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(54) Fluid transfer apparatus and method

(57) A fluid transfer apparatus (100) comprising: a memory device (101,102) arranged to store information indicative of a fluid content of at least one first storage device (115); a first verification device (108) communicable with the memory; and a second verification device (112) associated with a second storage device (116) and arranged to store information relating to the contents thereof; wherein the first and second verification devices (108,112) are arranged to communicate to output a signal (119) representative of a match condition.

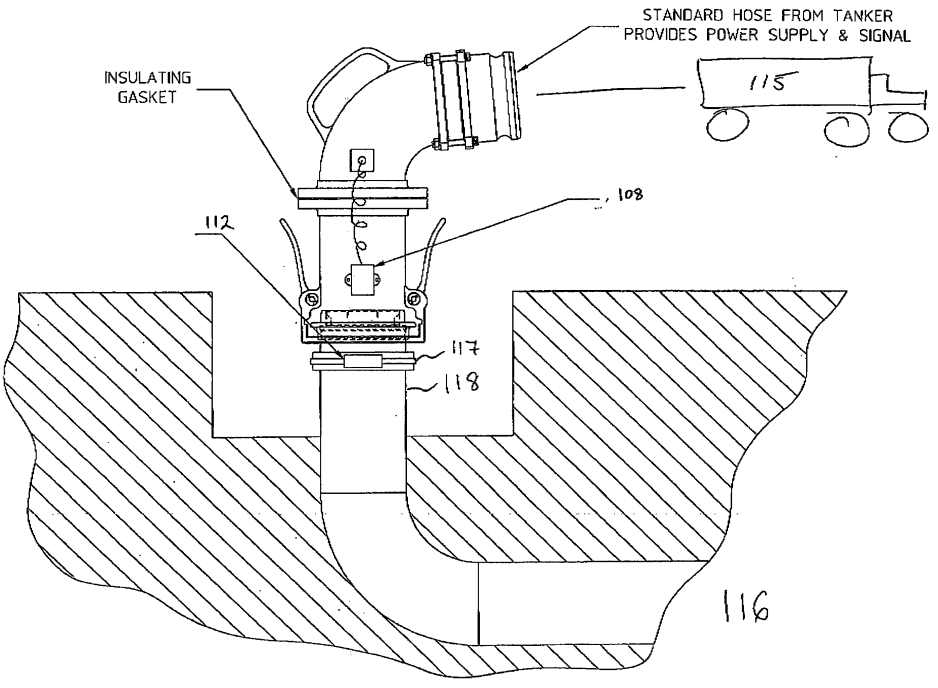

FIG. 2

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Description

Technical Field

[0001] This invention relates generally to an apparatus and method for performing fluid transfers between storage tanks.

Background to the Invention

[0002] Movement of fluids from manufacturing source to end consumer can be a complex operation requiring several transfer operations from tank to tank, via pipes or hoses and to both mobile and fixed installations. A common example is the supply chain for petroleum fuels from refinery to automobile.

[0003] It is common when performing such transfer operations, however, that the source tank be incorrectly connected to the wrong destination tank, typically as a result of poor labelling of the tank contents, or in some circumstances, due to the operator being pushed for time and neglecting to check the contents of both tanks before making the transfer. As a result, "cross-over prevention" systems, or COPS, have been developed to prevent such accidental mismatch.

[0004] The oil industry in particular has investigated many COPS to prevent cross contamination, ranging from the simplistic (for example the use of different sized fittings for different products) to highly sophisticated electronic systems, which proved to be impractical in industrial working environments.

Summary of the Invention

[0005] In a first aspect the present invention provides a fluid transfer apparatus comprising: a memory arranged to store information associated with fluid contents of at least one first storage device; a first verification device communicable with the memory; and a second verification device associated with a second storage device and arranged to store information relating to the contents thereof; wherein the first and second verification devices are arranged to communicate to output a signal representative of a match condition.

[0006] The apparatus may also comprise a control device arranged to control a flow of fluid between the at least one first storage device and second storage device, based on the output signal.

[0007] The output signal may be displayed on a display device.

[0008] The display device may be arranged to display the contents of the at least one first storage device and second storage device.

[0009] The first verification device may be disposed on a hose attachment removably coupled to one of the at least one first storage device.

[0010] The first verification device may be provided in the form of a first RFID reader and the second verification device in the form of an RFID tag.

[0011] The memory may be arranged to communicate with additional RFID readers associated with each of the at least one first storage device to obtain the information associated with a fluid content of the at least one first storage device by interrogating a second RFID tag.

[0012] The apparatus may also comprise a measurement device arranged to measure a quantity of fluid passing between the at least one first storage device and second storage device and output measurement information.

[0013] The apparatus may further comprise a transportation device arranged to transport the at least one first storage device.

