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(54) Vapour recovery device and method

(57) A fuel dispensing device (1) for dispensing fuel to a motor vehicle tank (11), comprises fuel dispensing means and vapour recovery means for recovering vapour from the motor vehicle tank. The fuel dispensing means comprises fuel flow rate measuring means (7) for measuring the amount of dispensed fuel, and the vapour recovery means comprises vapour flow rate measuring means (9) for measuring the amount of vapour recovered from the motor vehicle tank (11) and adjusting means (14) for adjusting the amount of vapour recovered.

ered from the motor vehicle tank (11). The adjusting means (14) are arranged to, at a predetermined periodicity, receive a fuel measuring value from the fuel flow rate measuring means (7), compare the fuel measuring value with a vapour measuring value from the vapour flow rate measuring means (9), and adjust the flow of vapour from the motor vehicle tank (11) so that the volume of the vapour recovered from the motor vehicle tank (11) is equal to the volume of the fuel dispensed to the motor vehicle tank (11).

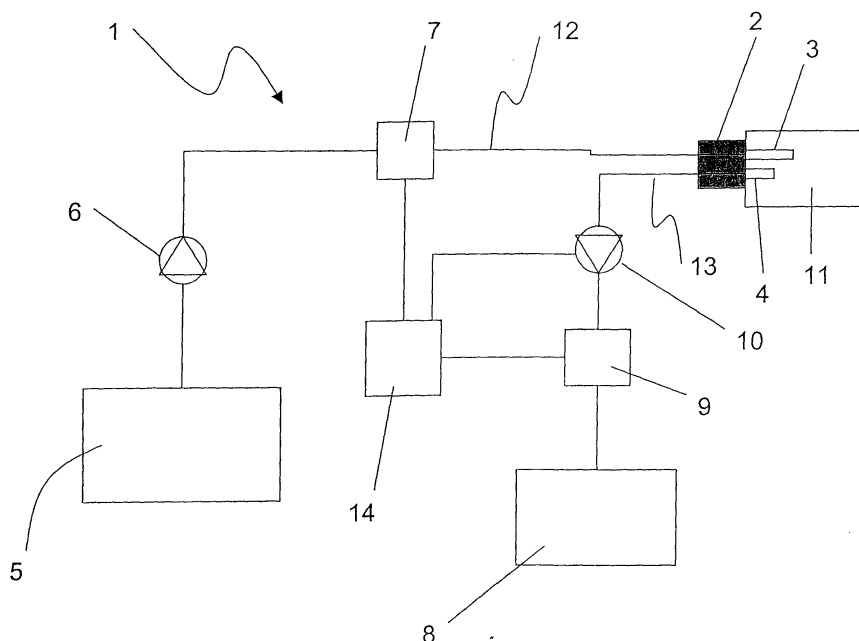


Fig 1

Description

Technical Field of the Invention

[0001] The present invention relates to a fuel dispensing device according to the preamble of claim 1.

Background Art

[0002] When filling the fuel tank of a motor vehicle, it is a common measure to recover the vapour escaping the tank when filling it with liquid fuel. This measure is taken for both safety and environmental reasons. The vapour recovery is for instance achieved by arranging a vapour suction nozzle next to the fuel dispensing nozzle which is used for filling the tank with fuel. Vapour is then removed from the tank during the filling, at a certain rate, often controlled by the standard rate of the fuel dispensed to the tank. However, when the vapour suction means are exposed to wear and lose their original adjustment, for instance due to leakage in a vapour pump, or when the fuel for some reason is dispensed at a different rate, the amount of fuel dispensed to the tank differs from the amount of vapour removed from the tank through the vapour suction nozzle. This can lead to an unwanted discharge of vapour into the air.

[0003] To make certain that all vapour escaping the tank is recovered, different kinds of control methods have been employed.

[0004] In GB 2352437 a method for checking the correct operation of a vapour recovery system is described which generates an alarm if the vapour delivery rate differs more than a certain amount from the liquid delivery rate.

[0005] In EP 0 461 770 a liquid delivery system with vapour and liquid recovering means is described, where the vapour flow is continuously measured so that it conforms to a desired value, which can be the value of the liquid flow.

[0006] In US 6,109,311 a method of recovering vapours when a liquid is dispensed is described. According to this method the vapour recovery rate is adjusted before every filling of a tank according to the relation between the vapour flow and the liquid flow during the previous filling.

