United States Patent

Erwin, Jr.

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[54] FUEL SYSTEM FOR DIESEL ENGINES

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[52] **U.S. Cl.** **137/338**

[51] **Int. Cl.** **F16k 49/00**

[58] **Field of Search** 137/338; 123/139.16

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[57] **ABSTRACT**

The system of the invention is designed for treating liquid which may comprise as one instance means for cooling liquid. Such is accomplished by a novel cooling tank. The system has particular application in Diesel engines and also may be used as cooling systems for the liquid used in cooling machine tools. The system may include a meter arranged to measure consumption of fuel, particularly in the Diesel system. Where the system is used with Diesel engines and a meter is used, a by-pass is provided around the meter which includes a valve so that the by-pass can be used when it is desired that the flow be not measured.

19 Claims, 10 Drawing Figures

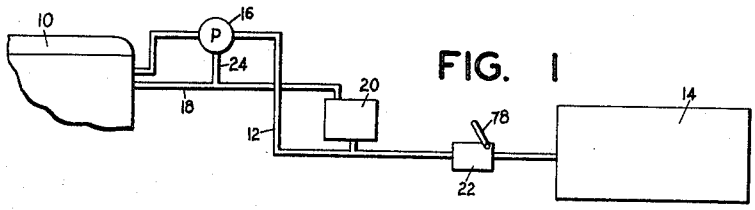
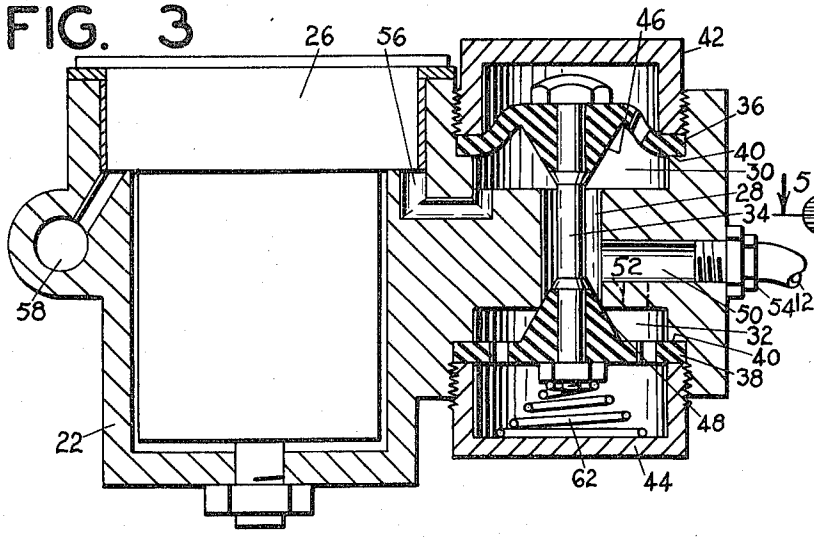


