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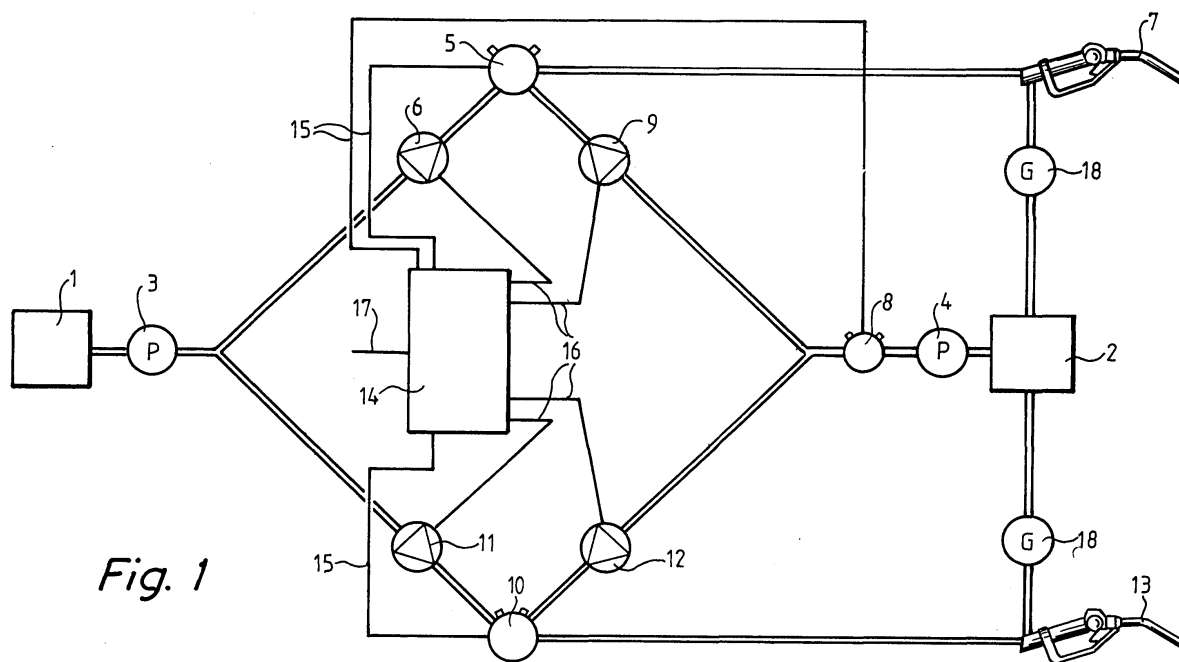
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200 71 Malmö (SE)****(54) Fuel dispenser for dispensing liquid fuel**

(57) A fuel dispenser for a petrol station for dispensing liquid fuel from at least one fuel container comprises at least two fuel containers (1, 2) and at least one delivery nozzle (7, 13). Each delivery nozzle is connected to each of the fuel containers via separate flow control means (6, 9, 11, 12), for controlling a flow of fuel to each

delivery nozzle from each of the fuel containers. The fuel dispenser further comprises a flow meter (5, 10) for each delivery nozzle for metering the total flow of fuel to each delivery nozzle from the fuel containers, and at least one flow meter (8) for metering the flow of fuel from a fuel container.

*Fig. 1***EP 0 987 215 A2**

Description

Field of the Invention

[0001] The present invention relates to a fuel dispenser for dispensing liquid fuel according to the preamble to claim 1.

Background Art

[0002] At petrol stations for motor vehicles, use is made of fuel dispensers or fuel pumps in connection with one or more fuel containers for dispensing liquid fuel to fuel tanks of motor vehicles. The fuel is stored in the fuel container, which is connected to the fuel dispenser/ fuel pump by means of a conduit. The difference between fuel dispensers and fuel pumps is that the latter have a built-in pump and valves for controlling the flow of fuel whereas dispensers have only valves for controlling the flow of fuel. For dispensers, the flow of fuel must be produced by there being a pump in connection with each one of the fuel containers. The term fuel dispenser will be used in the following for both fuel pump and fuel dispenser.

