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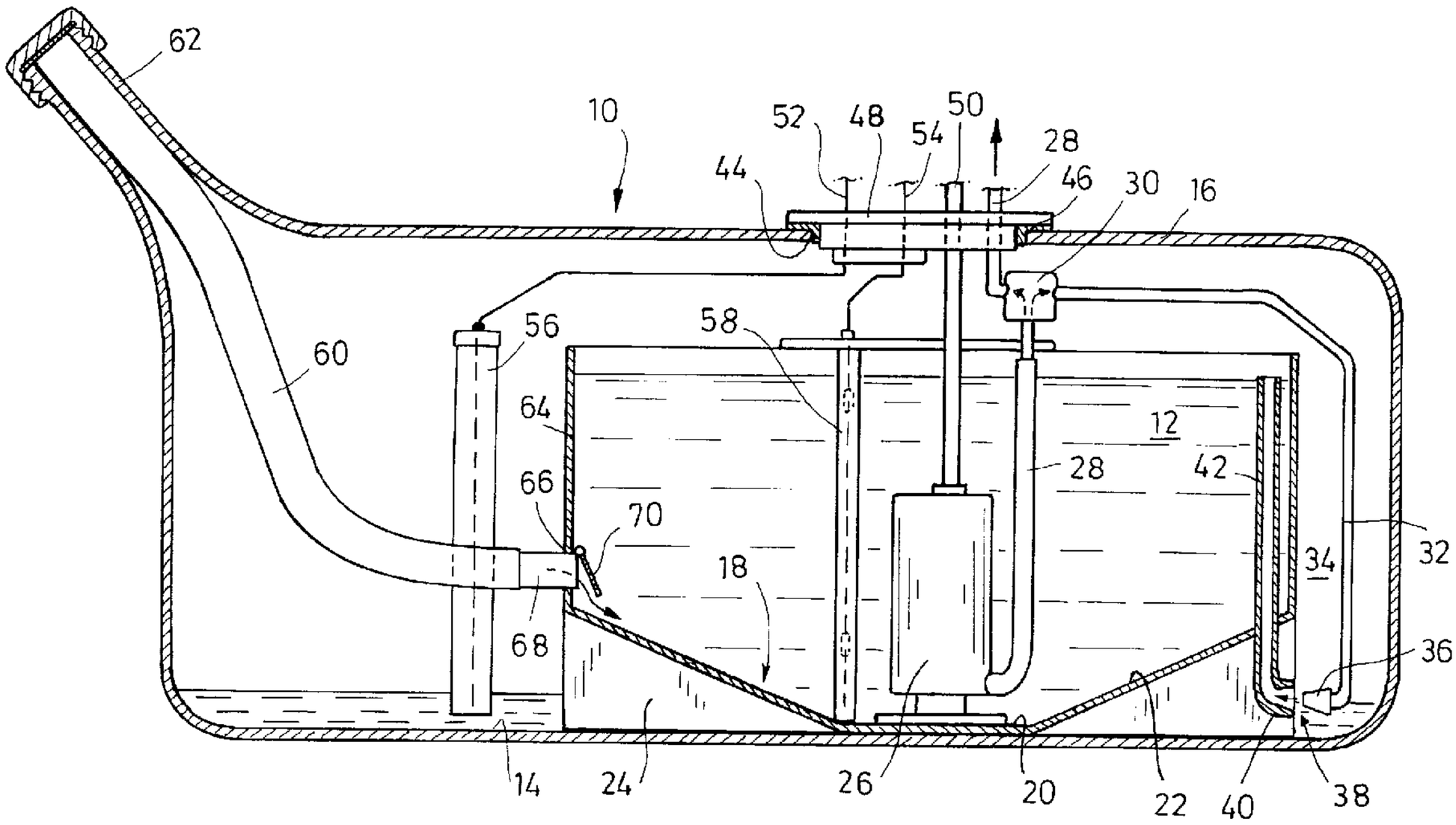
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(54) **RESERVOIR D'ESSENCE**
(54) **FUEL TANK**



(57) A fuel tank for a motor vehicle has a reservoir arranged within the tank body and a motor-driven pump operatively associated with the reservoir for feeding fuel to the engine. Fuel can be introduced into the tank through a filling pipe. The filling pipe has an outlet end arranged in relation to the reservoir such that at least a part of the fuel flowing through the filling pipe is passed directly into the reservoir. At least the lower region of the reservoir is closed off with respect to the surrounding space in the tank body.

