

1. Technical Field of the Invention

[0001] The present invention relates to a fueling apparatus for supplying fuel oil to automobiles, and more particularly to a fueling apparatus having a function of detecting intermixture of water in fuel oil.

2. Description of the Related Art

[0002] In gas stations, fuel oil supplied to automobiles from fueling apparatus is stored in oil storage tanks. Since these oil storage tanks are buried underground in the gas stations, water generated by dew condensation of water vapor in the air may be mixed in fuel oil in the oil storage tank and groundwater may permeate the oil storage tank because of corrosion of the oil storage tank. In addition, since the oil storage tank and the fueling apparatus are connected with each other through oil lines buried underground, when a small hole opens in the oil storage tank by the corrosion, the groundwater will be sucked through this small hole and the water will be mixed in the fuel oil.

[0003] Then, when fuel oil in which water is mixed is supplied to automobiles, it may cause a major accident such as engine breakage by poor combustion. In view of the situation described above, a fueling apparatus with a function of detecting intermixture of water in fuel oil has been desired.

[0004] Here, it is possible to detect whether a water is mixed in a fuel oil or not with various sensors. However, the fuel oil treated with fueling apparatus is inflammable, and a fuel oil supply system including a pump unit and a flowmeter is arranged in an area where steam of fuel oil exists, what is called a dangerous area, so that the various sensors should be in the dangerous area also. Therefore, when transmitting detection

results of the sensors through electric signal, there exists a problem that the sensors and an electric device for processing the detection results of the sensors must be explosion-proof to prevent sparking. Since the sensors and the electric device with explosion-proof structure become large, it is difficult to install them in a narrow case of a fueling apparatus.

[0005] As another conventional art exists a technique in which a fueling control device and an indicator for amount of oil supply, the both of which are not provided with explosion-proof structure, are disposed in an area where steam of fuel oil is not filled (non-dangerous area) (refer to Patent document 1).

[0006] However, it is necessary to mount the sensor for detecting intermixture of water in fuel oil in the fuel oil supply system, and the fuel oil supply system is arranged in the dangerous area where steam of fuel oil exists. Therefore, in the conventional art mentioned above also, the sensor for detecting intermixture of water in fuel oil is required to be explosion-proof, and the problem mentioned above is not solved.

[0007] Patent document 1: Japanese Patent Publication Heisei 11-106000 gazette

BRIEF SAMMARY OF THE INVENTION

[0008] The present invention has been made in consideration of the above problems in the conventional art, and the object thereof is to provide a fueling apparatus that can detect intermixture of water in fuel oil and does not necessitate a sensor for intermixture of water in fuel oil to be explosion-proof.

[0009] To achieve the above object, a fueling apparatus according to the present invention is characterized by comprising: a detection sensor having a detecting portion for detecting whether a water is mixed in a fuel oil or not, the detecting portion disposed in a dangerous area; and a device for processing an optical signal from the

detecting portion of the detection sensor, the device disposed in non-dangerous area.

[0010] With this invention, since no electric signal is used in the dangerous area, no spark is generated, which does not necessitate the detecting portion of the detection sensor to be explosion-proof.

[0011] In the fueling apparatus, the detection sensor can be provided with an optical fiber having the detecting portion at a tip of the sensor, and a portion of the optical fiber where penetrates into a boundary portion between the dangerous area and the non-dangerous area is sealed with a cable clamp. With this, a vapor of fuel oil in the dangerous area can be prevented from permeating the non-dangerous area.

[0012] The fueling apparatus described above may further comprise: a sealed equipment case whose inside is the dangerous area; a flowmeter disposed in the equipment case; a fueling pipe connected to the flowmeter, an environment of the fueling pipe being the dangerous area; a fueling hose connected to the fueling pipe through a connecting portion; a fueling nozzle disposed at a tip of the fueling hose; a sealed indicator case whose inside is the non-dangerous area; and a fueling control device, an indicator, a control device for detecting intermixture of water and a photoelectric conversion device that are installed in the indicator case; wherein the optical fiber is connected to the photoelectric conversion device and extends from the indicator case into the dangerous area, and a portion where the optical fiber penetrates into the boundary portion between the dangerous area and the indicator case is sealed with a cable clamp. It is not necessary to apply explosion-proof structure to the control device for detecting intermixture of water and the photoelectric conversion device in the indicator case, which enables flexible layout placement of various devices.

