United States Patent [19]

Shimrony

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[54] **IN-TANK FUEL PUMP RESERVOIR**

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[73] Assignee: **The Bendix Corporation,** Southfield, Mich.

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(Under Rule 47)

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[52] **U.S. Cl.** **417/79,** 417/151, 417/171, 55/178

[51] **Int. Cl.** **F04b 23/04,** F04f 5/46, B01d 19/02

[58] **Field of Search**.....417/151, 159, 171, 417/198, 79, 80, 81, 82, 83, 76; 141/113; 55/178

[56] **References Cited**

UNITED STATES PATENTS

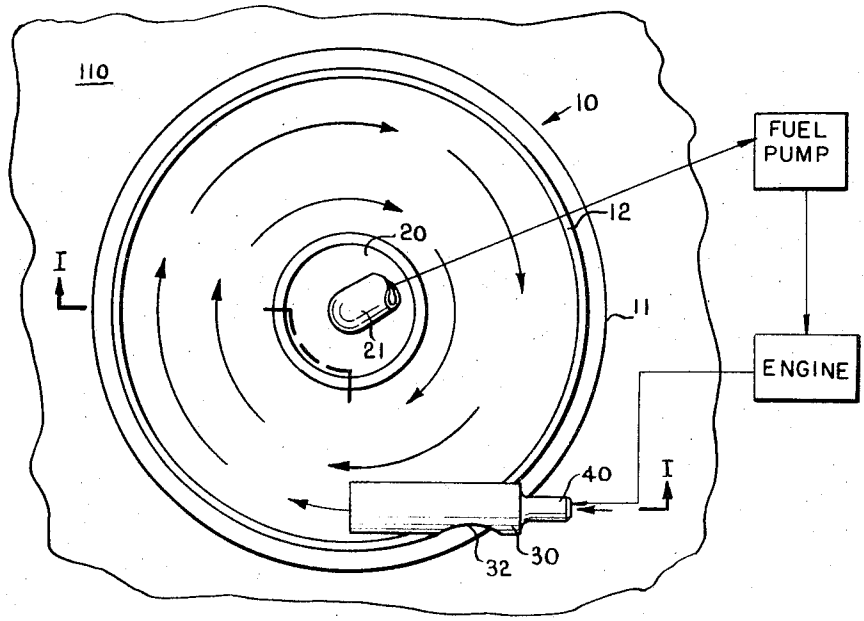
3,143,187	8/1964	Stefan	123/196 R
3,020,950	2/1962	Schraivogel	55/178 X
2,953,156	9/1960	Bryant	417/79 X
3,049,171	8/1962	Neuerburg et al.	137/549
2,077,024	4/1937	Tanner et al.	417/151

Primary Examiner—Carlton R. Croyle
Assistant Examiner—Richard E. Gluck
Attorney—William S. Thompson et al.

[57] **ABSTRACT**

A fuel reservoir arranged about the intake or suction conduit of a fuel pump supply line in a fuel tank utilized by internal combustion engines, consisting of a cylindrical container having a bottom and open top and to which a venturi nozzle is mounted. The venturi receives the return fuel and injects it into the reservoir. The auxiliary fuel is provided through an inlet opening at the throat of the venturi. The return flow of excess fuel delivered by said fuel pump creates a low pressure zone at the throat of the venturi thereby sucking the auxiliary fuel into the venturi causing both auxiliary fuel and return fuel to be injected into the reservoir in a vortical motion about said suction conduit.