FIG. 1

FIG. 3



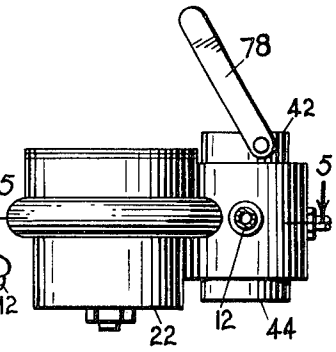


FIG. 4

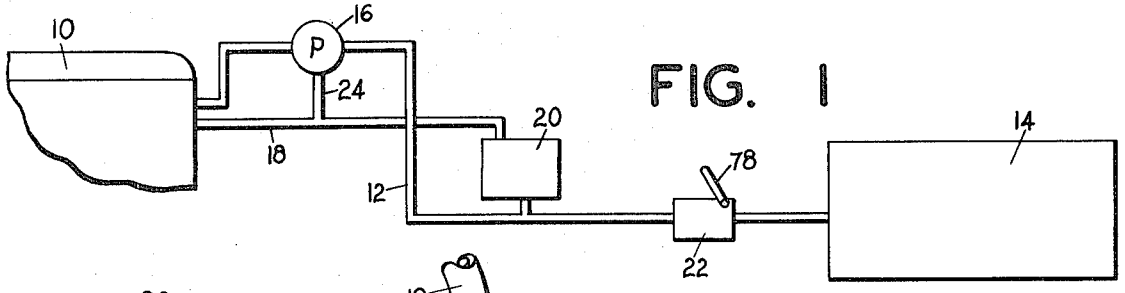


FIG. 1

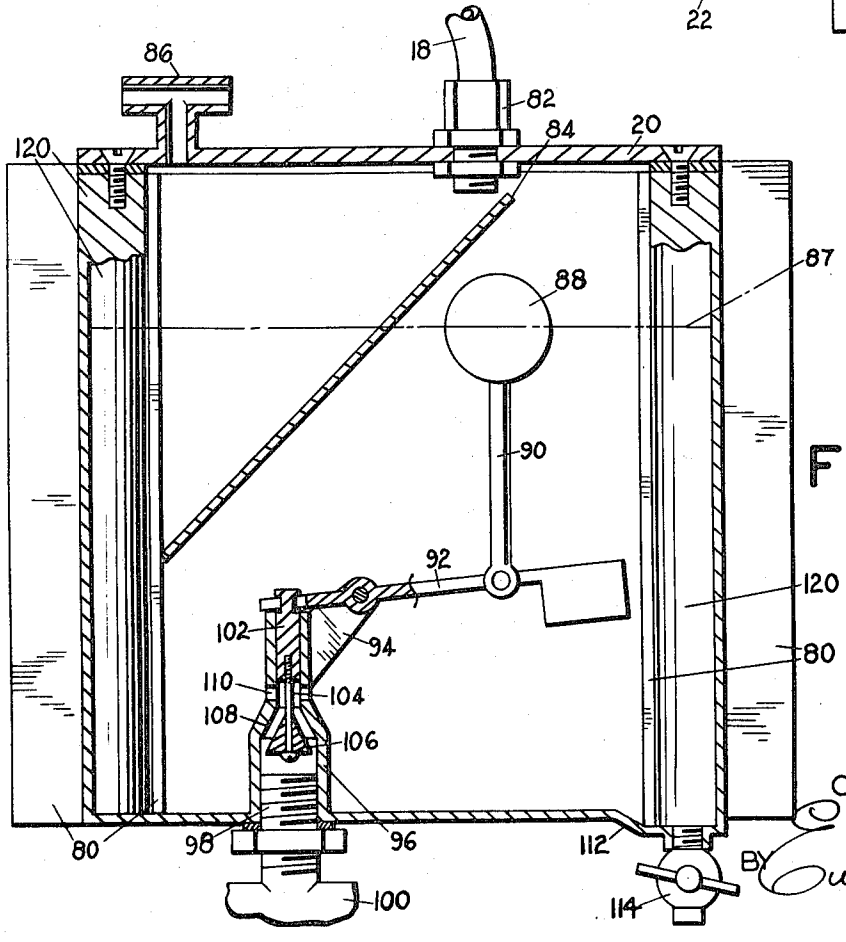


FIG. 2

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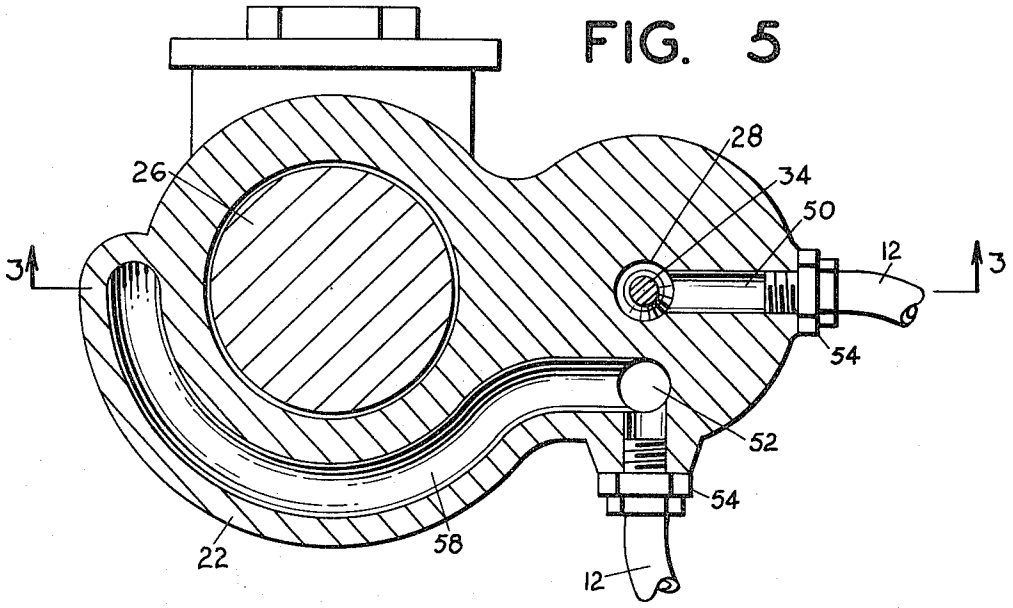
FIG. 5