ABSTRACT OF THE INVENTION

A fuel tank for a motor vehicle has a reservoir arranged within the tank body and a motor-driven pump operatively associated with the reservoir for feeding fuel to the engine. Fuel can be introduced into the tank through a filling pipe. The filling pipe has an outlet end arranged in relation to the reservoir such that at least a part of the fuel flowing through the filling pipe is passed directly into the reservoir. At least the lower region of the reservoir is closed off with respect to the surrounding space in the tank body.

The invention concerns a fuel tank, for example for a motor vehicle.

A fairly typical form of fuel tank for a motor vehicle comprises a tank body with a reservoir arranged therewithin. A motor-driven pump is associated with the reservoir, for delivering fuel to the engine of the motor vehicle. The tank also includes a filling pipe for introducing fuel into the tank. The reservoir which is in general part of a fuel delivery unit which also includes the fuel pump is intended in particular to ensure the function that, even under adverse operating conditions, for example when the motor vehicle in which the fuel tank is installed is negotiating a curve or bend of considerable length or when the vehicle with the fuel tank is in a position that deviates markedly from the horizontal, there is still an adequate amount of fuel in the intake region of the fuel pump to ensure an adequate supply of fuel to the engine to avoid fuel starvation thereof. That therefore presupposes the presence of a certain minimum amount of fuel in the reservoir.

The electric fuel pump which is generally arranged within the reservoir can be of a two-stage design, wherein the first stage of the pump conveys fuel from the space or chamber in the fuel tank, which surrounds the reservoir, into the actual reservoir. For that purpose, in or in the proximity of its bottom region, the reservoir can be provided with a passage which is possibly closable and through which fuel can be sucked by the first stage of the pump. The second stage of the pump then draws fuel from the reservoir and delivers it towards the engine of the vehicle. In that respect, the second stage of the fuel pump is generally operable to continually supply an amount of fuel per unit of time, which is greater than the amount which would correspond to the maximum fuel consumption of the engine. Therefore, there is generally connected on the outlet or discharge side of the fuel pump a control device, generally in the form of a pressure regulator, in which the surplus amount of fuel is branched off and recycled back into the reservoir.

Another option in this respect is for only a single-stage fuel pump to be associated with the reservoir. The fuel pump draws fuel from the reservoir and delivers it to the engine. That fuel pump therefore merely

performs the function of the second stage of the two-stage fuel pump referred to above. In that case, fuel is conveyed from the space or chamber in the tank body, which surrounds the reservoir, into the reservoir itself, for example by a suction jet pump or ejector pump which is kept in operation by the flow of fuel which is branched off in the pressure regulator as surplus and flows through the return conduit for recycling purposes.

In both the above-described alternative arrangements and configurations, when the tank is filled with fuel the fuel is introduced into the space or chamber in the tank body, which surrounds the reservoir. The disadvantage of this is that, particularly in the case of fuel tanks which have a large bottom surface area and/or which involve a complicated geometry, when the fuel system is empty a relatively large amount of fuel has to be introduced into the tank so that fuel also passes into the reservoir in order to initiate the supply of fuel to the engine. That applies in particular to the second of the above-described alternative configurations, namely the design using a single-stage fuel pump, as effective operation of the suction jet pump requires an adequate amount of fuel in the reservoir in order to produce the flow of fuel required for operation of the pump in the return conduit and the drive or propulsion nozzle connected thereto, while sufficient fuel must also be present in the tank space or chamber outside the reservoir if fuel is to be conveyed into the reservoir by the suction jet pump.

It will be appreciated that the above-described problems occur in particular at the first filling of the tank of a motor vehicle after manufacture thereof, an operation for which fuel of particular quality and which is comparatively expensive is used. For that reason also the motor vehicle manufacturers at which the first tank-filling operation is implemented endeavour to minimise the amount of the fuel used for the first tank-filling operation. It may be for example of the order of magnitude of between 1 and 3 liters. Depending on the respective configuration of the tank and the reservoir disposed therein and also the pump system however there may be a need to introduce a greater amount of fuel than would be

necessary for the operating procedures carried out on or with the vehicle, using the fuel of the first tank fill.