[0003] To make it possible for the fuel dispenser to dispense different grades of fuel, a plurality of different containers with different fuel are currently used at petrol stations. The dispenser can be arranged so that fuel can be dispensed to one or more delivery nozzles simultaneously. As a rule, delivery nozzles are arranged on two sides of the dispenser and can be used simultaneously.

[0004] In some cases, one delivery nozzle is arranged for each grade of fuel. For each nozzle, there is a flow control means which controls the flow from the fuel container to the delivery nozzle and a flow meter connected to a display unit. The flow meter used to meter the dispensed amount of fuel must be accurate in order to satisfy the requirements issued by the authorities as to the dispensing of fuel at a petrol station. The accuracy requirements placed on the flow meter are different in different countries. The accuracy of a flow meter can be measured, for instance, by filling a container with a given amount of fuel at three different flow rates. The three different flow rates selected are the maximum flow rate for which the flow meter is intended, a tenth of the maximum flow rate and a flow rate between the two flow rates mentioned. The accuracy requirement usually is that the metered amount of fuel be not allowed to deviate by more than 0.5%, preferably not by more than 0.25% from the actual one as the fuel dispenser is supplied from factory. This makes an accurate and, thus, expensive flow meter necessary. In many countries, the flow meter must also be calibrated each year, which causes an additional cost.

[0005] By an accurate flow meter is thus meant a flow meter in which the metered flow rate deviates by at most 0.5%, preferably at most 0.25%, from the actual flow, within a range between the maximum flow rate for which

the flow meter is intended and a tenth of the maximum flow rate. For a flow meter intended for a flow rate of, for instance, a maximum of 40 l/min., the accuracy must be kept in the range of 4-40 l/min. A less accurate flow meter has inferior accuracy.

[0006] It happens that gas recirculation from the delivery nozzle is desired in order to minimise the fuel vapour in the vicinity of the delivery nozzle. Gas recirculation requires a gas pump which should be operated at a speed which is proportional to the flow of fuel. This is usually done by regulating the gas pump according to the flow of fuel. This necessitates control equipment for the gas pump.

[0007] In some cases, for instance when the fuel is petrol, petrol with different octane numbers is supplied, such as three octane numbers. In order not to need one container for each octane number, there are usually two containers holding petrol with the highest and lowest octane numbers, respectively. To obtain petrol with octane numbers therebetween, the petrol from the two containers is mixed. A dispenser which is arranged to permit mixing of petrol from two containers has a flow control means and a flow meter between each of the containers and the delivery nozzle. The flow control means are connected to a display unit and a control unit. When petrol from the two containers is being mixed, the control unit receives signals about the size of the flow from the flow meters, and then uses these signals to control the flow control means so as to produce the correct octane number. With the described configuration, two accurate flow meters are required for each delivery nozzle.

[0008] An alternative method is disclosed in US Patent 5,630,528, according to which a dispenser is connected to a plurality of fuel containers. The dispenser has a plurality of flow control means, but only one flow meter. The flow control means control the flow so that fuel from one of the containers passes the flow meter. A drawback of this solution is that the number of fuel containers must be the same as the number of fuel grades supplied, which means a great investment cost.

[0009] There is thus a need for a fuel dispenser for a petrol station, by means of which fuel from different containers can be mixed and by means of which the installation costs and the maintenance costs have been minimised.

Summary of the Invention

[0010] An object of the present invention is to provide a fuel dispenser for a petrol station and a method therefor, which allows controlled mixing of fuel from different containers with reduced costs for installation and maintenance compared with prior art fuel dispensers.

[0011] A further object of the present invention is to provide a fuel dispenser for a petrol station, in which the number of accurate flow meters has been minimised.

[0012] These objects are achieved by a fuel dispenser and a method which have the features defined in the

claims.

