



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.11.2008 Bulletin 2008/48

(51) Int Cl.:
B67D 5/04 (2006.01)

(21) Application number: **07108807.4**

(22) Date of filing: **24.05.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

- **Hakansson, Marie**
211 41 Malmö (SE)
- **Martensson, Mattias**
275 93 Sjöbo (SE)

(71) Applicant: **Dresser Wayne Aktiebolag**
200 61 Malmö (SE)

(74) Representative: **Milanov, Nina Vendela Maria**
Awapatent AB
P.O. Box 5117
200 71 Malmö (SE)

(72) Inventors:
• **Larsson, Bengt I.**
274 53 Skivarp (SE)

(54) **A vapour recovery system, a method for control thereof, and a fuel dispensing apparatus**

(57) The vapour recovery system comprises a first vapour path (7) between the fuel dispensing nozzle (5) and a vapour tank (9), a vapour pump (11) arranged in said first path (7) and configured to pump vapour from the motor vehicle tank (3) to the vapour tank (9), and a flow rate measuring means (13) arranged in said first

path (7). The system is characterised in that the vapour recovery system further comprises a second path (15) which has a valve (17) and one end of which is connected to the first path (7) downstream of the fuel dispensing nozzle (5) and upstream of the flow rate measuring means (13) and the vapour pump (11).

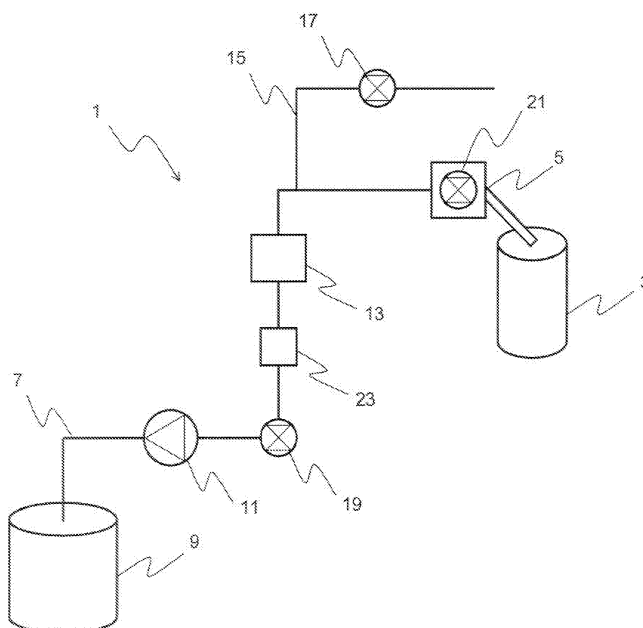


Fig 1

Description

Technical Field of the Invention

[0001] The present invention relates to a vapour recovery system for recovering vapour from a motor vehicle tank via a fuel dispensing nozzle. The present invention also relates to a method for control of a vapour recovery system for recovering vapour from a motor vehicle tank, and to a fuel dispensing apparatus for dispensing fuel to a motor vehicle.

Background Art

[0002] When filling the tank of a motor vehicle, it is a common measure to recover the vapour escaping the tank when filling it with liquid fuel from a fuel pump unit. The vapour recovery is performed by a system which is incorporated in the fuel pump unit, such that vapour of hydrocarbons are prevented from escaping to the environment outside the tank of the motor vehicle. Such vapour recovery system typically consists of a vapour inlet arranged in a fuel dispensing nozzle, a vapour pump and a flow meter. The recovered vapour is accumulated in a vapour tank. The vapour pump draws fuel vapour from the tank of the motor vehicle, through the flow meter and to the vapour tank. The flow meter measures the vapour flow and compares the measured value with the flow of dispensed fuel. Adjusting means are connected to the flow meter and to the vapour pump so that the vapour flow matches the flow of the dispensed fuel.