In accordance with the present invention there is provided a fuel tank for a motor vehicle, comprising a fuel tank body, a reservoir within the fuel tank body, a motor-driven pump operatively associated with the reservoir, for supplying fuel to the engine of the motor vehicle, and a filling pipe for introducing fuel into the tank, the filling pipe having an outlet end associated with the reservoir in such a way that at least a part of the fuel flowing through the filling pipe is passed directly into the reservoir, wherein the reservoir is of such a configuration that at least the lower region thereof is fluid-tightly closed off with respect to the surrounding internal space of the tank body.

As will be seen from a description hereinafter of a preferred embodiment of the invention, the fuel tank according to the invention which can be used for for example gasoline or diesel is of such a configuration as to ensure, under virtually all practical operating conditions, that the pump for delivering fuel to the engine has a sufficient amount of fuel available to it, even if the amount of fuel available in total in the tank is very slight, as is the case for example when the tank is first filled after for example manufacture but also for example when the tank is re-filled from a reserve can after the tank has been completely emptied in use of the engine.

It will further be seen hereinafter that, when the teaching in accordance with the invention is applied, filling of the fuel tank is effected by way of the reservoir which is within the fuel tank body and which is of a substantially smaller volume than the tank in its entirety, this ensuring in any case that the reservoir is firstly at least partially filled so that, if the pump which supplies fuel to the engine and the intake region of which is in any case disposed in the lower part of the reservoir is suitably arranged, the engine is guaranteed to be supplied with fuel, even if small amounts of fuel are introduced into the tank or have remained in the reservoir. The requirement for the reservoir to be of a fluid-tight nature at least in its lower region so that at least a minimum amount of fuel remains in the reservoir can be implemented by virtue of a fluid-tight

configuration at least in respect of the lower part of the reservoir, without encountering serious difficulties on this score and in particular without an increase in cost.

In accordance with a preferred feature of the invention the outlet end of the filling pipe can open directly into the reservoir, for which purpose for example a side wall of the reservoir can be provided with a suitable connection to the filling pipe, through which in the simplest case the filling pipe merely extends into the reservoir. It will be appreciated that it is also possible in a further preferred feature of the invention for the outlet end of the filling pipe to be connected to the wall of the reservoir, which connection can also be fluid-tight. The filling pipe however can also be introduced into the reservoir from above, especially as in many cases the reservoir is in any case open at the top. It will be further appreciated that in accordance with another preferred feature of the invention it is possible for the outlet end of the filling pipe simply to terminate above the upwardly open reservoir.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawing in which:

Figure 1 is a view in longitudinal section through a first embodiment of a fuel tank for a motor vehicle,

Figure 2 is a view corresponding to Figure 1 of a second embodiment of the invention, and

Figure 3 is a view corresponding to Figure 1 of a third embodiment of the invention.

Referring firstly to Figure 1, reference numeral 10 therein denotes a fuel tank for example for a motor vehicle, which can be used for containing for example gasoline or diesel and which can be produced in any suitable fashion from for example metal or plastic material. The fuel tank 10 has a tank body and a residual fuel container or reservoir 12, referred to herein as the reservoir 12, which is of markedly smaller volume than the tank body in its entirety and which is suitably fixed to the bottom 14 of the tank body. The reservoir 12 which is open at its top terminates at a spacing from the inside surface of the top wall 16 of the tank body.

The bottom 18 of the reservoir 12 is provided with a central region 20 which extends substantially perpendicularly with respect to the longitudinal axis of the reservoir and parallel to the bottom 14 of the tank body of the tank 10. An outer region 22 of the bottom 18 of the reservoir 12, which adjoins the central region 20 thereof, is arranged to rise towards the periphery of the reservoir 12 so that that outer region 22, starting from the central region 20, is at a spacing from the bottom 14 of the tank body, which progressively increases towards the periphery of the reservoir 12. In order to be able to dispose the reservoir 12 within the tank body of the tank 10 with the necessary degree of stability, the reservoir 12 is provided at its underside in the outer region of the bottom thereof with a plurality of substantially radially extending ribs 24 which are arranged at spacings over the periphery of the reservoir 12 and which are supported on the inside surface of the bottom 14 of the tank body of the tank 1.