[0013] The fueling apparatus may further comprise: an oil line connecting an oil storage tank disposed underground and the flowmeter with each other; and a pump

unit mounted to the oil line, wherein the detecting portion is disposed between the pump unit and the connecting portion of the fueling pipe to the fueling hose. In this position where the detecting portion is disposed, fuel oil and water are uniformly mixed with each other by the pump unit to become cloudy (condition that water exists in fuel oil as fine particles), so that it becomes easy to detect intermixture of water in fuel oil.

[0014] The fueling apparatus may further comprise: an oil line connecting an oil storage tank disposed underground and the flowmeter with each other; and a submersible pump mounted to the oil line in the oil storage tank, wherein the detecting portion is disposed between the submersible pump and the connecting portion of the fueling pipe to the fueling hose.

[0015] The fueling apparatus may further comprise: an agitator mounted to the oil line between the submersible pump and the flowmeter, wherein the detecting portion is disposed between the agitator and the connecting portion of the fueling pipe to the fueling hose. In this position where the detecting portion is disposed, fuel oil and water are uniformly mixed with each other by the agitator to become cloudy, which makes it easy to detect intermixture of water in fuel oil.

[0016] As mentioned above, with the present invention, it is possible to provide a fueling apparatus capable of detecting intermixture of water in fuel oil without requiring explosion-proof structure for a detecting sensor for detecting intermixture of water in fuel oil.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. 1 is a fragmentary sectional front view showing a fueling apparatus according to the first embodiment of the present invention.

FIG. 2 is an enlarged sectional view for explaining a condition that a cable

clamp, which is used in the fueling apparatus shown in FIG. 1, is attached.

FIG. 3 is a perspective view exemplarily showing a condition that a detecting portion at a tip of an optical fiber is attached to a pump unit used in the fueling apparatus shown in FIG. 1.

FIG. 4 is an enlarged sectional view showing a portion where a detecting portion at a tip of an optical fiber is attached to the pump unit shown in FIG. 3.

FIG. 5 is a characteristic graph used for detecting intermixture of water in fuel oil.

FIG. 6 is a block diagram of a controlling device of the fueling apparatus according to the present invention used for detecting whether water is mixed in a fuel oil or not while utilizing the characteristic shown in FIG. 5.

FIG. 7 is a flowchart showing a control of the fueling apparatus according to the present invention used for detecting whether water is mixed in a fuel oil or not while utilizing the characteristic shown in FIG. 5.

FIG. 8 is a fragmentary sectional front view showing a fueling apparatus according to the second embodiment of the present invention.

FIG. 9 is an enlarged sectional view showing a portion where a detecting portion at a tip of an optical fiber is attached to an agitator used in the fueling apparatus shown in FIG. 8.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Next, embodiments of the present invention will be explained with reference to drawings. First, a fueling apparatus according to the first embodiment of the present invention will be explained with reference to FIGs. 1 to 4.

[0019] In FIG. 1, a fueling apparatus 1 has an equipment case 2 and an indicator case 15. The inside of the equipment case 2 is a dangerous area where steam of fuel

oil exists with high possibility. The devices in the equipment case 2 are formed to be explosion-proof. In the equipment case 2 are provided a pump unit 4 driven by a motor 3, a flowmeter 5 for measuring amount of oil supply and so on.

[0020] In this pump unit 4 are provided an inflow port 4A, a pump 4B, and a discharge port 4C, and to each of the inflow port 4A and the discharge port 4C is provided a strainer 6. The inflow port 4A of the pump unit 4 is communicated with an underground oil storage tank 8 through an oil line 7. The discharge port 4C is connected to the flowmeter 5. As mentioned above, the pump 4B (gear pump shown in FIG. 1) is driven by the motor 3.