[0014] The apparatus may also comprise a device to determine at least one of a location, time and velocity of the transportation device and output location information.

[0015] The device to determine at least one of a location, time and velocity of the transportation device may be in the form of a OPS receiver.

[0016] The apparatus may also comprise an audit device arranged to record at least one of the location information and measurement information.

[0017] The apparatus may also comprise a transmitting device arranged to transmit the recorded data to a remote receiving device.

[0018] In a second aspect the present invention provides a method of transferring a fluid, the method comprising the steps of: providing a first verification device communicable with a memory having stored therein information associated with the contents of at least one first storage device; providing a second verification device associated with a second storage device arranged to store information relating to the contents thereof; arranging the first and second verification devices in a communicable arrangement; and outputting a signal representative of a match condition.

[0019] The method may further comprise the step of controlling a transfer of fluid between the at least one first and second storage devices based on the output signal.

[0020] The method may also comprise the step of displaying the output signal on a display device.

[0021] The step of arranging the first and second verification devices in a communicable arrangement may comprise locating the first verification device within a predetermined distance of the second verification device.

[0022] The method may also comprise the step of measuring an amount of fluid transferred between the at least one first and second storage devices and outputting a measurement information.

[0023] The method may further comprise the step of determining at least one of a location, time and velocity of the at least one first storage device and outputting location information.

[0024] The method may also comprise the step of transmitting the location information and measurement information to a remote location for external audit review.

Brief Description of the Drawings

[0025] An embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a diagram of a fluid transfer apparatus according to an embodiment of the present invention;
Figure 2 is a schematic view of a fluid transfer apparatus having the first verification device mounted on a hose coupling and the second verification device mounted on a storage tank delivery pipe;
Figure 3 is a schematic diagram of a mobile tanker comprising the fluid transfer apparatus of Figure. 1;
Figure 4 is a flow diagram representing the steps involved in filling the mobile tanker of Figure 3; and
Figure 5 is a system diagram of a fluid transfer apparatus according to a further embodiment of the present invention.

Detailed Description of the Preferred Embodiment

[0026] Referring to Figures 1 & 2, there is shown a fluid transfer apparatus 100 comprising a memory device in the form of control unit 101 and RAM chip 102. The RAM chip 102 is arranged to store information indicative of the contents of a first storage device. In this instance the first storage device is in the form of a mobile tank (see Figure 2 - item 115) carrying a delivery of kerosene. The apparatus further comprises a first verification device in the form of an active RFID reader (see Figure 2 item 108) which is mounted on a flexible hose 109 connected to the mobile tank 115. The RFID reader 108 is arranged to communicate with the control unit 101 and RAM chip 102, via wire 110. Shown with reference to Figure 2, is a second verification device in the form of a passive RFID tag 112. The passive RFID tag 112 is encoded with second content information indicative of the contents of a second storage device in the form of a kerosene storage tank 116. The RFID tag 112 is attached to a delivery pipe 118 of the kerosene storage tank 116 by elastic retainer 117.

[0027] When placed within a predetermined distance of one another, the RFID reader 108 interrogates the RFID tag 112 to obtain the second content information before subsequently passing it to control unit 101. Once in receipt of the second content information, the control unit 101 retrieves the information indicative of the contents of the mobile tank 115 from the RAM chip 102. The control unit 101 then compares the contents of both storage tanks 115 & 116 and outputs an indication of a match condition in the form of a green flashing light 119 displayed on a display device 120 to thereby notify an operator that the contents of both tanks match and to proceed with the transfer. Should the control unit 101 establish that the contents of both tanks 115 & 116 do not match, however, an indication in the form of a red flashing light (not shown) is displayed on the display device 120 to alert the operator of the mismatch. The display device 120 is further arranged to display the content information 122 of both tanks 115 & 116 for viewing by the operator.

[0028] A method of filling a mobile tank 115 using the apparatus of Fig. 1 will now be described with reference to the system diagram of Fig. 3 and flow diagram of Fig. 4. As shown in Fig. 3, the fluid transfer apparatus 300 comprises an additional RFID reader 302 fitted to the mobile tank's input coupling 304. The additional RFID reader 302 is arranged to communicate with an RFID tag 306 permanently fixed to a depot tank 308. The RFID tag 306 is encoded with information indicative of the depot tank's content.