The tank 10 according to the invention further includes a single-stage electric fuel pump indicated diagrammatically at 26, which is fixed within the reservoir 12 at the central region 20 of the bottom 18 thereof and to which there is connected a conduit or pipe 28 which leads to the engine to be supplied with fuel by the fuel pump 26. Incorporated into the conduit 28 within the tank 10 is a pressure regulator 30 from which a return conduit 32 extends. The pressure regulator 30 is operable to branch off the surplus amount of fuel which is not required for supply to the engine and which is returned through the return conduit 28 disposed outside the reservoir 12, into the general space or chamber 34 of the tank 10, which surrounds the reservoir 12. At its discharge end, the return conduit 32 is provided with a drive or propulsion nozzle 36 of a suction jet pump 38 which also includes a catch or receiving nozzle 40 forming the intake end of an overflow pipe 42, as can be clearly seen from Figure 1. The pipe 42 is arranged to extend substantially vertically and opens at a short distance from the upper boundary edge of the reservoir 12 within same and passes in fluid-tight relationship through the outer region 22 of the bottom 18 of the reservoir 12. The arrangement thereof makes it possible for the suction jet pump 38 to be disposed in the region beneath the reservoir 12.

In its top wall 16 the tank body is provided with an opening 44 which is closed by a cover 48, with the interposition of a seal 46. The conduit or line 28 and electric lines 50 for the power supply for the pump 26 and electrical connecting lines 52 and 54 are passed in fluid-tight relationship through the cover 48. The connecting lines 52 and 54 form the connection between respective filling level measuring devices 56 and 58 in the tank body and the reservoir respectively and for example a device such as a fuel gauge or display. As can be seen from Figure 1 the filling level measuring device 56 is disposed in the space or chamber 34 in the tank body, which is around the reservoir 12, while the filling level measuring device 58 as mentioned above is disposed within the reservoir 12 itself. As the reservoir 12 is fluid-tightly closed off with respect to the space or chamber 34 surrounding it within the tank body, in the region of the bottom of the reservoir and at least in the lower region of the side walls thereof, it is possible, for example in the last phase of a tank fill being consumed when the space or chamber 34 is very substantially emptied of fuel and the fuel which is still present in the tank 10 is to be found substantially within the reservoir 12, for the amount of fuel which is still present generally in the tank to be monitored by means of the filling level measuring device 58 which is within the reservoir 12 itself.

The tank 10 is provided with a filling pipe 60 which extends from the filling connection or neck 62 of the tank into the reservoir itself. For that purpose the side wall 64 of the reservoir 12 is provided with an opening 66 therethrough, through which the end region 68 of the filling pipe 60 is passed in fluid-tight relationship into the reservoir 12. The discharge or outlet opening at the outlet end of the filling pipe 60 is closable by a closure means illustrated in the form of a flap 70 which is mounted pivotably to the outlet end portion 68 of the filling pipe 60 and which, when no fuel is flowing through the filling pipe 60 into the reservoir 12, automatically assumes its closure position and thus prevents fuel from passing from the reservoir 12 back into the filling pipe 60.

As the tank 10 is filled with fuel through the filling pipe 60 which in the region of the tank connection 62 can bear in fluid-tight relationship

against the internal boundary wall surface thereof the entire amount of fuel which is introduced into the tank firstly flows into the reservoir 12 so that, even when a small amount of fuel is introduced into the tank 10 through the filling pipe 60, the reservoir 12 is in any case filled to such an extent that there is a sufficient amount of fuel in the intake region of the fuel pump 26 which is arranged immediately above the central bottom region 20 of the reservoir 12.

Reference will now be made to Figure 2 showing a further embodiment of the fuel tank in accordance with the invention, which is substantially identical in terms of structure to the embodiment described hereinbefore with reference to Figure 1 so that there is no need at this point for a further detailed description of the Figure 2 arrangement. For the same reason identical components are denoted by the same references but increased by 100.

As can be seen from Figure 2, the only difference of substance between the Figures 1 and 2 embodiment lies in the fact that in the embodiment of Figure 2 the filling pipe 160 is disposed with its outlet end portion between the top wall 116 of the tank 110 and the upper edge of the reservoir 112, and therefore above the reservoir 112, in such a way that fuel flowing out of the filling pipe 160 flows from above down into the reservoir 112. In this case also the space or chamber 134 within the tank 110 around the reservoir 112 is filled with fuel by an overflow of fuel from the reservoir 112. For that purpose, as also in the Figure 1 structure, the side walls 164 of the reservoir 112 can possibly be provided with openings disposed at a suitable level.