Summary of the Invention

[0007] The present invention relates to a device for recovering vapour from a motor vehicle tank according to claim 1, with preferred embodiments in claims 2-4, and to a method according to claim 5.

[0008] According to the invention, a fuel dispensing device for dispensing fuel to a motor vehicle tank comprises fuel dispensing means and vapour recovery means for recovering vapour from the motor vehicle tank, wherein the fuel dispensing means comprises fuel flow rate measuring means for measuring the amount

of dispensed fuel, and the vapour recovery means comprises vapour flow rate measuring means for measuring the amount of vapour recovered from the motor vehicle tank and adjusting means for adjusting the amount of vapour recovered from the motor vehicle tank, wherein the adjusting means are arranged to, at a predetermined periodicity, receive a fuel measuring value from the fuel flow rate measuring means, compare the fuel measuring value with a vapour measuring value from the vapour flow rate measuring means, and adjust the flow of vapour from the motor vehicle tank so that the volume of the vapour recovered from the motor vehicle tank is equal to the volume of the fuel dispensed to the motor vehicle tank.

[0009] This is an efficient and reliable way of calibrating the vapour recovery means, which ensures that all vapour is recovered. Thus no vapour escapes into the air, which is important for both safety and environmental reasons.

[0010] The periodicity can be determined by a predetermined volume of fuel dispensed to the motor vehicle tank, or the fuel flow rate measuring means can be arranged to also measure the number of separate refuelling events of motor vehicles tanks and the periodicity be determined by a predetermined number of separate refuelling events.

[0011] This gives the advantage of minimising measuring errors and using a number of refuelling events for determining the periodicity gives the advantage that the adjustment is made after the same number of refuelling events on a fuel dispensing apparatus which is situated by a highway, where most cars fill up the tank completely, as on a fuel dispensing apparatus in the countryside where a lot of smaller vehicles such as mopeds fill up their tanks.

[0012] Further, according to an embodiment of the invention, the fuel flow rate measuring means are arranged to measure the fuel flow rate, and, for each time interval where the fuel flow rate is above a predetermined value, measure the volume of the fuel dispensed during this time interval, and the vapour flow rate measuring means are arranged to measure the volume of vapour recovered from the motor vehicle tank during this time interval, and the adjusting means are arranged to adjust the flow of vapour recovered from the motor vehicle tank so that the total volume of vapour recovered from the motor vehicle tank during a predetermined set of time intervals is equal to the total volume of fuel dispensed during the same set of time intervals.

[0013] This is advantageous since it makes it possible to make more precise measurements of the vapour flow rate, and, thus more precise adjustments of the vapour flow rate. This since the vapour flow rate measuring means cannot be made to measure equally precise in all flow rate intervals, but can be made to measure reasonably precisely in a certain flow rate interval.

[0014] The above advantages are also achieved by a method according to the invention.

Brief Description of the Drawings

[0015] The invention will be further elucidated below with reference to the accompanying drawing, which shows an exemplifying embodiment of the invention.

[0016] Fig. 1 is a schematic view of a fuel dispensing device.

Detailed Description of Preferred Embodiments of the Invention

[0017] The fuel dispensing device 1 in Fig. 1 comprises a fuel dispensing nozzle 2 with a fuel outlet 3 and a vapour inlet 4. A fuel tank 5, a fuel pump 6 and fuel flow rate measuring means 7 are provided in the fuel dispensing device 1. Further, the fuel dispensing device 1 comprises a vapour tank 8, vapour flow rate measuring means 9, a vapour pump 10, a fuel line 12, a vapour line 13 and adjusting means 14. A motor vehicle tank 11 is also shown in Fig. 1

[0018] Fuel is fed from the fuel tank 5, by means of the fuel pump 6, via the fuel line 12 and the fuel outlet 3, to the motor vehicle tank 11. The output from the fuel flow rate measuring means 7 is used to indicate the amount of fuel dispensed to the motor vehicle tank 11 on a display (not shown) on the fuel dispensing device 1 and is further used for calculating the fuel cost for the filling up of the motor vehicle tank 11. When the fuel is fed to the motor vehicle tank 11, vapour is displaced by the fuel. To prevent the vapour from escaping into the ambient air, the vapour is sucked into the vapour inlet 4 by means of the vapour pump 10, via the vapour line 13, into the vapour tank 8. It is possible that the vapour tank 8 and the fuel tank 5 is the same tank, i.e. that the vapour is recovered to the fuel tank 5 instead of to a separate vapour tank 8.