[0003] Since a vapour recovery system consists of several components, there are several possible causes for such vapour recovery system to malfunction. If the value measured by the flow meter drops, this might be due to e.g. pump failure, flow meter failure, or dust, particles or other obstruction in the vapour line. Thus, there is a need for checking the correct operation of a vapour recovery system.

[0004] GB 2352437 discloses a method for control of a vapour recovery system. The vapour delivery rate is constantly detected. The value of the vapour delivery rate thus detected is transmitted to comparison means which compare it with a value of the liquid delivery rate and if the result of this comparison is outside a predetermined range, which may or may not be adjustable, an alarm is triggered in order to indicate a malfunction.

Summary of the Invention

[0005] It is an object of the present invention to provide an improvement of the above techniques and prior art. More particularly, it is an object of the present invention to provide a built-in control of a vapour recovery system for recovering vapour from a motor vehicle tank via a fuel dispensing nozzle.

[0006] The above objective is achieved according to a first aspect of the invention by a vapour recovery system

for recovering vapour from a motor vehicle tank via a fuel dispensing nozzle, said system comprising a first vapour path between the fuel dispensing nozzle and a vapour tank, a vapour pump arranged in said first path and configured to pump vapour from the motor vehicle tank to the vapour tank, and a flow rate measuring means arranged in said first path. The system is characterised in that the vapour recovery system further comprises a second path which has a valve and one end of which is connected to the first path downstream of the fuel dispensing nozzle and upstream of the flow rate measuring means and the vapour pump. This is advantageous in that control of functionality of the vapour recovery system is possible in a simple way.

[0007] The first path may comprise a valve arranged downstream of the fuel dispensing nozzle. Thus, the first vapour path can be shut off during e.g. service operations.

[0008] The first path may comprise a valve arranged within the fuel dispensing nozzle, which is advantageous in that a minimum amount of vapour is present in the first path when the path is shut off.

[0009] The other end of the second path may be connected to the atmosphere. This is advantageous in that the control can be performed at atmospheric pressure.

[0010] The other end of the second path may be connected to the first path downstream of the flow rate measuring means and the vapour pump and upstream of the vapour tank. This is advantageous in that the second path is a closed circuit, whereby the risk of contamination is minimised.

[0011] The above objective is achieved according to a second aspect of the invention by a method for control of a vapour recovery system for recovering vapour from a motor vehicle tank, said method comprising the steps of measuring a vapour recovery flow rate through a first vapour path between a fuel dispensing nozzle and a vapour tank and including a vapour pump and a flow rate measuring means. The method is characterised in that a second flow rate is measured through a second path one end of which is connected to the first path downstream of the fuel dispensing nozzle and upstream of the flow rate measuring means and the vapour pump, and in that the method comprises the step of comparing the measured vapour recovery flow rate with the second flow rate in order to detect malfunction of the vapour recovery system. The advantages of the first aspect of the invention are also applicable to this second aspect of the invention.

[0012] The second flow rate may be measured through a second path the other end of which is connected to the atmosphere.

[0013] The second flow rate may be measured through a second path the other end of which is connected to the first path downstream of the flow rate measuring means and the vapour pump and upstream of the vapour tank.

[0014] The measured vapour recovery flow rate may be compared to a reference flow rate, and the step of

measuring the second flow rate is performed if the measured vapour recovery flow rate differs from the reference flow rate.

[0015] The vapour recovery flow rate and the second flow rate may be measured at the same speed of the vapour pump.

[0016] The above objective is also achieved according to a third aspect of the invention by a fuel dispensing apparatus for dispensing fuel to a motor vehicle comprising fuel dispensing means and a vapour recovery system according to the first aspect of the invention.

[0017] Other objectives, features and advantages of the present invention will appear from the following detailed disclosure, from the attached claims as well as from the drawings.

Brief Description of the Drawings

[0018] Embodiments of the present invention will now be described in more detail, by way of examples, with reference to the accompanying drawings, in which

[0019] Fig. 1 shows schematically a first embodiment of a vapour recovery system according to the present invention.

[0020] Fig. 2 shows schematically a second embodiment of a vapour recovery system according to the present invention.