[0021] In the fueling apparatus 1 shown in FIG. 1 stands up a fueling pipe 9 connected to the flowmeter 5 in the a support 10. Then, to a connecting port 9A at a tip of the fueling pipe 9 is connected a fueling hose 11; to a tip of the fueling hose 11 is attached a fueling nozzle 12; and the fueling nozzle 12 is hung on a nozzle holder 13. In this connection, a circumference of the fueling pipe 9 is the dangerous area where steam of fuel oil exists with high possibility.

[0022] The indicator case 15 located above the equipment case 2 is a non-dangerous area where no steam of fuel oil exists. A fueling control device 16, an indicator 17 and so on that are provided in the indicator case 15 are, unlike the devices in the equipment case 2, not explosion-proof. The fueling control device 16 provided in the indicator case 15 is connected with the motor 3 in the equipment case 2 and the flowmeter 5 through signal wires 18.

[0023] The indicator case 15 has a vapor barrier 15A. To a portion where the signal wire 18 penetrates the vapor barrier 15A is provided a cable clamp 19. In other words, the portion where the signal wire 18 penetrates the vapor barrier 15A is sealed by the cable clamp 19. Since the portion where the signal wire 18 penetrates the vapor

barrier 15A is sealed by the cable clamp 19, the steam of fuel oil in the equipment case 2 is prevented from entering into the indicator case 15 along the signal wire 18.

[0024] In the indicator case 15 is provided a control device 21 for water detection, and a photoelectric conversion device 22 connected to the control device 21, and to the photoelectric conversion device 22 is connected an optical fiber 23b. Here, the sensor for water detection is comprehensively expressed as numeral 23, and has the optical fiber 23b. And, the sensor 23 has a function of detecting intermixture of water in fuel oil, and a detecting portion 23a (refer to FIG. 4) is a light-receiving portion at the tip of the optical fiber 23b.

[0025] As described above, to the vapor barrier 15A of the indicator case 15 is provided a cable clamp 24; the optical fiber 23b penetrates the cable clamp 24 to be introduced in the equipment case 2; and the optical fiber 23b is disposed in an oil channel of the pump unit 4. Since the portion where the optical fiber 23b penetrates the vapor barrier 15A is sealed by the cable clamp 24, the steam of fuel oil in the equipment case 2 is prevented from entering into the indicator case 15 along the optical fiber 23b.

[0026] More specifically, the steam of fuel oil in the equipment case 2 is prevented from entering into the indicator case 15 along the signal wire 18, and this steam is prevented from entering into the indicator case 15 along the optical fiber 23b also. Therefore, the indicator case 15 is sealed against the steam of fuel oil in the equipment case 2, so that the indicator case 15 becomes a safe area (non-dangerous area) where no accident occurs even through electric sparks or the like occur.

[0027] As shown in FIG. 4, at the tip of optical fiber 23b (light-receiving optical cable 232) is provided the detecting portion 23a of the sensor 23 for detecting intermixture of water. As described below, the sensor 23 for detecting intermixture of water is a

light-receiving sensor, and it is possible to arrange the detecting portion 23a of the sensor 23 for detection to an area from the oil line 7 in communication with the oil storage tank 8 of the gas station buried underground to a connecting portion (connecting port) 9A of the fueling hose 11. The detecting portion is preferably arranged to an area to which hatching is attached in FIG. 1, which means the area from an accommodation portion of a gear (rotating body) of the pump 4B to the connecting port 9A (connecting portion of the fueling hose 11).

[0028] In addition, in FIG. 1, in the equipment case 2 and the indicator case 15 are shown only devices relating to the right-hand fueling hose 11, and construction of devices relating to the left-hand fueling hose 11 is omitted for simple illustration.

[0029] FIG. 2 shows in detail a condition where the optical fibers 23b penetrate the vapor barrier 15A of the indicator case 15. As mentioned above, the portion where the optical fibers 23b penetrate the vapor barrier 15A is sealed by the cable clamp 24.