[0019] The amount of vapour recovered from the motor vehicle tank 11 is determined by the vapour flow rate measuring means 10.

[0020] The adjusting means 14 are arranged to adjust the vapour pump 10 so that a desired volume of vapour is recovered from the motor vehicle tank.

[0021] When designing vapour flow rate meters it is difficult, if not impossible to make it measuring the vapour flow correctly in a large flow rate interval. The measuring of the vapour flow rate is often inaccurate and so is of course also the measure of the volume. However, it is often possible to build a vapour flow rate measuring means which will measure with good accuracy in a certain limited flow rate interval, for instance 25-40 l/min. Therefore, according to an embodiment of the invention, the volume of the vapour and the volume of the fuel are only measured in a certain fuel flow rate interval, for instance above 25 l/min. The fuel flow rate during normal refuelling is most of the time, with exception from the first and the last part of the refuelling where it is lower, about 35-40 l/min. The fuel flow rate is used for deciding the flow interval since the fuel flow rate

measuring means, as opposed to the vapour flow rate measuring means, are very accurate. The volume of vapour and the volume of fuel during a certain set of time intervals where the fuel flow rate was above 25 l/min is then compared by the adjusting means 14, and the vapour pump 10 is adjusted so that the volume of fuel and the volume of vapour during the measured time intervals is the same. For instance, the total volume when the fuel flow was above 25 l/min during three different filling-up instances can be used for the comparison and calibration of the vapour pump. Any measuring errors will then have less impact on the result.

[0022] The calibration of the vapour pump can be made at the beginning of a filling event, during such an event or between two successive events.

[0023] It is also possible to provide an alarm or indicator which indicates, for instance to the owner of the fuel distribution device, that an adjustment of the vapour pump has been made, is made or will be made. The alarm can also be arranged to be activated when there has been a number of consecutive comparisons of the vapour volume and the fuel volume where there were discrepancies which lead to an adjustment of the vapour pump. This can be useful for the owner or the fuel distribution device when determining if the fuel distribution device needs servicing.

Claims

1. A fuel dispensing device (1) for dispensing fuel to a motor vehicle tank (11), comprising fuel dispensing means and vapour recovery means for recovering vapour from the motor vehicle tank, wherein the fuel dispensing means comprises fuel flow rate measuring means (7) for measuring the amount of dispensed fuel, and the vapour recovery means comprises vapour flow rate measuring means (9) for measuring the amount of vapour recovered from the motor vehicle tank (11) and adjusting means (14) for adjusting the amount of vapour recovered from the motor vehicle tank (11), **characterised in that** the adjusting means (14) are arranged to, at a predetermined periodicity, receive a fuel measuring value from the fuel flow rate measuring means (7), compare the fuel measuring value with a vapour measuring value from the vapour flow rate measuring means (9), and adjust the flow of vapour from the motor vehicle tank (11) so that the volume of the vapour recovered from the motor vehicle tank (11) is equal to the volume of the fuel dispensed to the motor vehicle tank (11).
2. A fuel dispensing device according to claim 1, wherein the fuel flow rate measuring means (7) are arranged to measure the fuel flow rate, and, for each time interval where the fuel flow rate is above a predetermined value, measure the volume of the

fuel dispensed during this time interval, and wherein the vapour flow rate measuring means (9) are arranged to measure the volume of vapour recovered from the motor vehicle tank (11) during this time interval, and wherein the adjusting means (14) are arranged to adjust the flow of vapour recovered from the motor vehicle tank (11) so that the total volume of vapour recovered from the motor vehicle tank (11) during a predetermined set of time intervals is equal to the total volume of fuel dispensed during the same set of time intervals.

3. A fuel dispensing device according to claim 1, wherein the periodicity is determined by a predetermined volume of fuel dispensed to the motor vehicle tank (11).
4. A fuel dispensing device according to claim 1, wherein the fuel flow rate measuring means (9) are arranged to also measure the number of separate refuelling events of motor vehicles tanks and the periodicity is determined by a predetermined number of separate refuelling events.
5. A method of recovering vapour from a motor vehicle tank (11) in connection with fuel being dispensed to the motor vehicle tank (11), comprising the steps of:
 - measuring the volume of fuel dispensed to the motor vehicle tank (11),
 - measuring the volume of recovered vapour,
 - comparing the fuel volume and the vapour volume with a predetermined periodicity, and, according to the result of the comparison,
 - adjusting the flow of vapour from the motor vehicle tank (11) so that the volumes are equal.