[0021] Fig. 3 shows schematically a fuel dispensing apparatus having a vapour recovery system according to the present invention.

Detailed Description of Preferred Embodiments of the Invention

[0022] The vapour recovery system according to the present invention for recovering vapour from a motor vehicle tank during filling-up has a first vapour path, drawing vapour from the vehicle tank to a vapour tank. The vapour flow rate is measured by a flow rate measuring means. After filling-up is finished, the built-in control of the vapour recovery system according to the present invention is activated. A valve arranged in the vapour path is closed and at the same time a valve arranged in a second path is opened. The second path is connected to the first path downstream of the valve arranged in the first path. Thus, the vapour pump draws vapour (or any other gas present in the second path, e.g. air) through the second path and through the flow meter measuring means. The flow meter measuring means performs a new measurement, resulting in a new measured flow rate. This second flow rate is compared to the measured vapour flow rate in order to detect malfunction of the vapour recovery system.

[0023] In fig. 1, a first embodiment of a vapour recovery system 1 is shown. The vapour recovery system 1 conveys fuel vapour from a motor vehicle tank 3 to a vapour tank 9 along a first vapour path 7. One end of the vapour path 7 is arranged via a valve 21 within a fuel dispensing nozzle 5. A vapour pump 11, a valve 19, a damper 23

and a flow rate measuring means 13 are arranged in the first vapour path 7. A second path 15 is at one end connected to the first vapour path 7, and the other end is an open end connected to the atmosphere. A valve 17 is arranged in the second path 15. The damper 23 is preferably incorporated in the first vapour path 7 in order to reduce variations in vapour flow so that the vapour pump 11 is exposed to a uniform vapour flow. The damper 23 can be of a simple construction, e.g. a fixed volume.

[0024] During the filling-up of a vehicle, the valve 17 is closed. The valves 21 and 19 are open and the vapour pump 11 is activated. Vapour is thereby drawn from the motor vehicle tank 3 through the valve 21. The vapour enters the flow rate measuring means 13, flows through the damper 23 and is accumulated in the vapour tank 9. The flow rate measuring means 13 measures the flow rate of vapour.

[0025] According to a first method, the measured flow rate is compared to a reference flow rate corresponding to the actual speed of the vapour pump 11. Thus, a comparing means (not shown) is connected to the flow rate measuring means 13 and the vapour pump 11 so that a specific pump speed corresponds to a specific reference flow rate. After filling-up, the valve 21 is closed and the fuel dispensing nozzle 5 is detached from the motor vehicle tank 3. If the measured vapour flow rate equals the reference flow rate, or lies within a predetermined interval from the reference volume, the vapour recovery system 1 is considered to operate satisfactory and no further action is needed. If the measured flow rate lies outside the predetermined range, the vapour recovery system 1 is considered to malfunction and the built-in control of the vapour recovery system 1 is activated. The valve 17 is opened, and the vapour pump 11 draws air from the open end of the second path 15 through the second path 15, the flow rate measuring means 13, the damper 23, the valve 19 and down to the vapour tank 9. The flow rate measuring means 13 measures a new flow rate of air, and the measured new flow rate is compared to a new reference flow rate corresponding to the actual speed of the vapour pump 11. If the measured new flow rate lies within a predetermined range, the vapour recovery system 1 is considered to malfunction upstream of where the second path 15 connects to the first path 7. If the measured new flow rate lies outside the predetermined range, the vapour recovery system 1 is considered to malfunction downstream of where the second path 15 connects to the first path 7. Information related to any of these conclusions is e.g. stored in a memory circuit (not shown) connected to the flow rate measuring means 13. Further equipment (not shown) is used to let an operator receive said information. Such equipment may e.g. enable wireless transmission of the information to a server. Malfunction as described above may e.g. be a result of dust particles which have been drawn into the first vapour path 7 via the fuel dispensing nozzle 5. The flow rate measuring means 13, the damper 23, the valve 19 and the fuel pump 11 may be arranged in another order along

the first vapour path 7 than is shown in fig. 1. Further components may also be arranged in the first vapour path 7 in order to enhance the function or efficiency of the vapour recovery system 1.