[0029] When filling a mobile tank, it is important to determine whether the fluid to be put into the tank is compatible with fluid that was previously in the tank. For instance, It is not permissible to fill a tank with milk if the last fluid in the tank was kerosene. Before filling the mobile tank 115, a number of process and safety checks must first take place. With reference to Fig. 4 there is shown a first step 402, which involves securely connecting the depot tank's delivery pipe 307 to the mobile tank's input coupling 304. Once connected, the additional RFID reader 302 interrogates the RFID tag 306 to retrieve the encoded information before sending it to the control unit 101 for processing (step 406). At step 408, the control unit 101 performs the process and safety checks, which includes stepping through a list of allowable circumstances for changing the fluid content information from that previously stored in the memory, before updating the RAM chip 102 with the new content information and allowing the transfer (step 410). Lastly, at step 412, the new content information is displayed on the display device 120 thereby notifying the operator that the process and safety checks have been completed and that the mobile tank 115 is ready for filling.

[0030] Turning to Fig. 5, there is shown an audit system 500 employing the fluid transfer apparatus of Figs 1 & 3. According to this embodiment, the RFID tags 112 & 306 connected to the depot and storage tanks are additionally encoded with information identifying a connection point and site location. The encoded information is obtained by the RFID readers 108 & 302 using the technique described with reference to Fig. 1. The encoded information is passed to the control unit 101 for further processing. Control unit 101 is further arranged to communicate with a locating device in the form of global positioning system 502 to determine the mobile tank's position, speed and direction. The control unit 101 is also coupled to a measurement device in the form of a tank gauge 504 for providing continuous measurements of the mobile tank's volume and rate of change of content's. The above data is processed by the control unit 101 and stored in RAM chip 102 for later review. If required, the data may also be transmitted by a wireless transmitter (not shown) to a remote receiving device for external audit review.

[0031] Also shown with reference to Figure 5, is a tank

control device in the form of control valve 506 provided to control the discharge of the mobile tank's contents in accordance with instructions output by the control unit 101. The control unit 101 may, for example, instruct the control valve 506 to open if it establishes that the contents of the mobile and storage tanks match, and that the mobile tank has arrived at a prescribed location (also stored in RAM chip 102).

[0032] It is envisaged that the memory device may be arranged-to communicate with any number of RFID readers 302 associated with different mobile tanks. For example, the fluid transfer apparatus might employ three RFID readers 302 for a mobile tanker having three partitioned storage sections. In this form, the control unit 101 is arranged to simultaneously perform a multiplicity of process and safety checks and discharge operations. In addition, each of the tank connectors, RFID readers and hose couplings are electrically isolated to ensure that the signals transmitted and received by the RFID readers are not corrupted before reaching the control unit.

[0033] In the above described embodiment, the RFID tags 112 & 306 were attached to the pipes and couplings by elastic retainers, however as can readily be appreciated, the tags 112 & 306 may be fitted using any form of conventional attaching devices including pop rivets, screws, clips and the like.

[0034] It can also be appreciated that the above described apparatus would be equally suited to any form of mobile tank, including but not limited to, road tankers, rail tankers, and water going tankers. Similarly, the liquid being transported is not limited to petrochemicals, but could include other liquids and gasses such as liquid fertiliser bio-waste, water, gas, etc.

[0035] Although the location and time measurements of the above described embodiment were performed using a GPS receiver, the mobile tank location could equally be measured using any known form of locating device, including but not limited to, GSM (Global System for Mobile Communications) base station locating techniques, UMTS (Universal Mobile Telecommunications System) location techniques, and the like.

[0036] Any reference to prior art contained herein is not to be taken as an admission that the information is common general knowledge, unless otherwise indicated.

[0037] Finally, it is to be appreciated that various alterations or additions may be made to the parts previously described without departing from the spirit or ambit of the present invention.

Claims

1. A fluid transfer apparatus comprising:

a memory device arranged to store information indicative of a fluid content of at least one first storage device;
a first verification device communicable with the memory; and
a second verification device associated with a second storage device and arranged to store information relating to the contents thereof;

wherein the first and second verification devices are arranged to communicate to output a signal representative of a match condition.

2. A fluid transfer apparatus as claimed in claim 1, further comprising a tank control device arranged to control a flow of fluid between the at least one first storage device and second storage device, based on the output signal.

3. A fluid transfer apparatus as claimed in one of claims 1 or 2, wherein the output signal is displayed on a display device.

4. A fluid transfer apparatus as claimed in claim 3, wherein the display device displays the contents of the at least one first storage device and second storage device.

5. A fluid transfer apparatus as claimed in any one of the preceding claims, wherein the first verification device is disposed on a hose attachment removably coupled to one of the at least one first storage device.

6. A fluid transfer apparatus as claimed in claim 5, wherein the first verification device is in the form of an RFID reader and the second verification device is in the form of a first RFID tag.

7. A fluid transfer apparatus as claimed in any one of the preceding claims, wherein the memory is further arranged to communicate with an additional RFID reader associated with the at least one storage device and wherein the information associated with a fluid content of at least one first storage device is obtained by interrogating a second RFID tag.