2 Claims, 5 Drawing Figures



2 Sheets-Sheet 1

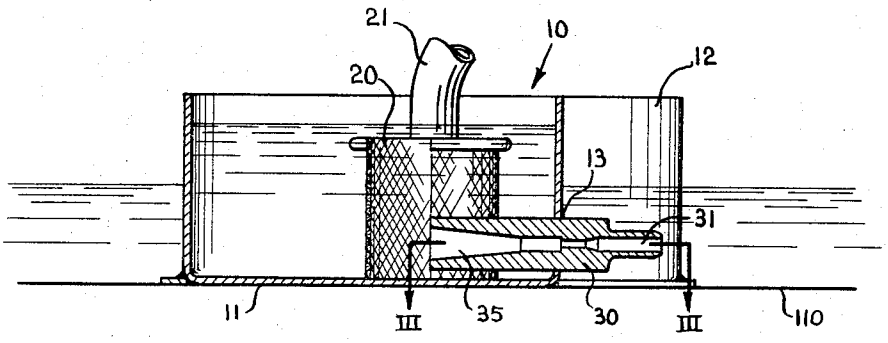


FIGURE 1

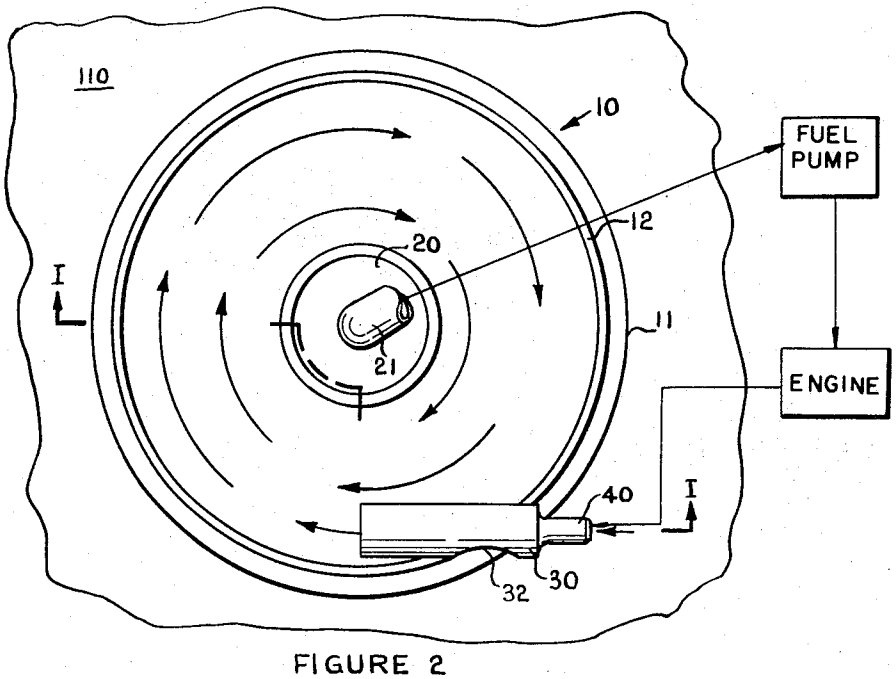


FIGURE 2

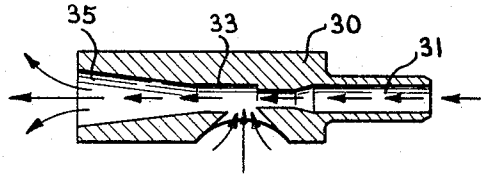


FIGURE 3

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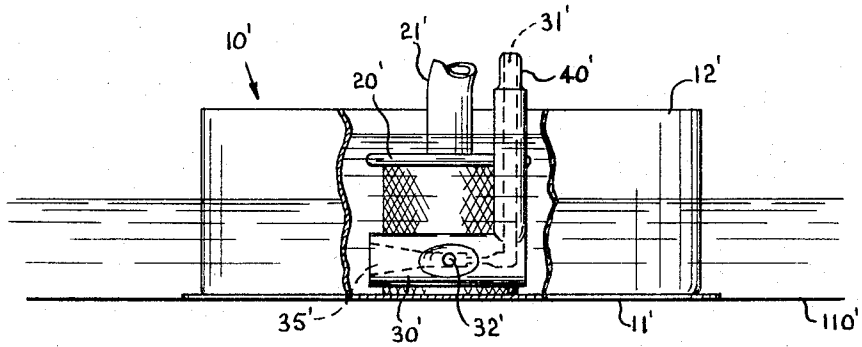