Mounted to the top wall 116 of the tank 110 at the inside thereof is a holder 172 for the outlet end portion of the filling pipe 160 which is also closable by a pivotable flap 170. In this embodiment also all of the fuel flowing through the filling pipe 160 firstly flows into the reservoir 112, irrespective of the fuel flow speed through the filling pipe 160 and the amount of fuel involved, so that the reservoir 112 is always filled first before the remainder of the tank body.

Reference will now be directed to Figure 3 showing an embodiment which once again is the same in terms of its general structure to the embodiment shown in Figure 1 so that there is once again no need for a further detailed description of the Figure 3 arrangement at this point. Once again the same components are denoted by the same references as in Figure 1 but increased in each case by 200.

Looking therefore at Figure 3 the essential distinction between that construction and the embodiments of Figures 1 and 2 is that the reservoir 212 is part of a fuel delivery unit 276 which is introduced through an opening 244 in the top wall 116 of the body of the tank 210. The cross-sectional configuration of the delivery unit 276 initially corresponds to that of the opening 244 and also the opening of an interposed sealing ring 246. The wall 264 delimiting the reservoir 212 can be adapted to be deformable for insertion of the reservoir 212 into the tank body through the opening 244 so that, after the delivery unit 276 has been at least partially introduced into the tank 210 through the opening 244, the delivery unit 276 experiences an increase in its radial or diametral dimension for the purposes of increasing the volume of the reservoir, at least in the transverse direction, by virtue of a reduction in the distance between end portions 277, 248 which comprise strong non-deformable material and which are mounted to respective ends of the reservoir 212. Figure 3 shows the reservoir 212 of the delivery unit 276 in its definitive form which it normally maintains throughout the entire service life of the tank system. In this case also a fuel pump which is not shown is disposed within the reservoir 212. The connecting conduits for same are passed through the upper end portion 248 which at the same time also forms the closure means for closing the opening 244 in the tank wall 216.

The tank 210 is once again provided with a filling pipe 260 which extends from the filling connection 262 to the delivery unit 276 at the reservoir 212 thereof. For that purpose the upper end portion 248 of the delivery unit 276, of rigid material, is provided with a tubular extension portion 280 which extends substantially coaxially with respect to the opening 244 downwardly therefrom and which at its lower end is connected to

an elastic tube portion 264 defining the wall of the reservoir 212 and a support structure 282 which is also elastically deformable and which is disposed within the tube portion 264. The tubular extension portion 280 has a hole 284 which receives the discharge or outlet end of the filling pipe 260 so that, when the tank 210 is filled with fuel, the fuel which is caused to flow through the filling pipe 260 initially flows into the reservoir 212. This therefore also ensures that, even when only a small amount of fuel is introduced into the tank 210, that small amount of fuel is within the reservoir 212 and is thus in the region of the intake opening of the fuel pump within the delivery unit 276.

The tubular extension portion 280 is also provided with additional holes 286 providing a flow communication between the interior of the reservoir 212 and the space or chamber 234 in the tank body, around the reservoir 212. The holes 286 provide that, during a tank-filling operation, when the reservoir 212 is full of fuel, the excess fuel being introduced into the reservoir 212 through the filling pipe 260 can flow out of the reservoir 212 through the holes 286 into the surrounding region 234 in the fuel tank. The additional holes 286 are desirably arranged in such a way that they are not opposite the outlet opening of the filling pipe 260 so that fuel issuing from the filling pipe 260 cannot flow directly to at least one of the additional holes 286 and through same into the space or chamber 234, so that the incoming flow of fuel from the pipe 260 is certain to be initially diverted into the reservoir 212.

It will be seen from the above description of the preferred embodiments that the fuel tank is of such a configuration that even when the tank is of a complicated and unfavourable form it guarantees under all conditions occurring in a practical context that the pump for supplying the engine with fuel has a sufficient amount of fuel available even if the total amount of fuel in the tank is very slight, for example when a small amount of fuel is introduced into the tank or has remained therein.

It will be appreciated that the above-described embodiments of the present invention have been set forth solely by way of example and illustration of the principles thereof and that various modifications and

alterations may be made therein without thereby departing from the spirit and scope of the invention.