[0026] According to a second method of the present invention, no reference flow rate is provided. After filling-up, the valve 21 is closed and the fuel dispensing nozzle 5 is detached from the motor vehicle tank 3. The built-in control of the vapour recovery system is activated whereby the valve 17 is opened, and the vapour pump 11, operating at the same speed as during the previously performed filling-up, draws air from the open end of the second path 15 through the second path 15, the flow rate measuring means 13, the damper 23, the valve 19 and down to the vapour tank 9. The flow rate measuring means 13 measures a new flow rate of air. If the measured flow rate does not equal the measured vapour flow rate, or lies outside a predetermined range from the measured vapour flow rate, a malfunction of the vapour recovery system is considered to be present somewhere in the first path upstream of where the second path is connected. Such malfunction may e.g. be an effect of a constriction in the first vapour path, e.g. in the fuel dispensing nozzle. The built-in control is activated after each filling-up, or after a predetermined number of filling-ups. In one method, the built-in control is activated after each 10th filling-up.

[0027] The built-in control of the vapour recovery system is active for a predetermined time that can be adjusted to fit to the surrounding equipment (i.e. the fuel dispensing unit). The built-in control of the vapour recovery system may be active 1-60 seconds, preferably 1-20 seconds or more preferably 5-10 seconds.

[0028] In fig. 2, a further embodiment of a vapour recovery system 1 is shown. The vapour recovery system 1 operates similarly to the vapour recovery system 1 shown in fig. 1, and the first vapour path 7 is identical with the first vapour path 7 shown in fig. 1, with the same reference numerals. One end of the second path 15 is connected to the first path 7 similarly to the embodiment shown in fig. 1, and the other end is connected to the first path 7 downstream of the vapour pump 11 and the flow rate measuring means 13. Thus, the second path 15 forms a closed loop with the first vapour path 7.

[0029] When the built-in control of the vapour recovery system 1 shown in fig. 2 is active, the valve 21 is closed and the valve 17 is opened. The vapour pump 11 draws vapour from the damper 23, the flow rate measuring means 13 and the second path 15 which is connected to the first path 7 downstream of the vapour pump 11 and thereby to the vapour tank 9. According to the second method disclosed herein, the flow rate measuring means 13 measures a new flow rate of vapour, and if the measured new flow rate lies within a predetermined range, the vapour recovery system 1 is considered to malfunction upstream of where the second path 15 connects to the first path 7 (upstream of the flow rate measuring means 13). If the measured new volume lies outside the prede-

termined range, the vapour recovery system 1 is considered to malfunction somewhere between the two positions where the second path 15 connects to the first path 7. Similar to what is described above, information about these conclusion is stored and accessible.

[0030] In fig. 3, a fuel dispensing unit 100 is shown schematically. The fuel dispensing unit 100 has a fuel dispensing means 50 and a vapour recovery system 1 according to the present invention. The fuel dispensing means 50 has a fuel pump 54 that draws fuel from a fuel tank 58, via a fuel path 52 through a flow meter 56 and to a fuel dispensing nozzle 5. During the filling-up of a vehicle, the fuel dispensing nozzle 5 is connected to a motor vehicle tank 3. The fuel pump 54 is activated, and the flow meter 56 measures a volume of dispensed fuel. The flow meter 56 and the fuel pump 54 are connected to control means (not shown) for adjusting the speed of the fuel pump 54. The measured volume of dispensed fuel is transmitted to a second control means (not shown) for adjusting the speed of the vapour pump 23. The vapour recovery system 1, having the valve 17 closed, operates so that vapour is recovered from the motor vehicle tank 3. The fuel tank 58 and the vapour tank 9 can be arranged as one single unit.