[0013] A fuel dispenser according to the invention enables mixing of fuel from different fuel containers. The inventive fuel dispenser further has the advantage that only one flow meter which meters the total flow through a delivery nozzle need to be so accurate as to satisfy the requirements issued by the authorities in respect of the totally dispensed quantity. The flow meters which meter the separate flow from a fuel container need only have such accuracy as to satisfy the accuracy requirements as to mixing proportions of fuel from different containers. This means that the flow meters which meter the separate flow from a fuel container can be less accurate and, consequently, less expensive than the flow meter metering the total flow through a delivery nozzle.

[0014] In a fuel dispenser according to an embodiment of the invention, which comprises a first and a second fuel container, a delivery nozzle, an accurate flow meter and a less accurate flow meter, a flow of fuel is fed from one of the containers or both at the same time, through the accurate flow meter. The less accurate flow meter is connected between the second container and the accurate flow meter. The flow of fuel from the first container can be determined by the difference between the accurate flow meter and the less accurate flow meter and, as a result, the mixing proportions can be determined while at the same time only one accurate flow meter is required. Thus three different grades of fuel can be supplied from two fuel containers while at the same time only one accurate flow meter for each delivery nozzle is required.

[0015] According to a further aspect of the invention, a gas pump can be arranged in connection with the accurate flow meter and be operated by the motion thereof. As a result, the gas pump pumps at a speed which is proportional to the fuel flow rate independently of whether the fuel comes from one of the containers or both simultaneously. Thus no control equipment and only one gas pump is required.

[0016] According to another aspect of the present invention, the fuel dispenser may comprise further fuel containers and associated less accurate flow meters. There is thus at least one less accurate flow meter for all fuel containers except one, which permits controlling of the mixing proportions of fuel from the fuel containers in all combinations.

[0017] According to one more aspect of the invention, only the flow meters that meter the total flow of fuel to a delivery nozzle are calibrated. This means a great saving compared with the case where all flow meters are calibrated. The requirements issued by the authorities as to the maximum intervals between calibrations vary from country to country. Also the accuracy requirements that the totally dispensed amount must satisfy vary from country to country. The calibration of the flow meter metering the total flow of fuel through the delivery nozzle is carried out sufficiently frequently to satisfy the requirements issued by the authorities in the country where the

fuel dispenser is placed.

[0018] Detailed embodiments of the invention will now be described with reference to the Figures.

5 Brief Description of the Drawings

[0019] Fig. 1 is a schematic view of a fuel dispenser according to a preferred embodiment of the present invention for dispensing liquid fuel, said fuel dispenser comprising two delivery nozzles and two fuel containers.

[0020] Fig. 2 is a schematic view of a fuel dispenser according to an alternative embodiment of the present invention for dispensing liquid fuel, said fuel dispenser comprising three delivery nozzles and three fuel containers.

[0021] Fig 3 is a schematic view of a fuel dispenser according to an alternative embodiment of the present invention for dispensing liquid fuel, said fuel dispenser comprising two delivery nozzles and two fuel containers.

20 Description of Preferred Embodiments

[0022] In Fig. 1 a first and a second fuel container 1, 2 are connected to associated pumps 3, 4. The first fuel container 1 is connected to a first accurate flow meter 5 via a flow control means in the form of a first valve 6. The first accurate flow meter is also connected to a first delivery nozzle 7. The second fuel container 2 is connected to a first less accurate flow meter 8. The less accurate flow meter is also connected to the first accurate flow meter via a flow control means in the form of a second valve 9. Correspondingly, a second accurate flow meter 10 is connected to the first fuel container via a flow control means in the form of a third valve 11 and to the first less accurate flow meter via a flow control means in the form of a fourth valve 12. The second accurate flow meter is connected to a second delivery nozzle 13. A control means 14 receives signals from the flow meters 5, 8, 10 about the current flow via signal lines 15. The control means also controls via control lines 16 the valves 6, 9, 11, 12, which are controllable either by being partially throttled or by being open only for short periods. In the latter case, the flow is regulated by varying the ratio of the time the valve is open to the time the valve is closed. The pulsing of the valve is carried out so quickly that it can be resembled to throttling of the flow.