[0030] In FIG. 2, a base 25 of the cable clamp 24 is fixed to the vapor barrier 15A with a nut 26. The optical fibers 23b passing through the inside of the cable clamp 24 are sealed by a packing 27.

[0031] As clearly shown in FIG. 2, the optical fibers 23b sealed by the cable clamp 24 consist of two optical cables.

[0032] One of the two optical cables is an optical cable 231 for optical irradiation, and has a function of irradiating light from the tip thereof (an end portion on the side of the detecting portion 23a in FIG. 4). The other of the two optical cables is an optical cable 232 for receiving light, and as described below with reference to FIG. 4, the optical cable 232 has a detecting portion 23a at a tip thereof and a function of transmitting light received at the detecting portion 23a to the photoelectric conversion device 22 in the indicator case 15.

[0033] Although illustration is omitted, it is also possible to fulfill the both functions of the optical cables for irradiating light and receiving light with one optical fiber 23b only.

[0034] In FIG. 2, the optical fibers 23b (the light-irradiating optical cable 231 and the light-receiving optical cable 232) in the equipment case 2 are covered with a resin tube 29, and a tip of the resin tube 29 is fixed to a bracket 62 by a clamp 30. And, the bracket 62 is fixed to the vapor barrier 15A with the nut 26. Fixing the optical fibers 23b with the clamp 30 allows the optical fibers 23b to be protected from vibration. Here, portions where the optical fibers 23b are covered with the resin tube 29 in the equipment case 2 only. In other words, with the above construction, when the resin tube 29 is damaged in accidents or the like in the worst case, the fuel oil in the equipment case 2 is prevented from entering into the indicator case 15 through a space between an inner wall surface of the resin tube 29 and the optical fibers 23b.

[0035] In FIGs. 3 and 4 is exemplarily shown a condition that the detecting portion 23a at the tip of the optical fiber 23b is disposed near the discharge port 4C of the pump unit 4. However, as mentioned above, the detecting portion 23a can be provided at a portion in the area to which hatching is attached in FIG. 1 (the area between the portion accommodating the gear of the pump 4B and the connecting port 9A that is a connecting portion of the fueling hose 11).

[0036] In order to detect intermixture of water in fuel oil with the sensor 23 for detecting intermixture of water with a mode described below, it is necessary that the mixture of the water and the fuel oil becomes cloudy, in which the water and the fuel oil are uniformly mixed with each other. The reason why the detecting portion 23a of the sensor 23 is arranged in an area on the side of the fueling nozzle 12 from the portion accommodating the gear of the pump 4B is that water and fuel oil are agitated

by the gear of the pump 4B in this area to allow the water to uniformly be mixed in the fuel oil so as to become cloudy, which enables detection of intermixture of water in fuel oil.

[0037] In FIGs. 3 and 4, a cap body 31 is disposed near the discharge port 4C of the pump 4, and the cap body 31 is fixed to the pump unit 4 with bolts 32. In a hole 33 drilled through the cap body 31 screws a hollow bolt 34; into the hollow bolt 34 is inserted a packing 35; and in the hollow bolt 34 screws the hollow bolt 36. And, into the hollow portion of the hollow bolt 36 is inserted the optical fiber 23b.

[0038] In other words, into the hollow bolt 34 that is screwed in the cap body 31 is thrust the hollow bolt 36; into the hollow portion of the hollow bolt 36 is inserted the optical fiber 23b; and the hollow portion of hollow bolt 34 is sealed by the packing 35. Then, as shown in FIG. 4, to the tip portion (lower end portion in FIG. 4) of the optical fiber 23b (light-receiving optical cable 232) is attached the detecting portion 23a of the sensor 23.

[0039] Next, with reference to FIGs. 5 to 7 will be explained an example of control for detecting whether water is mixed in fuel oil or not in the fueling apparatus of the present invention.