The embodiments of the invention in which an exclusive property or privilege is claimed, are defined as follows:

1. A fuel tank for a motor vehicle, comprising a fuel tank body, a reservoir within the fuel tank body, a motor-driven pump operatively associated with the reservoir, for supplying fuel to the engine of the motor vehicle, and a filling pipe for introducing fuel into the tank, the filling pipe having an outlet end operatively associated with the reservoir in such a way that at least a part of the fuel flowing through the filling pipe is passed directly into the reservoir, wherein the reservoir is of such a configuration that at least the lower region thereof is fluid-tightly closed off with respect to the surrounding internal space of the tank body.

2. A tank as set forth in claim 1 and further including

means connecting the filling pipe to the reservoir for the outlet end of the filling pipe to open directly into the reservoir.

3. A tank as set forth in claim 1

wherein the reservoir is open upwardly in its installed position of use and

wherein the outlet end of the filling pipe is arranged above the reservoir.

4. A tank as set forth in claim 1 and further including

a closure means adapted to close the outlet end of the filling pipe and openable under the action of fuel flowing through the filling pipe.

5. A tank as set forth in claim 4

wherein the closure means comprises a flap.

6. A tank as set forth in claim 1

wherein the reservoir includes an overflow means for passing fuel from the reservoir into the space within the tank body around the reservoir when a given amount of fuel in the reservoir is exceeded.