[0023] The control means controls the valves so that each delivery nozzle is supplied with fuel from one of the fuel containers or both simultaneously.

[0024] The desired octane number is supplied through an input 17.

[0025] Information about the flow through the flow meters renders it possible for the control means to control the valves so that the desired mixing proportions of fuel from the first and the second fuel container are achieved. When the second valve 9 is open and the fourth valve 12 is closed, the entire flow of fuel through

the first less accurate flow meter 8 will also pass through the first accurate flow meter 5. Consequently, the mixing proportions are determined with an accuracy which is determined by the less accurate flow meter 8. Since the requirement issued by the authorities in respect of the mixing proportions is lower than the requirement as to the total amount of dispensed fuel, it is possible to use the less accurate flow meter.

[0026] When both the second and the fourth valve 9, 12 are open, the flow of fuel through the less accurate flow meter 8 will be divided into two flows through the second and the fourth valve 9, 12, respectively. Since the different flows through the second and the fourth valve 9, 12 are not metered but only the sum thereof is metered, the regulation of the mixing proportions in the delivery nozzles is dependent on the fact that the flow as a function of the throttling of the valves is known, or alternatively the flow as a function of the relative time interval when the valves are open. Data about the flow of the valves as a function of the throttling are stored in the control means. An accuracy in the division between the two flows which is within the limits stipulated by the authorities can be achieved by means of ordinary valves.

[0027] A gas pump 18 is arranged in connection with each accurate flow meter and is operated by the motion thereof. A gas conduit is arranged between each delivery nozzle and the associated gas pump, each gas pump in turn being connected to at least one of the fuel containers. In this manner gas is pumped from the delivery nozzles at a speed which is proportional to the flow rate of the fuel.

[0028] A fuel dispenser according to the preferred embodiment as described above eliminates the need for an accurate flow meter for each fuel container and each delivery nozzle, which results in reduced costs. The two delivery nozzles can be arranged on different sides of a fuel dispenser.

[0029] A person skilled in the art realises that the second delivery nozzle 13 can be omitted, which is equivalent to closing the third and the fourth valve 11, 12. In the same way, it is possible to have three or more delivery nozzles without deviating from the inventive concept. The number of nozzles is only limited by the requisite accuracy of the mixed fuel, which in turn is determined by the accuracy in the throttling of the different valves.

[0030] Fig. 2 shows a variant of the preferred embodiment of the present invention, which has two less accurate flow meters 8', 8". One of the two less accurate flow meters 8' is arranged between the second fuel container 2 and the first delivery nozzle 7, for metering the flow of fuel from the second fuel container 2 to the first delivery nozzle 7. The other of the two less accurate flow meters 8" is arranged between the second fuel container 2 and the second delivery nozzle 13, for metering the flow of fuel from the second fuel container 2 to the second delivery nozzle 13. By having two less accurate flow

meters, an improved accuracy in the mixing proportions of different fuels in the two delivery nozzles 7, 13 is achieved compared with the preferred embodiment described above. Although the provision of a less accurate flow meter for each delivery nozzle involves an additional cost, it still means a saving compared with the prior art technique according to which two accurate flow meters are required for each delivery nozzle.

[0031] An alternative embodiment of the present invention is illustrated in Fig. 3, which comprises also a third fuel container 19 and a third pump 20, a fifth valve 21 and a sixth valve 22, and a second less accurate flow meter 23. The mixing proportions of fuel from the three different fuel containers to the associated delivery nozzle are controlled by the control means receiving signals from the three flow meters and controlling the valves so as to obtain the desired mixing proportions.

[0032] A person skilled in the art realises that it is possible to have an arbitrary number of delivery nozzles connected to the fuel containers, arranged in groups or separately on dispensers.