[0040] As mentioned above, a water mixed in a fuel oil is agitated when pumped up by the pump 4B of the pump unit 4; the water becomes fine particles; and the mixture of the fuel oil and the water becomes cloudy. A part of the light irradiated from the tip of the optical cable 231 for optical irradiation impinges on the fine water particles and reflected therefrom, and then received by the detecting portion 23a (of the sensor 23) at the tip of the optical cable 232 for light-reception. The amount of light received (amount of light reflected on the water particles) increases when water mixing ratio in the fuel oil becomes large (curve a in FIG. 5).

[0041] On the other hand, the other part of the light irradiated from the tip of the optical cable 231 for optical irradiation (light that did not impinge on the water particles) goes straight while penetrating into the fuel oil in which the fine water particles are mixed; reflects on an opposed wall surface (not shown); goes straight while penetrating into the fuel oil again; and is received by the detecting portion 23a at the tip of the optical cable 232 for light-reception. The amount of light received (amount of light received by the detecting portion 23a after going straight while penetrating into the fuel oil and being reflected on the opposed wall surface) decreases when the water mixing ratio in the fuel oil becomes large (curve β of FIG. 5).

[0042] Then, the total amount of light received by the detecting portion 23a at the tip of the optical cable 232 for light-reception becomes equal to the sum of the amount of light received shown in curve α in FIG. 5 and the amount of light received shown in curve β in FIG. 5, and the characteristic is expressed as the curve " $\alpha + \beta$ " in FIG. 5.

[0043] Here, the vertical axis of FIG. 5 shows the amount of light received, and the horizontal axis shows the water mixing ratio. Calculating the total amount of light received by the detecting portion 23a (for example, "sensor detection result" in FIG. 5) and searching a point γ , which is located on the characteristic curve " $\alpha + \beta$ " shown in a dashed dotted line in FIG. 5 as a corresponding point allows a numerical value δ on the horizontal axis corresponding to the point γ to be the water mixing ratio at the time.

[0044] FIG. 6 is a block diagram of the control device 21 that performs the control explained in FIG. 5, and FIG. 7 is a flow chart of the control explained in FIG. 5. The construction of the control device 21 and the control explained in FIG. 5 will be explained mainly with reference to FIGs. 6 and 7.

[0045] A light inputted into the photoelectric conversion device 22 through the light-receiving optical cable 232 (the amount of light received at the detecting portion

23a) is converted into an electric signal; this electric signal is read into a light quantity calculation block 41 through a signal line L3 (Step S1); and the total amount of light received at the detecting portion 23a is calculated (Step S2). The calculated amount of light received is transmitted to a water mixing ratio calculation block 42 through a line L4, and the water mixing ratio is calculated based on the characteristic, which is transmitted from a memory block 40 (refer to FIG. 5), relating to the amount of light received and the water mixing ratio (Step S3).

[0046] The calculated water mixing ratio is transmitted to a judgment block 43 through a line L5. And, a judgment result in the judgment block 43 is transmitted to an annunciation processing block 44, a means 45 for annunciation, a fueling stop processing block 46, a means 47 for stopping fueling, a maintenance processing block 48, a means 49 for maintenance and an indication means 50 through a line L6.

[0047] In the judgment block 43, the water mixing ratio of the water mixing ratio calculation block 42 is compared with the "threshold" transmitted through the line L2 from the memory block 40 (a threshold whether the water mixing ratio reaches to the level that needs annunciation or not; a threshold whether the water mixing ratio is in a normal level or not) (Step S4).

[0048] When the water mixing ratio is below the threshold (No in Step S4), it is judged that the water mixing ratio is in a normal level (satisfactory level), and it returns to Step S1. It means that the sensor 23 detects that the water is not mixed in the fuel oil at this time. When the water mixing ratio is larger than the threshold (Yes in Step S4), it progresses to Step S5. It means that the sensor 23 detects intermixture of water in fuel oil.

[0049] In Step S5, it is judged that only annunciation should be performed by a fueling control device 16 (refer to FIG. 1); the annunciation and/or a fueling stop

processing should be performed; or the annunciation, the fueling stop processing, and/or processing for maintenance should be performed.