8. A fluid transfer apparatus as claimed in any one of the preceding claims, further comprising a transportation device arranged to transport the at least one first storage device.

9. A fluid transfer apparatus as claimed in claim 8, further comprising a device to determine at least one of a location, time and velocity of the transportation device and output location information.

10. A fluid transfer apparatus as claimed in claim 10, wherein the device to determine at least one of a location, time and velocity of the transportation device is in the form of a GPS receiver.

11. A fluid transfer apparatus as claimed in any one of

the preceding claims, further comprising a measurement device arranged to measure a quantity of fluid passing between the at least one first storage device and second storage device, and output measurement information.

12. A fluid transfer apparatus as claimed in any one of claims 9 to 11, further comprising an audit device arranged to record at least one of the location information and measurement information.

13. A fluid transfer apparatus as claimed in claim 12, further comprising a transmitting device arranged to transmit the recorded data to a remote receiving device.

14. A method of transferring a fluid, the method comprising the steps of:

providing a first verification device communicable with a memory having stored therein information associated with the contents of at least one first storage device;
providing a second verification device associated with a second storage device and arranged to store information relating to the contents thereof:

arranging the first and second verification devices in a communicable arrangement; and
outputting a signal representative of a match condition.

15. A method of transferring a fluid as claimed in claim 14, further comprising the step of controlling a transfer of fluid between the at least one first and second storage devices based on the output signal.

16. A method of transferring a fluid as claimed in any one of claims 14 and 15, further comprising the step of displaying the output signal on a display device.

17. A method of transferring a fluid as claimed in any one claims 14 to 16, wherein the first verification device is in the form of an RFID reader and the second verification device in the form of an RFID tag.

18. A method of transferring a fluid as claimed in claim 17, wherein the step of arranging the first and second verification devices in a communicable arrangement comprises locating the RFID reader within a predetermined distance of the RFID tag.

19. A method of transferring a fluid as claimed in any one of claims 14 to 18, further comprising the step of measuring an amount of fluid transferred between the at least one first and second storage devices and outputting a measurement information.

20. A method of transferring a fluid as claimed in claim 19, further comprising the step of determining at least one of a location, time and velocity of the at least one first storage devices and outputting location information.

21. A method of transferring a fluid as claimed in claim 20, further comprising the step of transmitting the location information and measurement information to a remote location.