[0033] In the embodiments described above, a central pump is arranged for each fuel container, but alternatively one pump for each delivery nozzle or for each dispenser can be arranged for each fuel container.

[0034] A person skilled in the art realises that there are many possibilities of varying the described embodiments within the scope of the invention.

Claims

1. A fuel dispenser for a petrol station for dispensing liquid fuel from at least one fuel container, said fuel dispenser comprising:

at least two fuel containers (1, 2) and
at least one delivery nozzle (7, 13), each delivery nozzle being connected to each of the fuel containers via separate flow control means (6, 9, 11, 12) for controlling a flow of fuel to each delivery nozzle from each one of the fuel containers, **characterised** in that the fuel dispenser further comprises:

a flow meter (5, 10) for each delivery nozzle (7, 13) for metering the total flow of fuel to each delivery nozzle from the fuel containers, and at least one flow meter (8, 8', 8", 23) for metering the flow of fuel from a fuel container.

2. A fuel dispenser as claimed in claim 1, **characterised** in that for all fuel containers except one, there is arranged at least one flow meter (8, 8', 8", 23) for metering the separate flow from the respective fuel containers.
3. A fuel dispenser as claimed in claim 1 or 2, **characterised** in that it comprises pumps (3, 4, 20)

for pumping the fuel from the fuel containers.

4. A fuel dispenser as claimed in claim 1, 2 or 3, **characterised** in that it comprises two delivery nozzles (7, 13),

two fuel containers (1, 2), and
two flow meters (8', 8'') metering the flow from
one of the fuel containers (2) to each one of the
two delivery nozzles (7, 13).

5. A fuel dispenser as claimed in claim 1, 2 or 3, **characterised** in that it comprises two delivery nozzles (7, 13),

two fuel containers (1, 2), and
a flow meter (8) metering the total flow from one
of the fuel containers (2) to the two delivery nozzles (7, 13).

6. A fuel dispenser as claimed in any one of the preceding claims, **characterised** in that it further comprises a control means (14) which receives signals from the flow meters informing about the flow through the flow meters and which controls the flow control means.

7. A fuel dispenser as claimed in claim 1, 2, 3, 4 or 5, **characterised** in that it further comprises:
a control means (14) with an input (17), the control means receiving through the input signals about the desired mixing proportions of fuel from different fuel containers and receiving from the flow meters signals about the current flows, and thus controlling the flow control means so that the desired mixing proportions are achieved.

8. A fuel dispenser as claimed in any one of the preceding claims, **characterised** in that the flow rate metered by a flow meter (5, 10) for metering the total flow of fuel to each delivery nozzle deviates by at most 0.5% from the actual flow rate in a range between the maximum flow rate for which the flow meter is intended and a tenth of the maximum flow rate.

9. A fuel dispenser as claimed in any one of the preceding claims, **characterised** in that at least one gas pump (18) is arranged, which is operated by the motion of a flow meter for metering the total flow of fuel to each delivery nozzle.

10. A fuel dispenser as claimed in any one of the preceding claims, **characterised** in that the flow control means are valves.

11. A fuel dispenser as claimed in any one of the preceding claims, **characterised** in that only the flow meters for metering the total flow through a delivery

nozzle are arranged to be calibrated at predetermined intervals.

12. A method in fuel dispensers for a petrol station for dispensing liquid fuel from at least one fuel container comprising the steps of

connecting a delivery nozzle (7, 13) to at least two fuel containers (1, 2) via separate flow control means (6, 9, 11, 12) for each fuel container, for controlling a flow of fuel to the delivery nozzle from each of the fuel containers, **characterised** by the steps of
arranging a flow meter (5, 10) for the delivery nozzle (7, 13) for metering the total flow of fuel to the delivery nozzle from the fuel containers, arranging at least one flow meter (8, 8', 8'', 23) for metering the flow of fuel from a fuel container, and
calibrating at predetermined intervals only the flow meter for metering the total flow of fuel to the delivery nozzle.