[0050] More specifically, in case that the water mixing ratio is in a level that only the annunciation should be performed, neither the fueling stop processing nor the processing for maintenance will be performed. In case that the water mixing ratio is in a level that needs the fueling stop processing, the fueling stop processing will be performed by the fueling control device 16. The annunciation can also be performed in that case. In case that the water mixing ratio is larger, the fueling stop processing and/or the processing for maintenance will be performed. The annunciation can also be performed in that case.

[0051] According to the embodiment of the illustration, the detecting portion 23a of the sensor 23 is provided in the equipment case 2 whose inside is the dangerous area, but the control device 21 for processing the light (light signal) from the detecting portion 23a of the sensor 23, and the photoelectric conversion device 22 are arranged in the indicator case 15 whose inside is the non-dangerous area.

[0052] Therefore, the detecting portion 23a of the sensor 23 in the equipment case 2 irradiates and receives light only, and does not perform transmission and reception of electric signal. As a result, in case that the detecting portion 23a of the sensor 23 is provided in the equipment case 2 in which steam of fuel oil is likely to be full, no spark caused by electric signal occurs in this detecting portion 23a.

[0053] In addition, the light signal from the detecting portion 23a of the sensor 23 is converted into electric signal by the photoelectric conversion device 22 in the indicator case 15 and is processed with the control device 21, so that the electric signal corresponding to the detection result of the detecting portion 23a is transmitted and received only in the indicator case 15. Therefore, according to the embodiment of the

illustration, it is detectable whether the water is mixed in the fuel oil or not with the sensor 23 for detection while maintaining high safety.

[0054] In this relation, in the embodiment of the illustration, the detecting portion 23a of the sensor 23 in the equipment case 2 performs transportation and reception of light only, and the control device 21 that processes the light signal from the detecting portion 23a and the photoelectric conversion device 22 are disposed in the indicator case 15 whose inside is non-dangerous area. Therefore, the detecting portion 23a of the sensor 23, the control device 21, and the photoelectric conversion device 22 can be formed without explosion-proof structure.

[0055] Next, with reference to FIGs. 8 and 9, a fueling apparatus according to the second embodiment of the present invention will be explained. This fueling apparatus 51 differs from the fueling apparatus 1 in that the apparatus 51 has a submergible pump 52 in the oil storage tank 8 in place of the pump unit 4 of the fueling apparatus 1, and has an agitator 53 and a strainer 54 disposed in the position in which the pump unit 4 of the fueling apparatus 1 has been located. In addition, to the same constituent factors as the above-mentioned fueling apparatus 1 are attached the same reference numbers, or illustrations of the factors are omitted, and detailed explanations thereof are omitted.

[0056] The submergible pump 52 is provided with a vane wheel therein. And, in an agitator 53 is, as shown in FIG. 9, drilled a screw hole 53a; in the screw hole 53a is screwed a hollow bolt 34; into the hollow bolt 34 is inserted a packing 35; and into a hollow portion of the hollow bolt 36 is inserted the optical fiber 23b. To the tip portion (lower end portion) of this optical fiber 23b (light-receiving optical cable 232) is attached the detecting portion 23a of the sensor 23. In the agitator 53 is arranged a plurality of vanes 53b for agitation.

[0057] In addition, in the same manner as the above embodiment, since the portions where the signal wire 18 and the optical fiber 23b penetrate the vapor barrier 15A, which is a boundary portion between the equipment case 2 and the indicator case 15, are sealed by the cable clamps 19, 24, the steam of fuel oil in the equipment case 2 is prevented from entering into the indicator case 15 along the signal wire 18 and the optical fiber 23b. Therefore, the inside of the indicator case 15 is always maintained its safety as a non-dangerous area.

[0058] In this embodiment, in the same manner as the first embodiment described above, the existence of intermixture of water in fuel oil can be judged in a stage before supplying the fuel oil to automobiles. And, it is possible to take required measures such as annunciation and stoppage of oil supply in a stage before causing stoppage of engine.