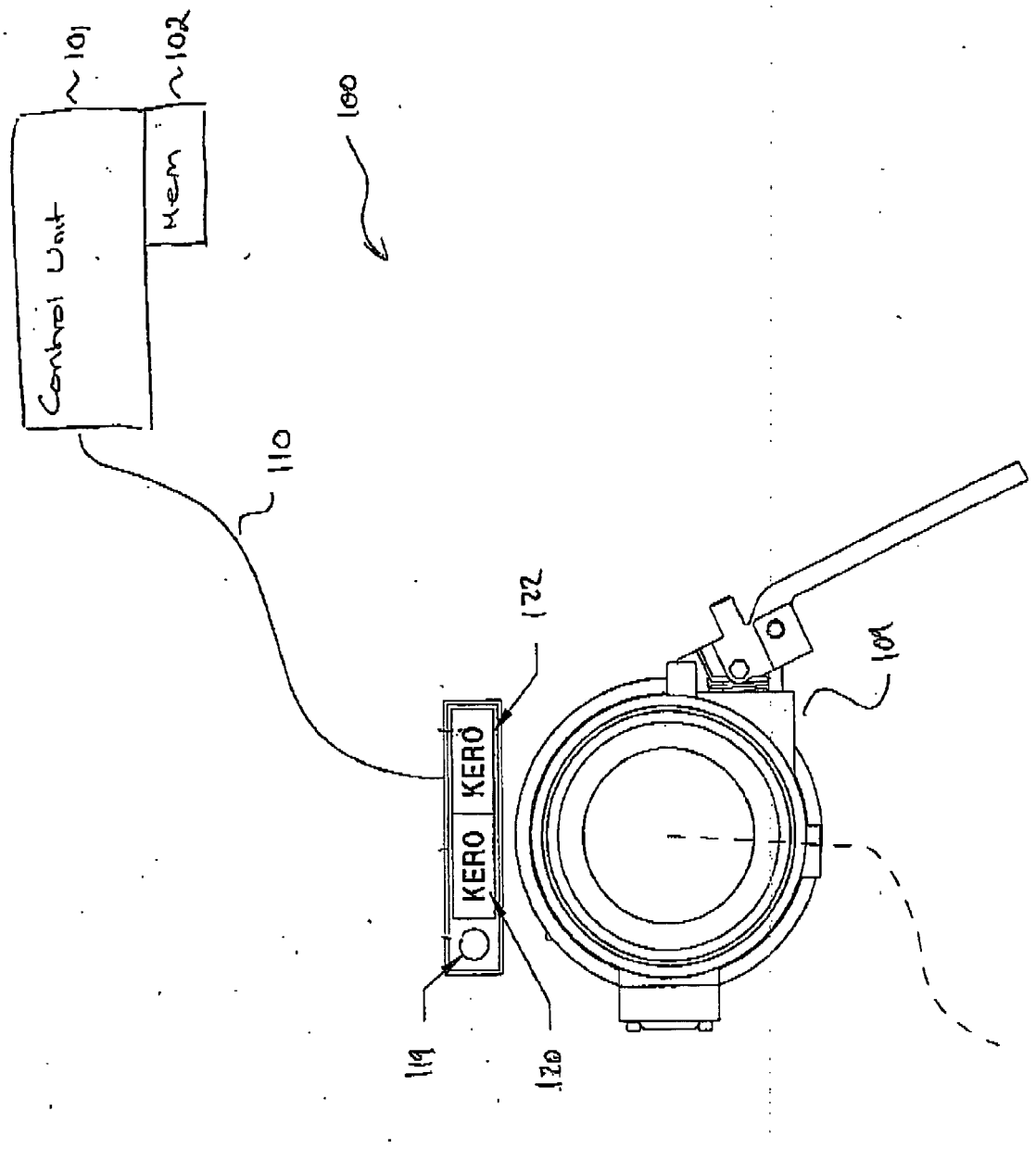

FIG. 1

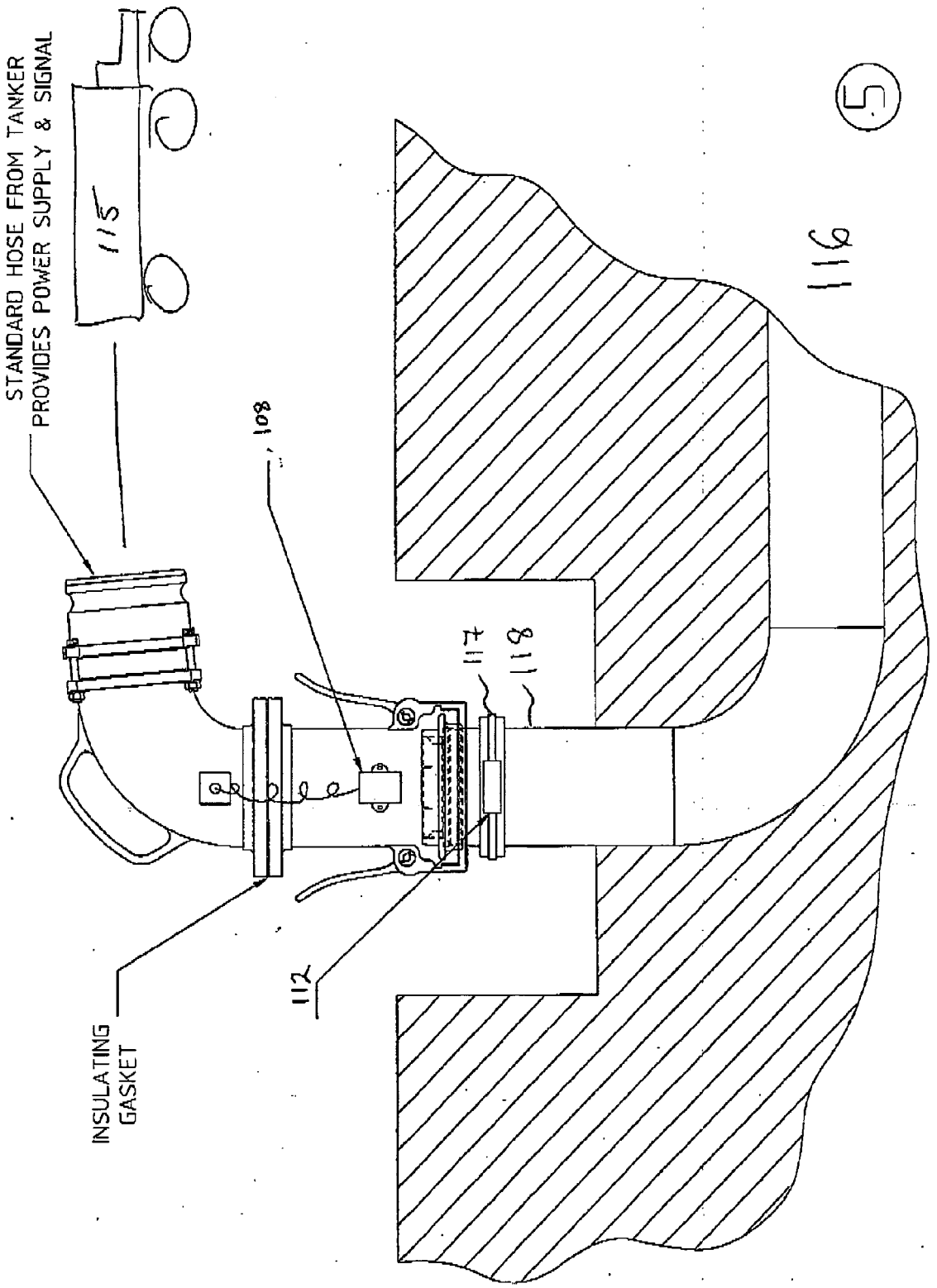
STANDARD HOSE FROM TANKER
PROVIDES POWER SUPPLY & SIGNAL
115
108
116
117
118
112
INSULATING
GASKET