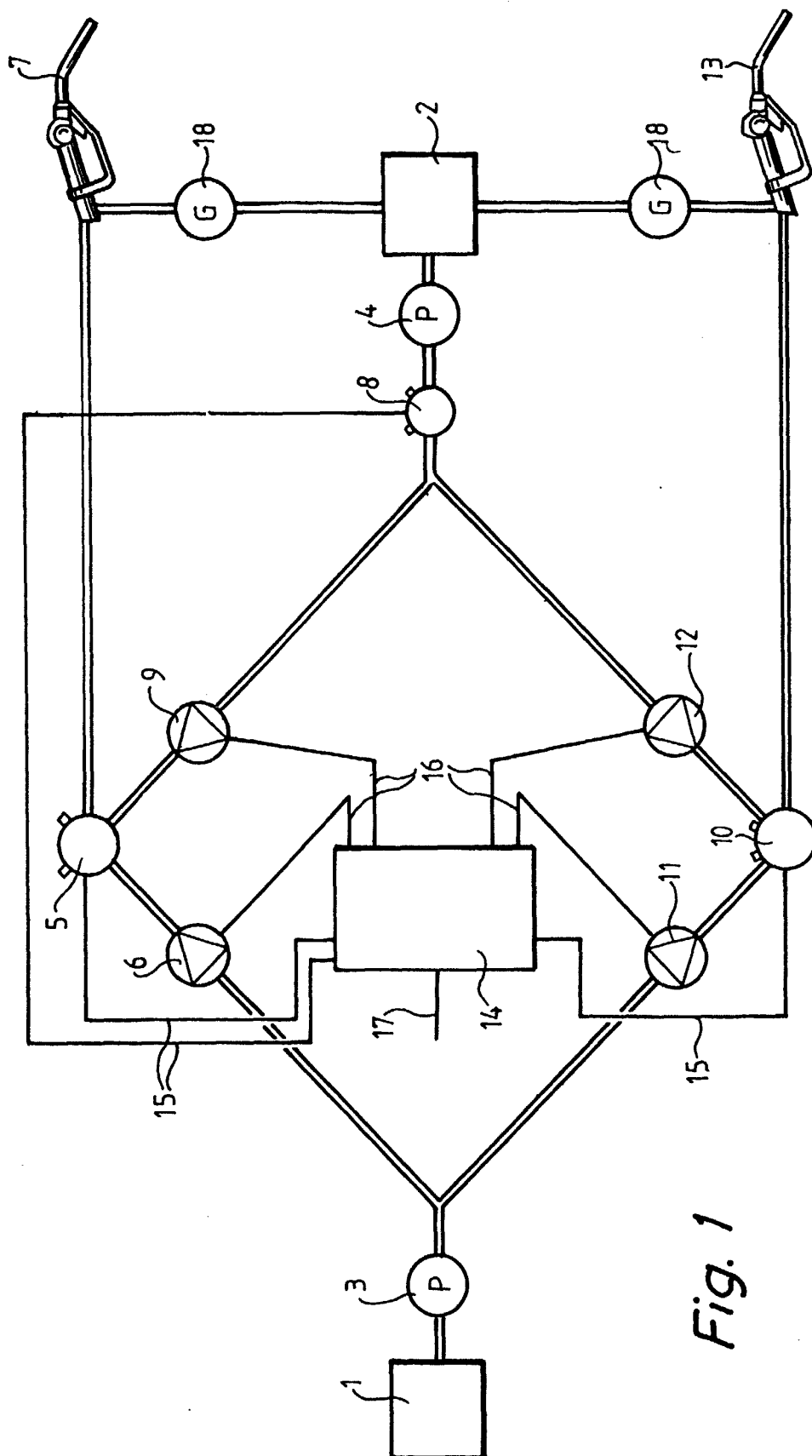


Fig. 1