[0059] The embodiments of illustration are illustrative only, and the embodiments are not described to limit the technical scope of the present invention. For example, it is also possible to arrange the detecting portion 23a of the sensor 23 to the area between the oil line 7 that is communicated with the oil storage tank 8 of the gas station buried underground and the connecting portion (connecting port) 9A of the fueling hose 11.

[0060] In addition, in case that the detecting portion 23a of the sensor 23 is arranged in the fueling pipe 9 (refer to FIG. 1), it is necessary to seal a portion where the optical fiber 23b penetrates the vapor barrier 15A of the indicator case 15 by cable clamps.

EXPLANATION OF REFERENCE NUMBERS

[0061]

1 fueling apparatus

2 equipment case

3 motor

4 pump unit

4A inflow port

4B pump

4C discharge port

5 flowmeter

6 strainer

7 oil line

8 oil storage tank

9 fueling pipe

9A connecting port

10 support

11 fueling hose

12 fueling nozzle

13 nozzle holder

15 indicator case

15A vapor barrier

16 fueling control device

17 indicator

18 signal wire

19 cable clamp

21 control device for water detection

22 photoelectric conversion device

23 sensor for detecting intermixture of water

23a detecting portion of detection sensor

23b optical fiber

231, 232 optical cables

24 cable clamp

25 base

26 nut

27, 35 packings

29 resin tube

30 clamp

31 cap body

34, 36 hollow bolts

41 light quantity calculation block

42 water mixing ratio calculation block

43 judgment block

44 annunciation processing block

45 annunciation means

46 fueling stop processing block

47 means for stopping fueling

48 maintenance processing block

49 means for maintenance

50 indication means

51 fueling apparatus

52 submersible pump

53 agitator

53a screw hole

53b vanes

54 strainer

CLAIMS

- [1] A fueling apparatus comprising:
- a detection sensor having a detecting portion for detecting whether a water is mixed in a fuel oil or not, said detecting portion disposed in a dangerous area; and
 - a device for processing an optical signal from the detecting portion of the detection sensor, said device disposed in non-dangerous area.
- [2] The fueling apparatus as claimed in claim 1, wherein said detection sensor is provided with an optical fiber having the detecting portion at a tip of said sensor, and a portion of the optical fiber where penetrates into a boundary portion between the dangerous area and the non-dangerous area is sealed with a cable clamp.
- [3] The fueling apparatus as claimed in claim 2, further comprising:
- a sealed equipment case whose inside is the dangerous area;
 - a flowmeter disposed in the equipment case;
 - a fueling pipe connected to the flowmeter, an environment of said fueling pipe being the dangerous area;
 - a fueling hose connected to the fueling pipe through a connecting portion;
 - a fueling nozzle disposed at a tip of the fueling hose;
 - a sealed indicator case whose inside is the non-dangerous area; and
 - a fueling control device, an indicator, a control device for detecting intermixture of water and a photoelectric conversion device that are installed in the indicator case;
- wherein said optical fiber is connected to the photoelectric conversion device and extends from the indicator case into the dangerous area, and a portion where said optical fiber penetrates into the boundary portion between the dangerous area and the

indicator case is sealed with a cable clamp.

[4] The fueling apparatus as claimed in claim 3, further comprising:

an oil line connecting an oil storage tank disposed underground and the flowmeter with each other; and

a pump unit mounted to the oil line,

wherein said detecting portion is disposed between the pump unit and the connecting portion of the fueling pipe to the fueling hose.

[5] The fueling apparatus as claimed in claim 3, further comprising:

an oil line connecting an oil storage tank disposed underground and the flowmeter with each other; and

a submersible pump mounted to the oil line in the oil storage tank,

wherein said detecting portion is disposed between the submersible pump and the connecting portion of the fueling pipe to the fueling hose.

[6] The fueling apparatus as claimed in claim 5, further comprising an agitator mounted to the oil line between the submersible pump and the flowmeter,

wherein said detecting portion is disposed between the agitator and the connecting portion of the fueling pipe to the fueling hose.