FIG. 2

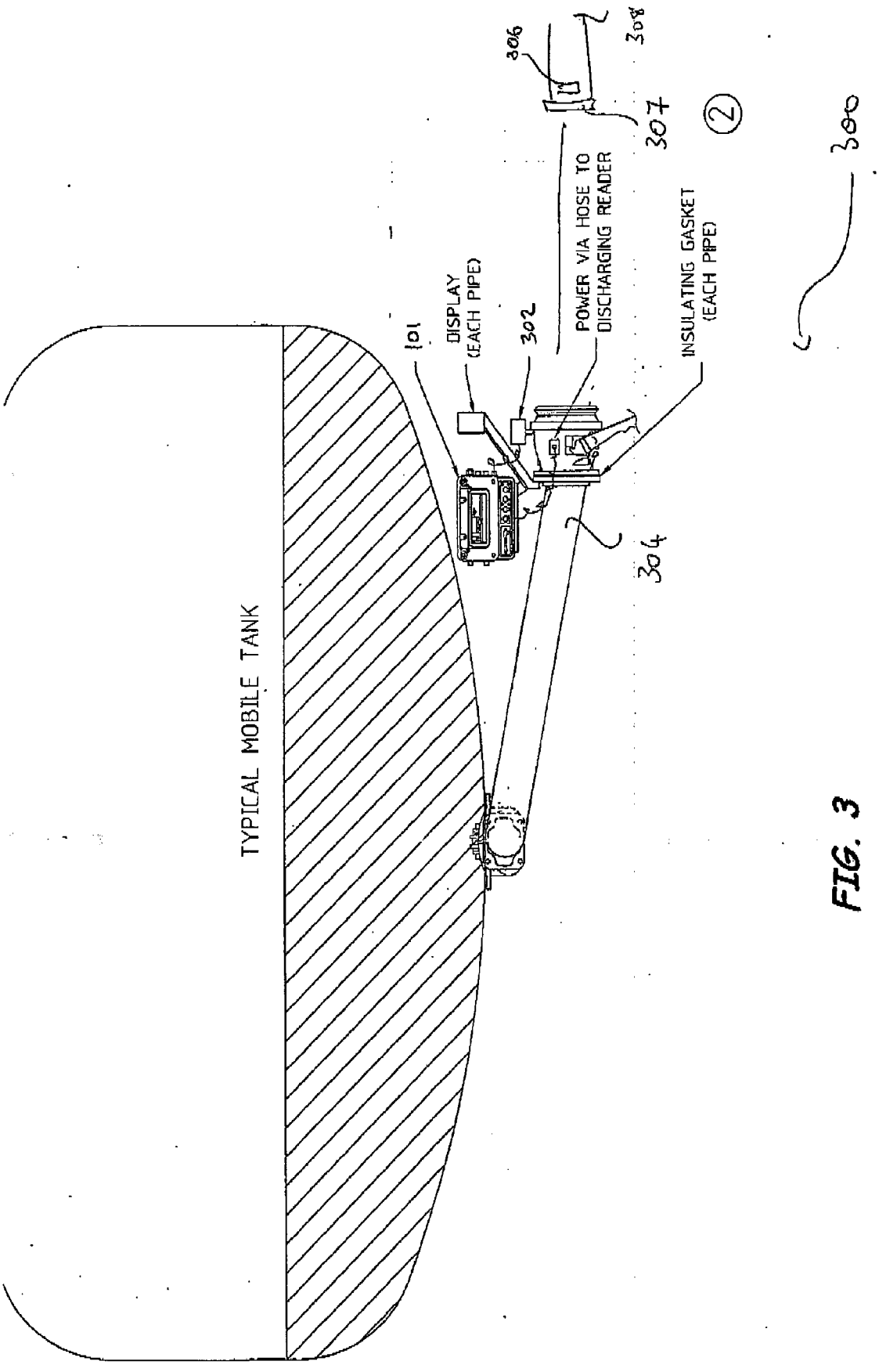
TYPICAL MOBILE TANK
101
DISPLAY (EACH PIPE)
302
POWER VIA HOSE TO DISCHARGING READER
INSULATING GASKET (EACH PIPE)
304
306
307
308
300
2