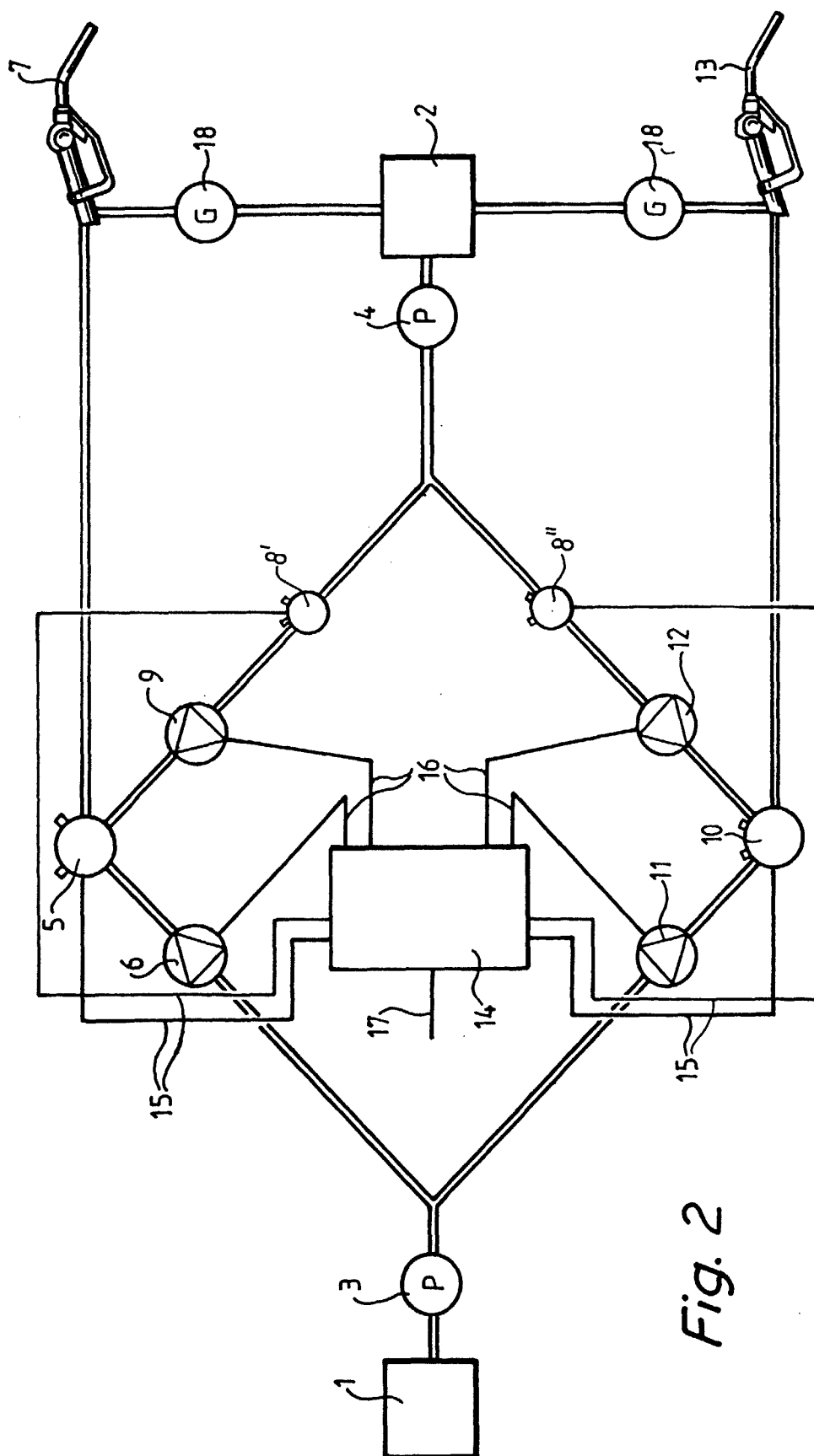


Fig. 2