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FIG.1

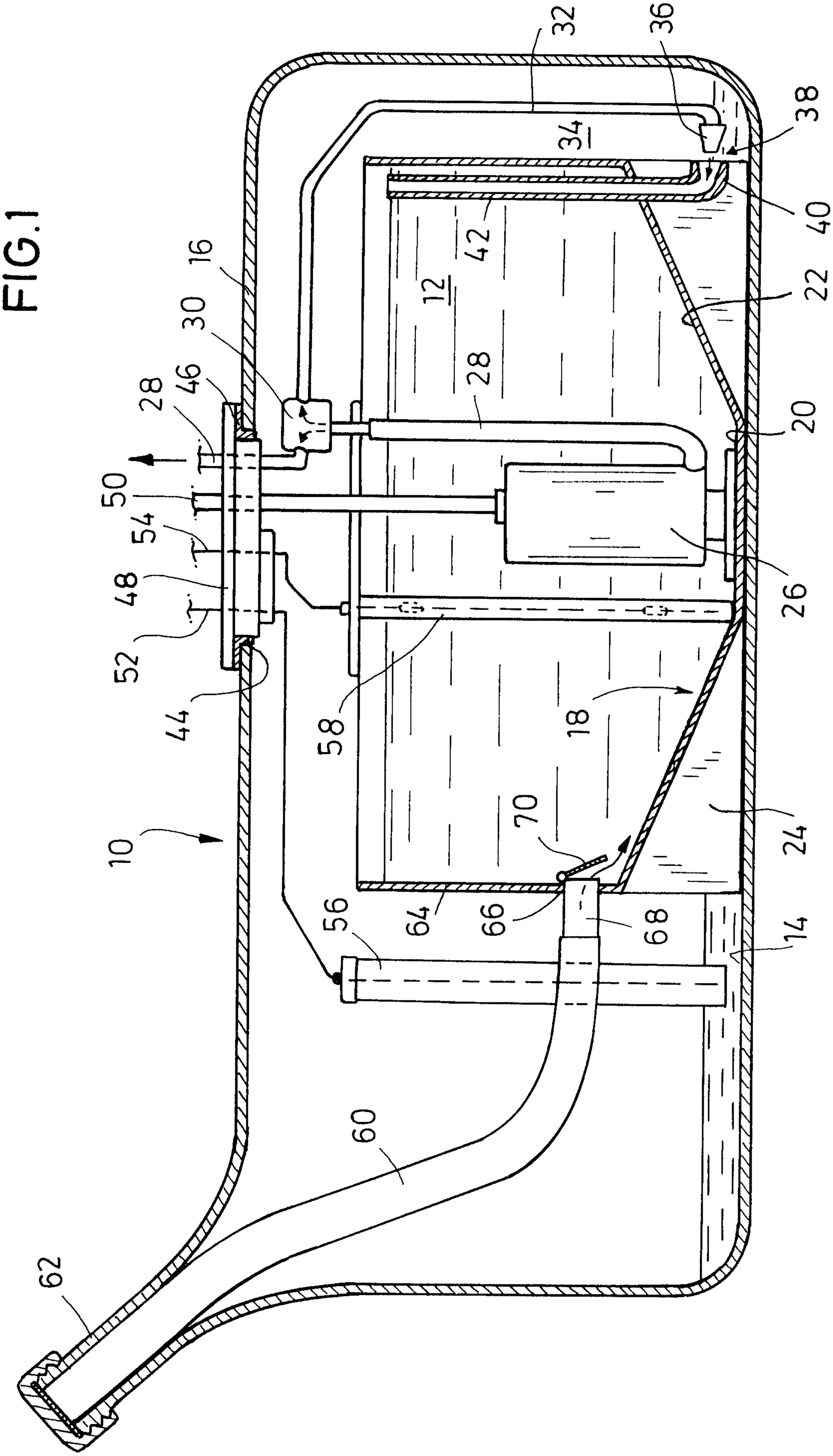

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FIG. 2