FIGURE 4

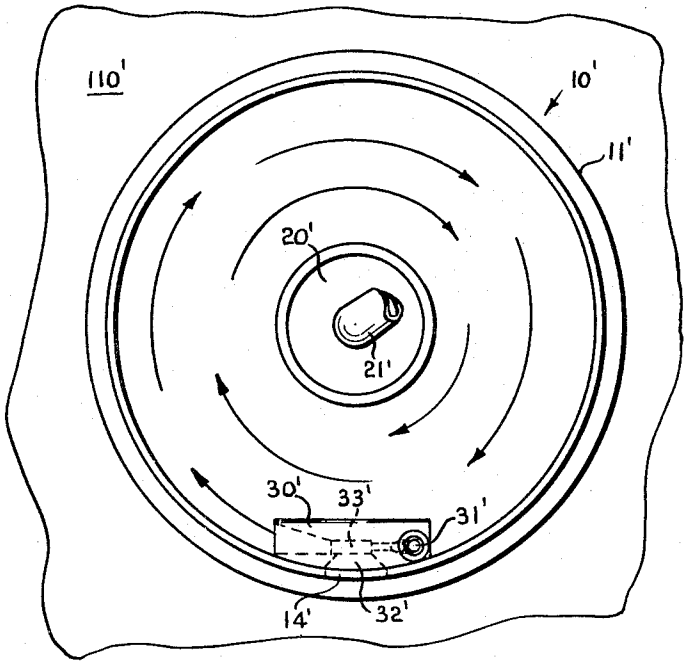


FIGURE 5

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IN-TANK FUEL PUMP RESERVOIR

FIELD OF THE INVENTION

The present invention relates to an apparatus provided in the fuel tank for internal combustion engines, especially of motor vehicles, for the purpose of damming-up or collecting a quantity of fuel sufficient for the supply of the internal combustion engine during the occurrence of accelerating forces acting on the vehicle in the form of a reservoir arranged about the intake or suction conduit of the fuel supply line and/or the fuel pump itself and positioned at or near the fuel tank bottom.

DESCRIPTION OF THE PRIOR ART

It is known in the prior art to provide installations for use in fuel tanks of internal combustion engines which serve the purpose of damming-up, collecting and storing, especially with a relatively low fuel level in the tank, the fuel present within the tank during breaking and acceleration as well as during curve drives. These prior art devices dam-up, collect and store the fuel within the region of the fuel suction line, and are used, for example, in the form of relatively low partition walls extending in a transverse direction of the fuel tank and secured to the tank bottom ahead and/or behind the suction line. With such an installation, fuel under the influence of accelerating and decelerating forces is effectively dammed-up and collected by these partition walls.

Other prior art arrangements are known in which an S-shaped vertically extending guide sheet metal strip is provided above the suction line in the fuel tank at the bottom thereof, whereby the fuel which runs off along the outer leg portions of the S-shaped strip is dammed-up and is thereby effectively conducted to the fuel suction line.

Furthermore, fuel tank constructions are known in the prior art, the inner space of which is subdivided in an S-shaped manner by means of sheet metal walls whereby an outlet is provided in each individual space. Additionally, it is known to form such S-shaped subdivisions by means of anti-roll baffle plates, also provided with a large number of small apertures.

It is also known in the prior art to arrange an anti-roll baffle box about the fuel supply line with the four side walls of the baffle box rigidly connected with the fuel tank bottom, which is thereby provided with apertures in proximity to the fuel tank bottom to enable therethrough the flow of fuel.

All of these prior art installations mentioned hereinabove, however, exhibit for the most part, considerable short comings and disadvantages.