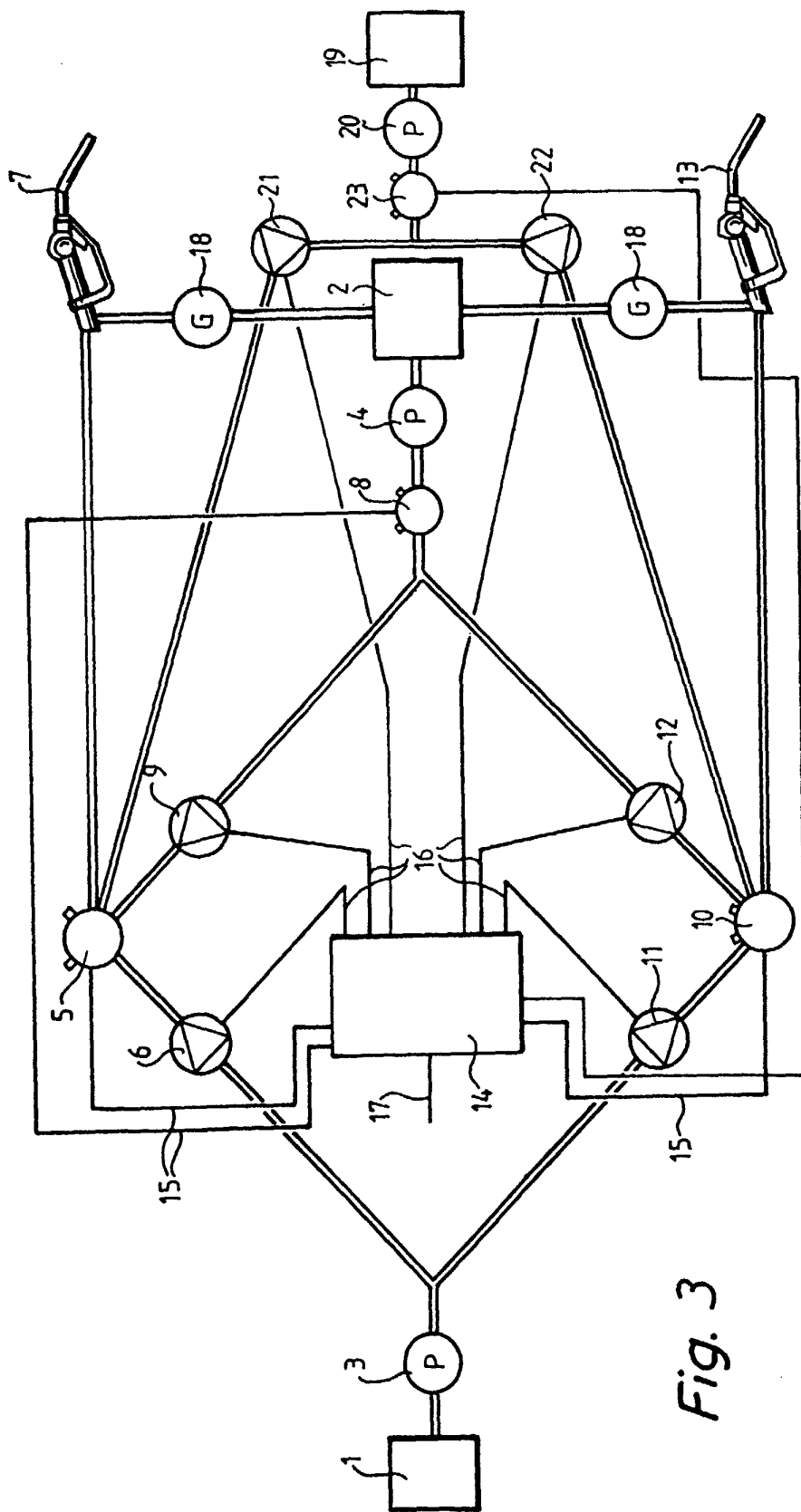


Fig. 3