FIG. 3

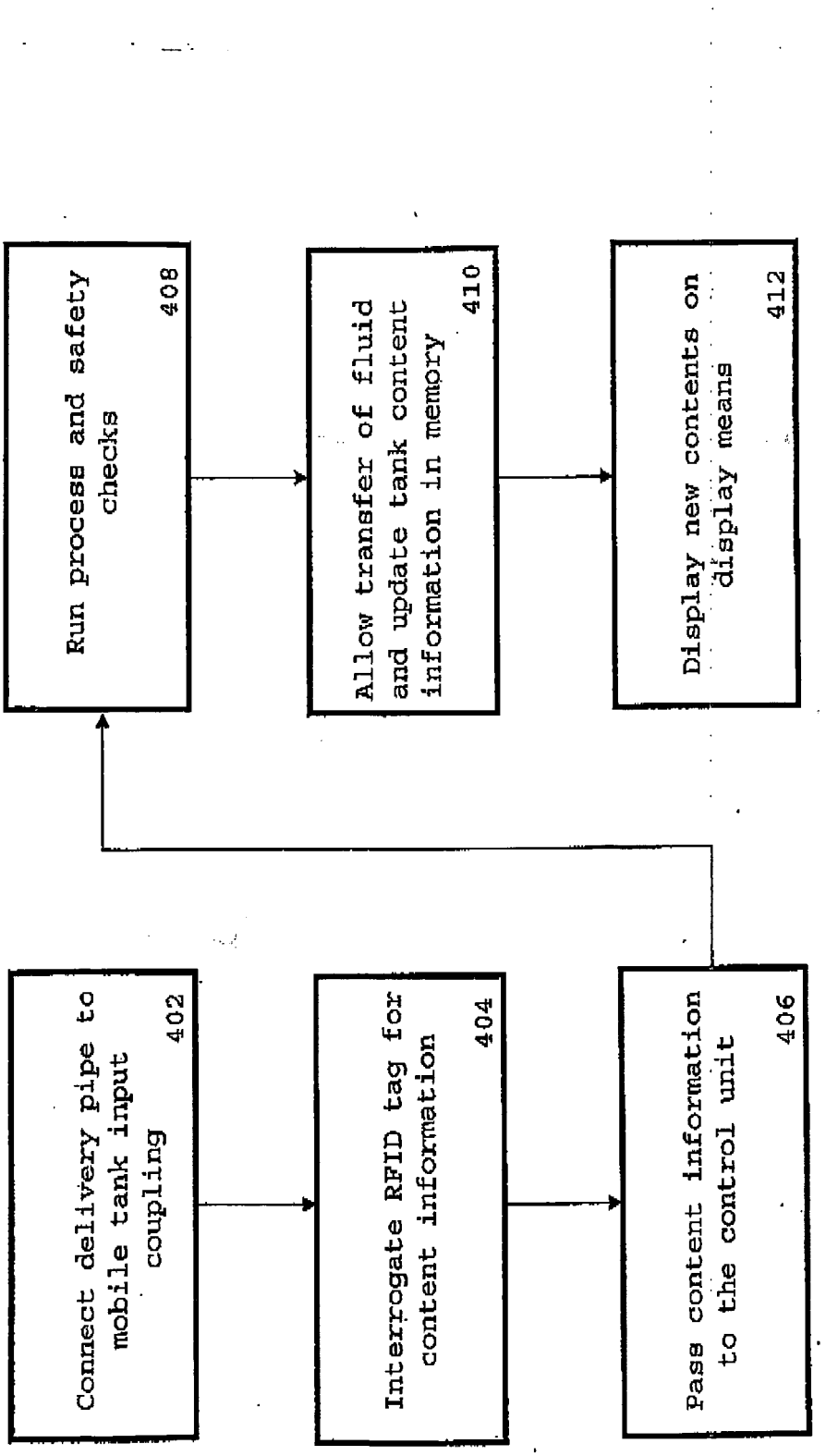
400
Connect delivery pipe to mobile tank input coupling
402
Interrogate RFID tag for content information
404
Pass content information to the control unit
406
Run process and safety checks
408
Allow transfer of fluid and update tank content information in memory
410
Display new contents on display means
412