For example, no definite assurance is given by the use of the particular damming-up walls and/or guide walls known in the prior art which are arranged only transversely to the driving direction, that a sufficient supply of fuel for the internal combustion engine is provided reliably under all possible conditions. Since it can be safely assumed that under normal driving conditions more accelerating forces for the fuel occur which are directed in the transverse direction of the vehicle in the form of centrifugal forces than in the longitudinal direction of the vehicle by reason of the more frequent occurrence of curved drives often times no appreciable damming-up of the fuel or none at all take place with the occurrence of centrifugal forces to assure a safe and reliable supply of fuel with the prior art installations.

Additionally, there exists also the danger that the fuel will flow out of the immediate vicinity of the fuel outlet with the prior art constructions utilizing individual baffle plates provided with small connecting passages, not to mention the high constructional costs and expenses necessitated by such prior art installations.

Many of the short comings and disadvantages of the prior art devices mentioned above were surportedly obviated by even later devices. These devices consisted essentially of a damming-up and storage housing having an outer curved wall and an inner curved wall forming therebetween a spiral shaped inlet channel for the fuel in communication at the outer end thereof with the inside of the fuel tank, and in communication at the inner end thereof with the inside of the storing housing. The excess fuel is returned to the housing by means of a return line that discharges the excess fuel either directly into the inner housing of the storage housing, or by discharging the excess fuel from the fuel return line essentially tangentially into the inlet of the storage space. The inlet channel of these devices is formed by an inner and outer wall mounted directly to the fuel tank's bottom. However, these devices also had major disadvantages.

For example, the provision of a spiral shaped channel formed by at least one wall is difficult to mount or assemble to the fuel tank's bottom. Furthermore, the lack of a unitary design would cause these devices to be unstable, i.e., a shifting of components with normal usage, or in the alternative would demand extensive supporting structure insuring proper alignment of the fuel return line. Also, the inlet channel formed by the double-wall spiral design is relatively large in cross section thereby permitting large quantities of return fuel and/or stored-up fuel to escape; this shortcoming extends unduly the length of time necessary to adequately fill the housing under conditions requiring a higher fuel level within the housing than is provided by the level of in-tank or auxiliary fuel.

SUMMARY OF THE INVENTION

The present invention is a fuel pump reservoir for a fuel tank utilized by internal combustion engines in which the fuel storage structure is of cylindrical form having a bottom and an open top to which a fuel venturi nozzle is attached. The venturi-like nozzle has a fuel return passage and an in-tank fuel inlet located adjacent the throat of the venturi so that the flow of said return fuel creates a low pressure zone at the auxiliary fuel inlet thereby sucking the auxiliary fuel into the nozzle causing the auxiliary fuel and return fuel to be introduced into the reservoir tangential of the wall thereof in a vortical motion.

It is, therefore, an object of this invention to provide a fuel pump reservoir having a relatively smooth continuous interior wall, and into which both return line fuel and in-tank fuel is injected. By the use of a venturi as an injecting nozzle, efficient use is made of the return line fuel. The creation of a vortex within the cylinder by the discharged fuel enables the fuel to defoam and degas before reaching the fuel pump

and/or fuel in-tank line located centrally of the reservoir. Furthermore, by resting the reservoir at the bottom of the fuel tank, practically complete consumption of the in-tank fuel is possible.

It is another object of this invention to provide a fuel collecting and storing arrangement of simple design lending itself to very economical construction.

Another object of the present invention is the provision of a storing device within a fuel tank which is of relatively simply unitary design thus enabling the device to be molded from a plastic material.

Another object of the present invention is to provide a fuel collecting and storing reservoir of cylindrical form having only one continuous relatively smooth side wall.

A further object of the present invention resides in the provision of a collector and storage construction within the fuel tank for an internal combustion engine, or similar moving vehicles and in particular for a fuel injection engine operating with a fuel supply pump in which the fuel sucked in excess of the required amount is returned to the fuel tank through the return line.