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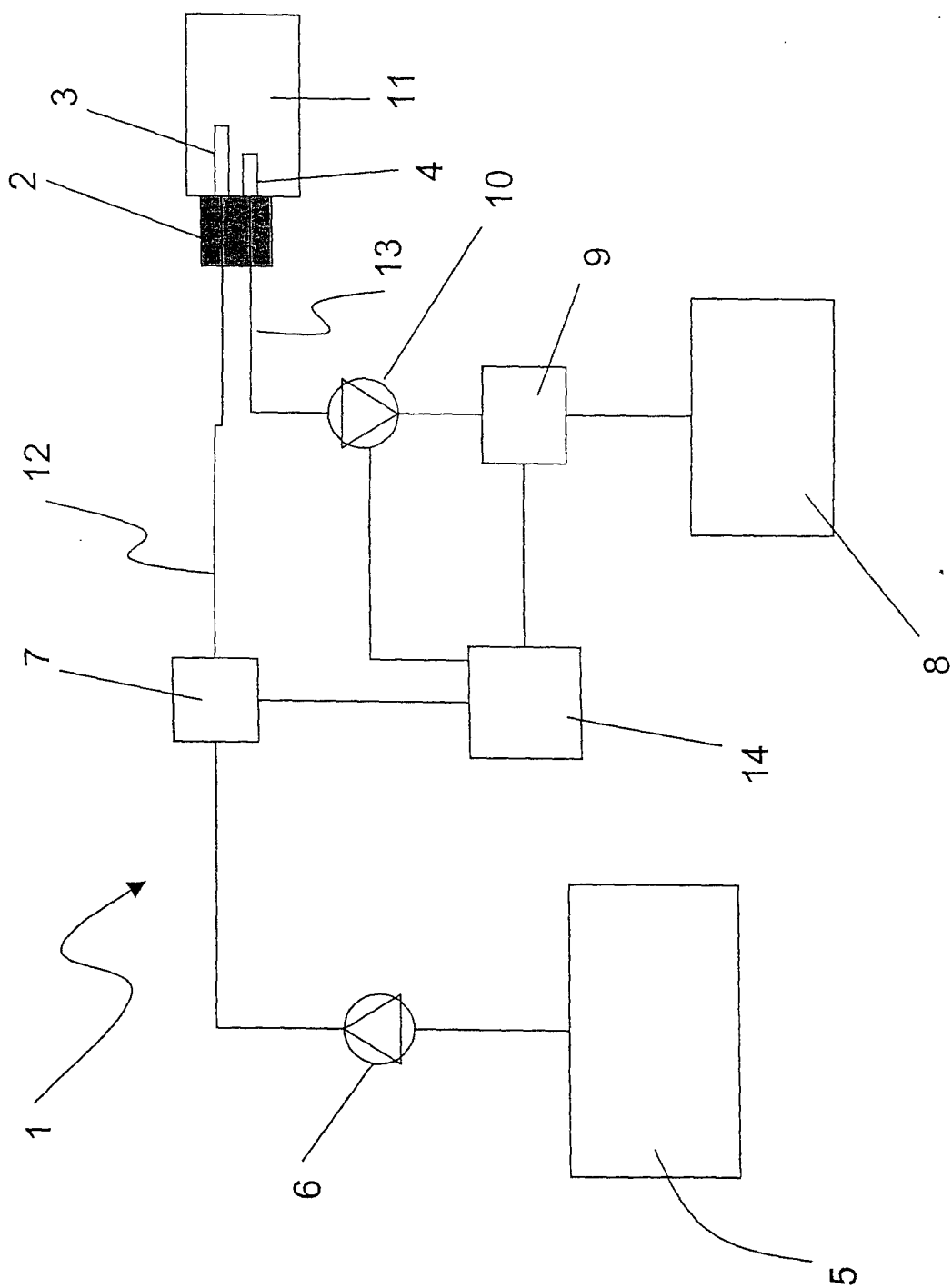


Fig 1



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Application Number
EP 04 44 5017

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Place of search		Date of completion of the search	Examiner
Munich		20 July 2004	Plenk, R
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EPO FORM 1503 03.82 (P04001)



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