Fig. 4

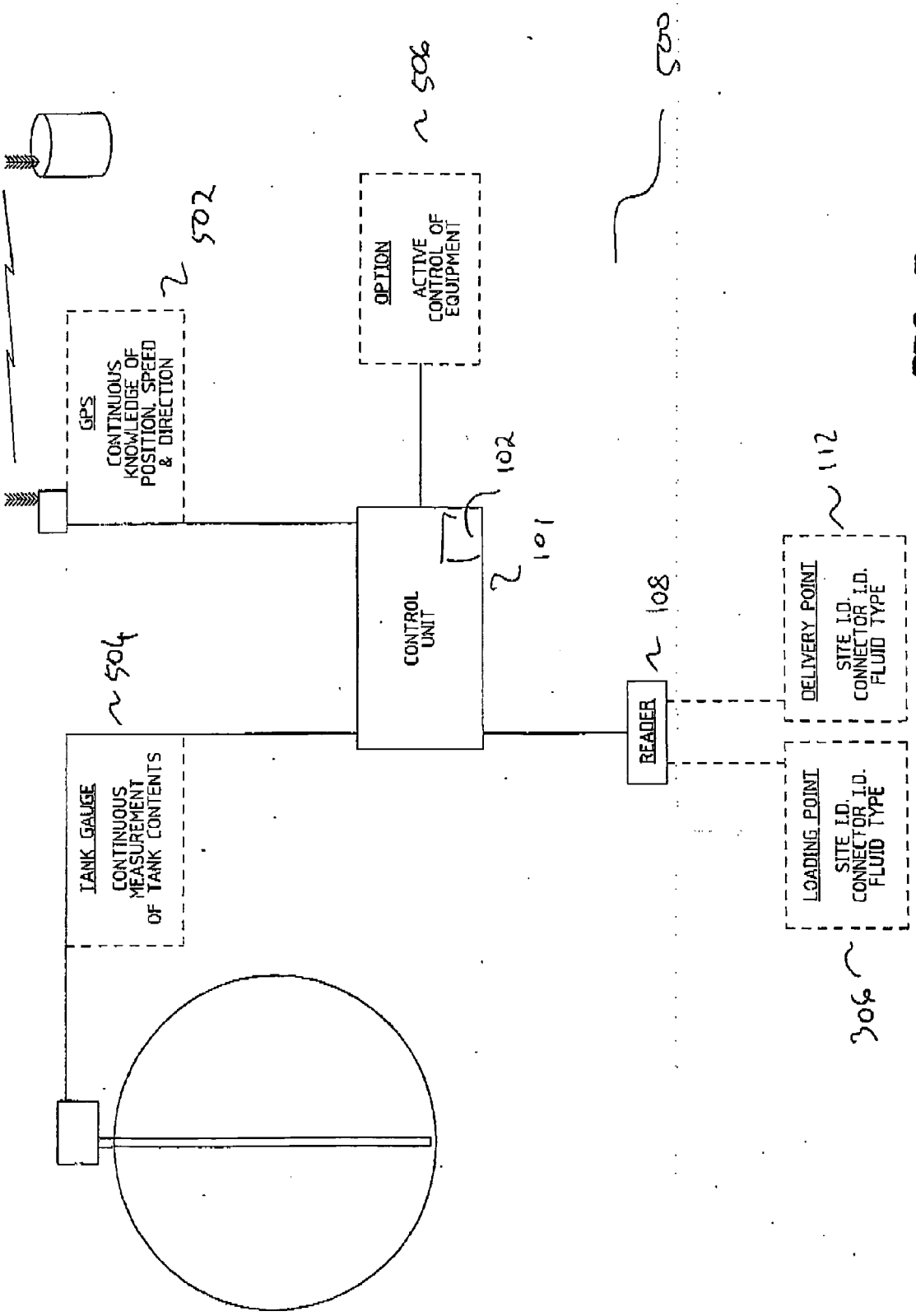
GPS
CONTINUOUS KNOWLEDGE OF POSITION, SPEED & DIRECTION
502
OPTION
ACTIVE CONTROL OF EQUIPMENT
506
500
CONTROL UNIT
102
101
504
108
READER
112
DELIVERY POINT
SITE I.D.
CONNECTOR I.D.
FLUID TYPE
LOADING POINT
SITE I.D.
CONNECTOR I.D.
FLUID TYPE
306
TANK GAUGE
CONTINUOUS MEASUREMENT OF TANK CONTENTS

FIG. 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 00 4199

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	* column 10, line 62 - column 14, line 27; figures 1-5 *	3,4,10, 13,16,21	
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A	* column 7, line 34 - column 8, line 24 * * figure 1 *	3,4,16	

TECHNICAL FIELDS SEARCHED (IPC)

B67D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 June 2007	Smolders, Rob

CATEGORY OF CITED DOCUMENTS

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14-06-2007

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