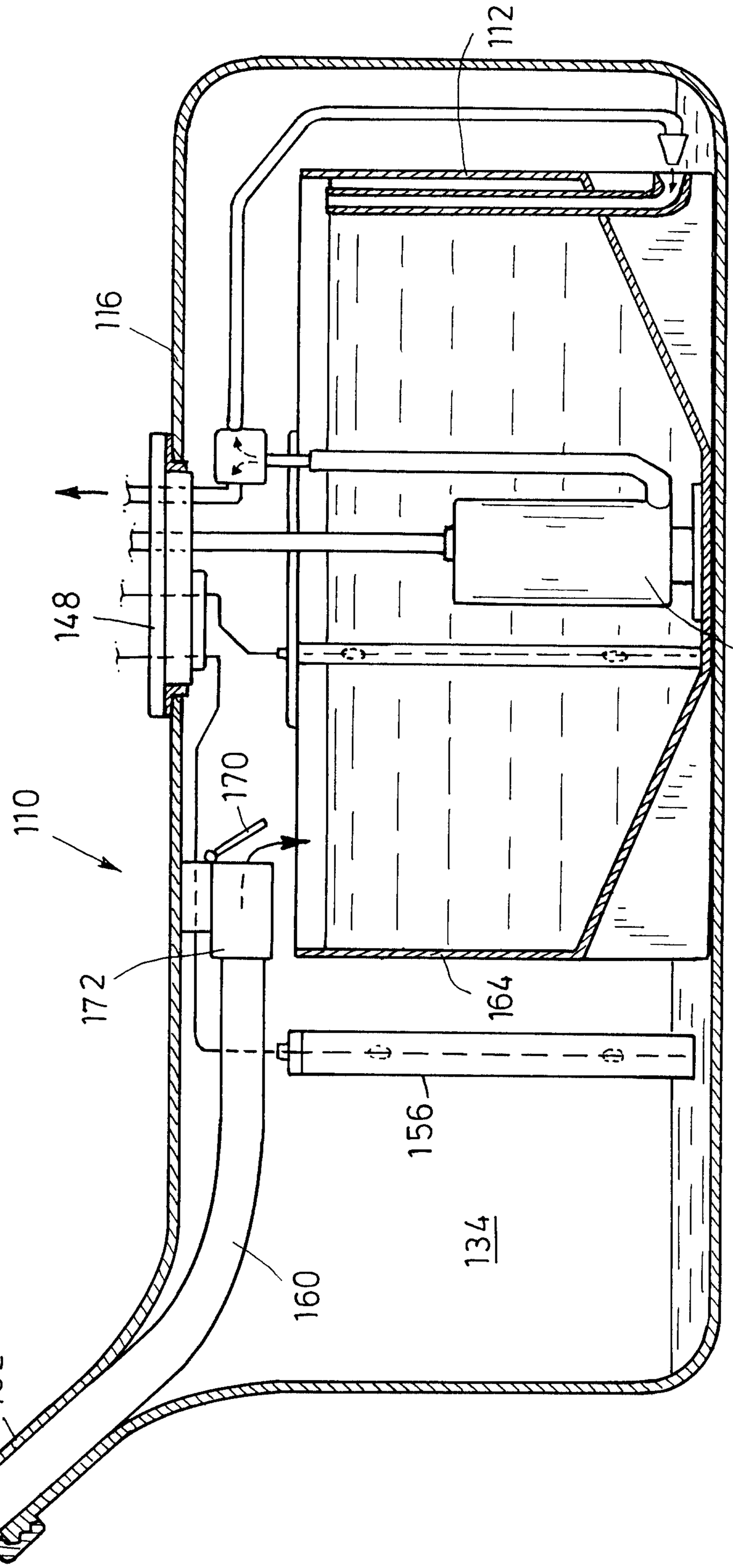
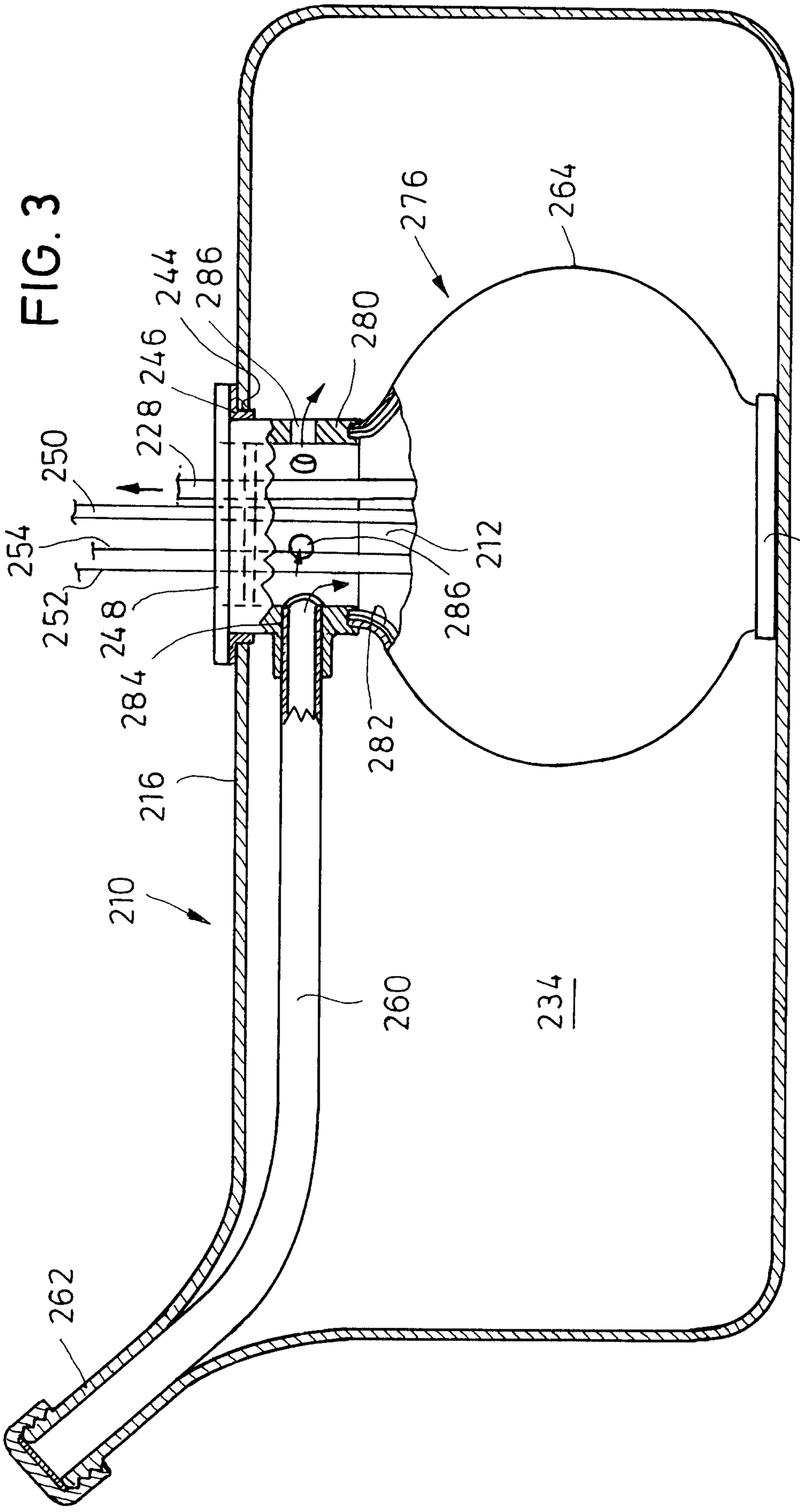


FIG. 3


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