[0031] The valve 21 has two separate valves, one positioned inside the fuel path 52 and one positioned inside the vapour path 7. The two valves arranged in the valve 21 are automatically closed when the nozzle 5 is put in a vertical direction, i.e. after filling-up is finished. The vapour recovery system 1 enables the built-in control to be performed when said valves 21 are closed i.e. at any time before or after filling-up.

[0032] The second path 15 of the vapour recovery system 1 can be open ended as shown in fig. 1.

[0033] The flow rate measuring means 13, the vapour pump 11, the damper 23 and the valve 19 can be arranged in any order along the first vapour path 7 as indicated in fig. 3.

[0034] Further components may be arranged in the first vapour path 7 in order to enhance the function or efficiency of the vapour recovery system 1.

[0035] The invention has mainly been described above with reference to a few preferred embodiments. However, as is readily appreciated by a person skilled in the art, other embodiments than the ones disclosed above are equally possible within the scope of the invention, as defined by the appended claims.

Claims

1. A vapour recovery system for recovering vapour from a motor vehicle tank (3) via a fuel dispensing nozzle (5), said system comprising a first vapour path (7) between the fuel dispensing nozzle (5) and a vapour tank (9), a vapour pump (11) arranged in said first path (7) and configured to pump vapour from the motor ve-

hicle tank (3) to the vapour tank (9), and
a flow rate measuring means (13) arranged in said
first path (7),

characterised in that

the vapour recovery system further comprises a sec-
ond path (15) which has a valve (17) and one end
of which is connected to the first path (7) downstream
of the fuel dispensing nozzle (5) and upstream of the
flow rate measuring means (13) and the vapour
pump (11).

2. A vapour recovery system according to claim 1,
wherein the first path (7) comprises a valve (19) ar-
ranged downstream of the fuel dispensing nozzle (5).

3. A vapour recovery system according to any one of
claims 1 or 2, wherein the first path (7) comprises a
valve (21) arranged within the fuel dispensing nozzle
(5).

4. A vapour recovery system according to any one of
claims 1-3, wherein the other end of the second path
(15) is connected to the atmosphere.

5. A vapour recovery system according to any one of
claims 1-3, wherein the other end of the second path
(15) is connected to the first path (7) downstream of
the flow rate measuring means (13) and the vapour
pump (11) and upstream of the vapour tank (9).

6. A method for control of a vapour recovery system
for recovering vapour from a motor vehicle tank, said
method comprising the steps of
measuring a vapour recovery flow rate through a first
vapour path between a fuel dispensing nozzle and
a vapour tank and including a vapour pump and a
flow rate measuring means,

characterised in that

a second flow rate is measured through a second
path one end of which is connected to the first path
downstream of the fuel dispensing nozzle and up-
stream of the flow rate measuring means and the
vapour pump, and

comparing the measured vapour recovery flow rate
with the second flow rate in order to detect malfunc-
tion of the vapour recovery system.

7. A method according to claim 6, wherein the second
flow rate is measured through a second path the oth-
er end of which is connected to the atmosphere.

8. A method according to claim 6, wherein the second
flow rate is measured through a second path the oth-
er end of which is connected to the first path down-
stream of the flow rate measuring means and the
vapour pump and upstream of the vapour tank.

9. A method according to any one of claims 6-8, where-

in the measured vapour recovery flow rate is com-
pared to a reference flow rate, and wherein the step
of measuring the second flow rate is performed if the
measured vapour recovery flow rate differs from the
reference flow rate.

10. A method according to any one of claims 6-8, where-
in the vapour recovery flow rate and the second flow
rate are measured at the same speed of the vapour
pump.

11. A fuel dispensing apparatus for dispensing fuel to a
motor vehicle comprising fuel dispensing means (50)
and a vapour recovery system according to any one
of claims 1-5.