Furthermore, it is an object of the present invention to provide a fuel collecting and return apparatus for the fuel tank of an internal combustion engine which apparatus comprises a cylindrical storage structure to which is attached or formed on the wall thereof a venturi-like nozzle having at least one opening therein providing an inlet for the auxiliary fuel so that the return fuel from the engine sucks auxiliary fuel into the nozzle through said opening thereby discharging both auxiliary and return fuel tangential of said cylinder wall in a whirling motion.

Further objects of this invention reside in the provision of a reservoir for the suction conduit of a fuel pump utilized by automotive vehicles which is of simple unitary design, easily installed in the fuel tank, operatively stable under all driving conditions, and having an auxiliary fuel inlet of relatively small cross-sectional area.

These and other objects and features and advantages of the present invention will become more obvious from the following description when taken in conjunction with the accompanying drawings which shows, for purposes of illustration only, two embodiments in accordance with the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an axial elevational cross-sectional view of a fuel collecting and storing device in accordance with the preferred embodiment of the present invention taken along section line I—I of FIG. 2.

FIG. 2 is a plan view of the device illustrated in FIG. 1.

FIG. 3 is a partial cross-sectional view of a venturi in accordance with the present invention taken along section line III—III of FIG. 1.

FIG. 4 is a partial elevational cross-sectional view of an alternative embodiment of a fuel reservoir in accordance with the present invention.

FIG. 5 is a plan view of the device illustrated in FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, wherein like reference numerals are used throughout the views thereof to designate corresponding parts, reference numerals **110** designates the bottom of the fuel tank. The in-tank fuel pump reservoir **10** is arranged essentially centrally within the fuel tank, at or near the fuel tank bottom **110**. The reservoir or housing **10** is of cylindrical form, having a circular base **11** and a side wall **12** extending upwardly therefrom. The fuel intake means, fuel pump or the intake line for a fuel pump, is arranged essentially centrally within reservoir **10** and is positioned at or near the base **11** of reservoir **10**. The fuel intake means is shown as a filter **20** with a fuel intake line **21** extending upwardly therefrom.

Wall **12** of reservoir **10** has an aperture **13** therein which receives a venturi-like nozzle **30**. Aperture **13** is cut through wall **12** such that the outlet **35** of venturi **30** is positioned essentially tangential to wall **12** and adjacent the base **11** of reservoir **10**. The axis of venturi **30** is essentially parallel to base **11** of of reservoir **10**. Where reservoir **10** is manufactured from metal, venturi **30** may be assembled to wall **12** in any conventional manner such as welding, or a snap - type fitting may be made where venturi **30** would be put in place by snapping it into a receiving structure formed in wall **12**. Where reservoir **10** is fabricated from a plastic material, the nozzle **30**, base **11**, and wall **12** are all one piece.

Referring specifically to FIG. **3**, a return line (not shown) for the excess fuel is press-fitted onto nipple **40** of venturi **30** so that return fuel is discharged into the inlet passage **31** of venturi **30**. Of course, many conventional methods of connecting the venturi line to venturi **30** may be used. Venturi **30** has an orifice or aperture **32** formed therein, which orifice **32** opens into the throat **33** of venturi **30**. Venturi **30** is mounted to wall **12** of reservoir **10** such that aperture **32** is located external of reservoir **10**. Although only one aperture **32** is shown in venturi **30**, it is possible to have more than one opening in venturi **30** external of wall **12** of reservoir **10** therefor providing more than one access to auxiliary fuel. Both auxiliary fuel and return fuel are discharged from nozzle **30** by means of discharge passage **35**.

DESCRIPTION OF AN ALTERNATIVE EMBODIMENT

Referring to FIG. **4**, the nozzle **30'** is shaped like a reverse L and is mounted to or formed on the inside wall **12'** such that orifice **32'** in nozzle **30'** is directly in line with aperture **13'** in wall **12'**. The axis of the venturi is parallel to base **11'**, and the inlet passage **31'** is parallel to wall **12'**. Nipple **40'** extends upward from the top of wall **12'**. The discharge passage **35'** is located tangentially of wall **12'** and adjacent base **11'** as shown in FIGS. **4** and **5**. The venturi-like chamber with nozzle **30'** is similar to the one described above and as shown by FIG. **3** with the exception of the bend in passage **31'** as noted above.