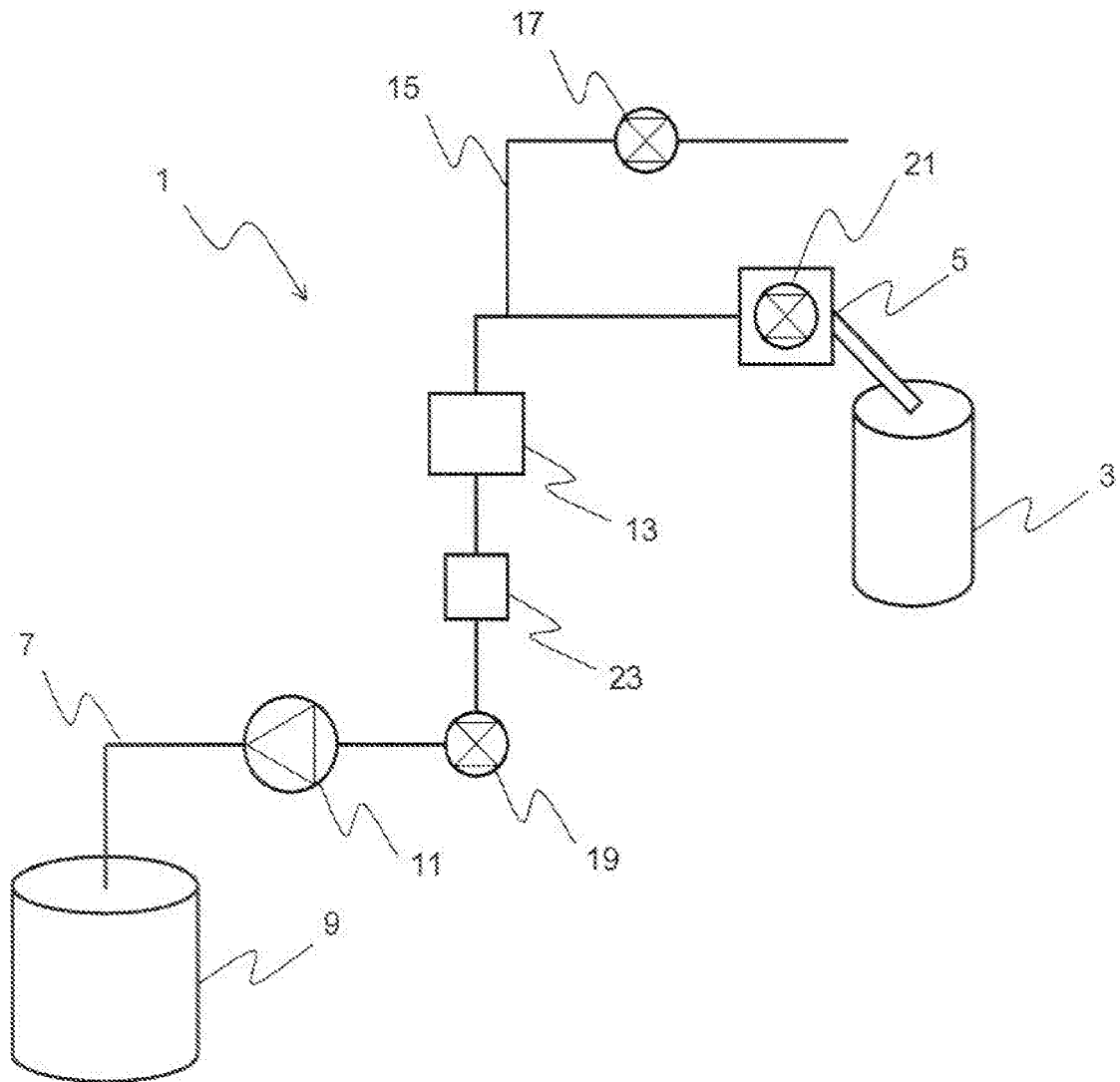


Fig 1

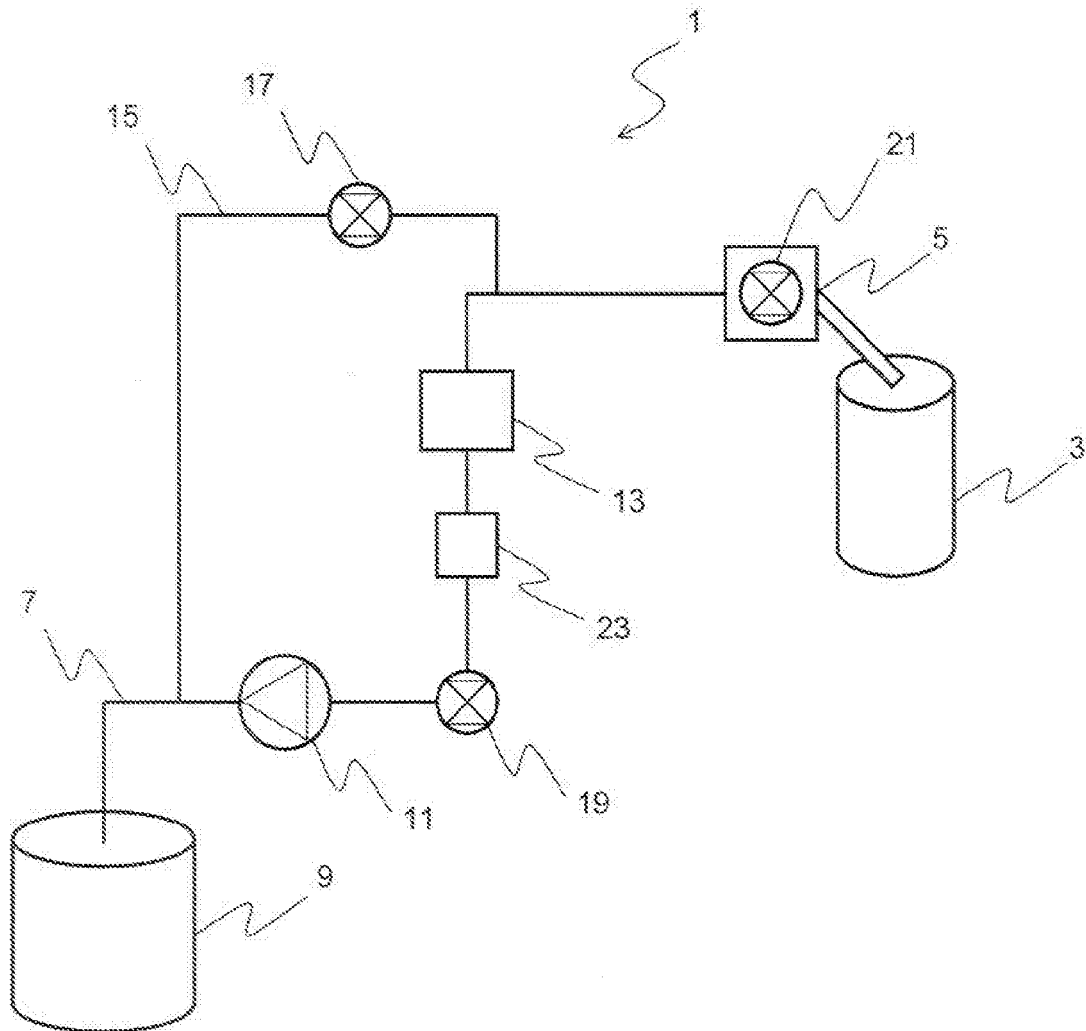


Fig 2

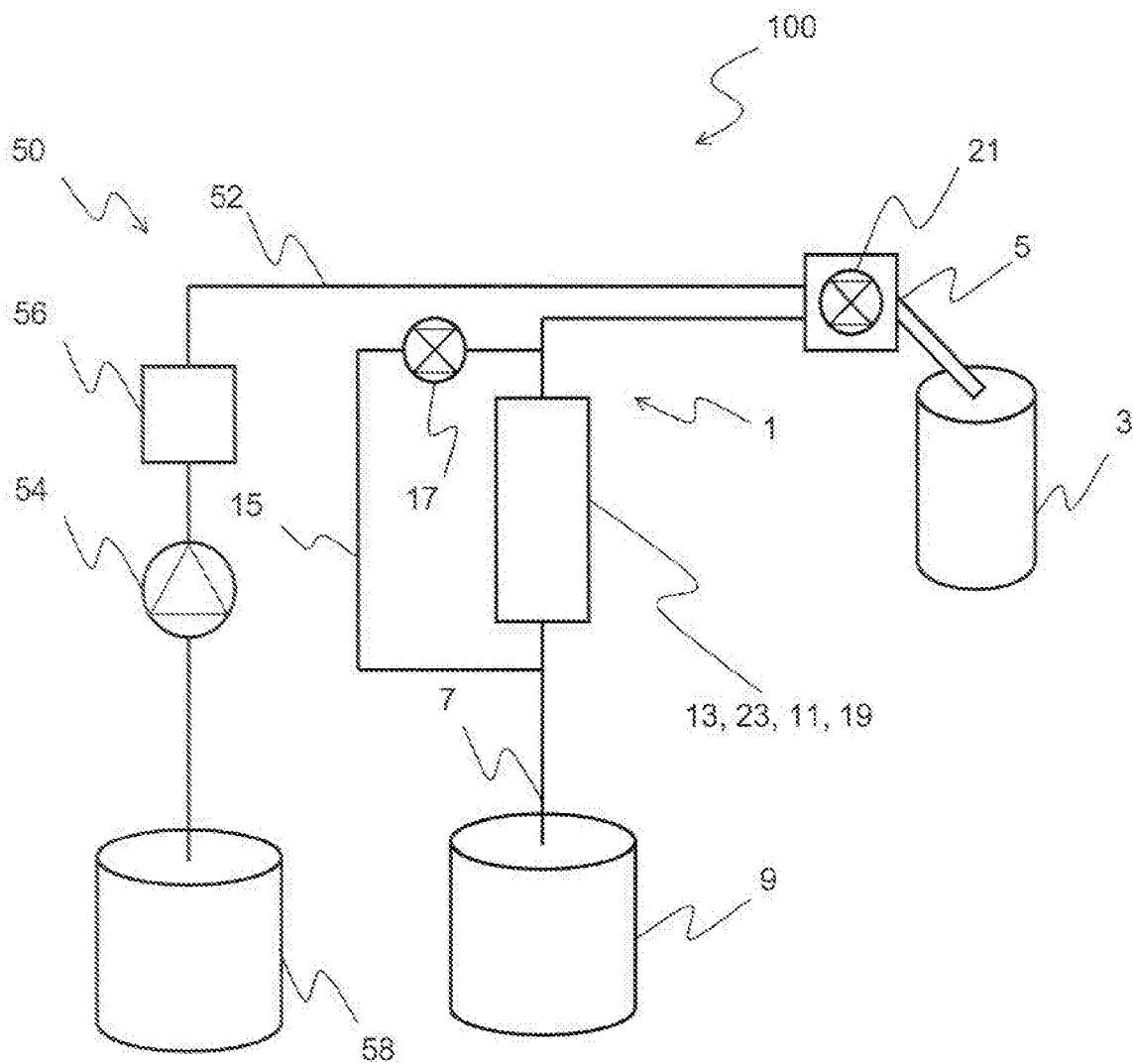


Fig 3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 10 8807

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	WO 00/55047 A (DRESSER EQUIPMENT GROUP, INC.) 21 September 2000 (2000-09-21) * page 3, line 9 - page 6, line 17 * * figure * -----	1,3,4,6, 7,9-11 2,5,8	INV. B67D5/04
			TECHNICAL FIELDS SEARCHED (IPC)
			B67D
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 8 October 2007	Examiner Smolders, Rob
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 10 8807

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on

The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-10-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0055047 A	21-09-2000	US 6247508 B1	19-06-2001

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- GB 2352437 A [0004]