OPERATION

As pointed out supra, the present invention is of particular significance and advantage if used in connection

with an internal combustion engine of the injection type, especially with a gasoline injection type engine which utilizes fuel injection for the gasoline. As is known with gasoline injection systems, even at full load or full throttle, only a fractional part of the supplied fuel quantity is injected into the engine whereas the considerably larger residual quantity of the fuel in the pump is discharged, for cooling purposes, and is conducted back into the fuel tank.

The fuel returns to the fuel tank by means of a return line connected to nipple **40** (**40'**) of venturi **30** (**30'**). As the fuel passes through the inlet passage **31** (**31'**) and into throat **33** (**33'**) a low pressure zone is created; this low pressure zone sucks the auxiliary fuel into the venturi through the orifice **32** (**32'** and aperture **13'**). Since the discharge passage **35** (**35'**) is located generally tangential to wall **12** (**12'**), the auxiliary fuel and return fuel is injected into reservoir **10** (**10'**) in a vortical motion. Thus, the return fuel is effectively defoamed and degassed by the whirling motion while simultaneously insuring that an adequate supply of fuel is maintained for the suction or fuel intake line **21** (**21'**) located centrally in reservoir **10** (**10'**). The relatively smooth continuous side wall **12** (**12'**) provides a relatively long return path for the injected fuel and prevents any significant turbulence from developing.

By positioning the reservoir on or close to the bottom of the fuel tank, practically complete consumption of in-tank fuel is guaranteed.

Note, that with this invention, no fuel is allowed to escape from the reservoir while the engine is on, i.e., so long as there is return fuel flow.

It should also be noted, that both embodiments shown are of unitary design and are operatively independent of other supporting structure once the fuel return line is fitted onto nipple **40** (**40'**).

While mention has been made throughout of a suction conduit, or a filter **20** (**20'**) and on intake line **21** (**21'**), the supply fuel pump could itself be positioned or attached to base **11** (**11'**) of reservoir **10** (**10'**); this is possible since with this invention a higher level of fuel in contact with the pump is maintained than would be possible through the use of prior art designs.

While I have shown and described two embodiments in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible to many changes and modifications within the spirit and scope of the present invention and I, therefore, do not wish to be limited to the particular details shown and described herein but intend to cover all such modifications and changes as are encompassed by the scope of the appended claims.

I claim:

1. A fuel reservoir for the intake of an internal combustion engine fuel pump or the like of the type delivering fuel to the engine in excess of the engine requirements and wherein the excess of fuel delivered to the engine is returned to the fuel tank by a return line, the intake for the pump being disposed within said reservoir, comprising:

a generally cylindrical structure having a base, a side wall, the side wall having an aperture; and

a venturi for receiving said return fuel mounted to said wall adjacent said base, said venturi having a flow channel extending therethrough generally tangentially relative to said side wall and forming an inlet passage, a throat, and a discharge passage respectively in the flow direction, said venturi also having at least one radial orifice therein opening into said throat, said venturi being mounted to said wall such that said radial orifice and said side wall aperture are aligned.

2. In combination with a fuel pump or an intake line for a fuel pump disposed within a fuel tank used by internal combustion engines, and having an excess engine fuel return line therein, a fuel reservoir arranged about said fuel pump or intake line comprising:

a cylindrical structure having a base and a relatively smooth continuous side wall extending upwardly therefrom, said wall having at least one aperture therethrough adjacent said base, and

a venturi mounted tangential to the interior of said wall, said venturi having a flow channel including a throat extending therethrough for receiving and delivering said return fuel to the reservoir, said venturi also having a radial orifice opening into said flow channel at the throat of said venturi, said orifice and said aperture in said wall being aligned one with the other.

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