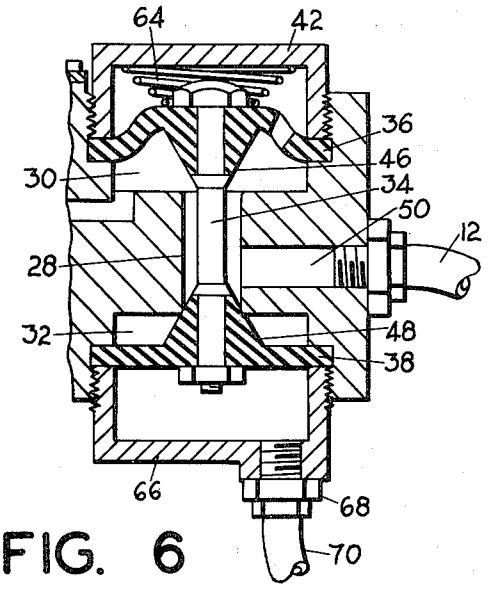


FIG. 6

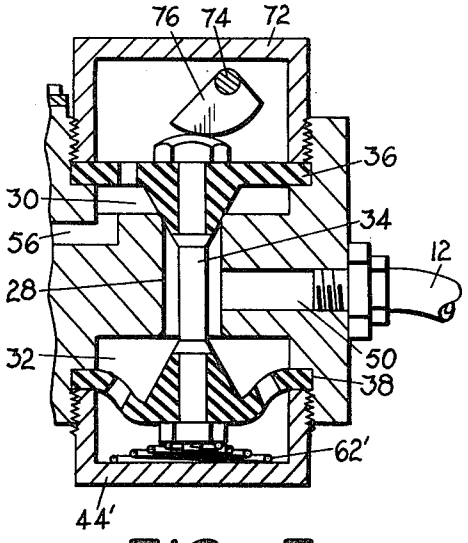


FIG. 7

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FIG. 8

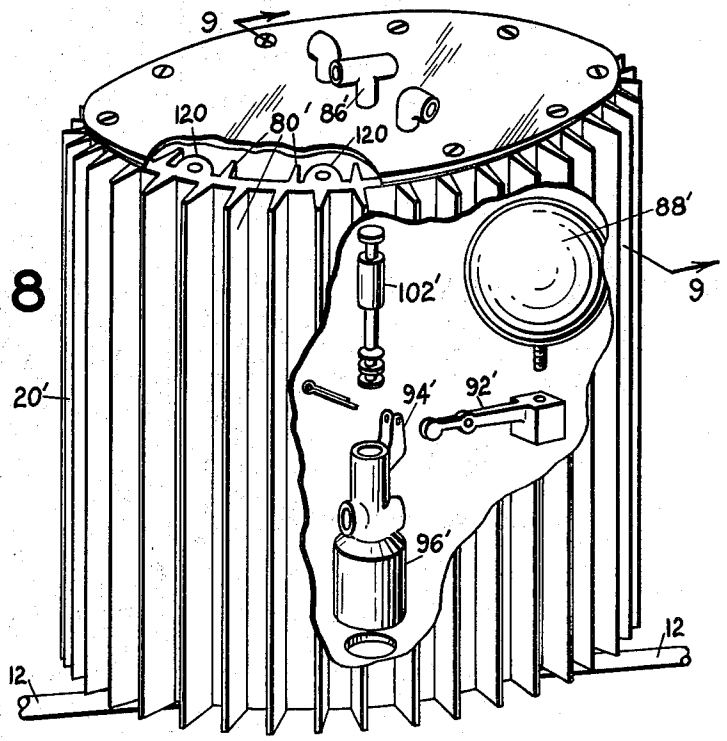
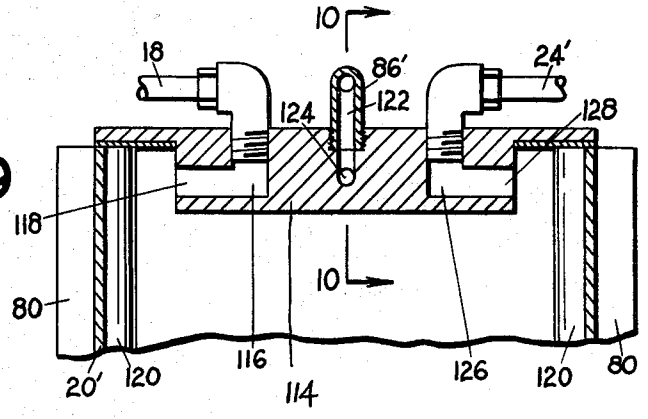


FIG. 9



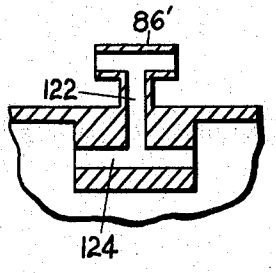


FIG. 10

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FUEL SYSTEM FOR DIESEL ENGINES

BACKGROUND OF THE INVENTION

This invention relates to a liquid treating system.

The present system is particularly applicable for use in fuel systems of Diesel engines. In most Diesel engine fuel systems, fuel from the fuel tank is forcefully moved to the injector and the return flow is by gravity. In such systems, the gravity return flow cannot be connected directly into the main forced flow as such would interrupt the main flow as well as put vacuum or back pressure on the injector. To avoid such undesirable operation, prior systems have returned the unburned fuel to the fuel tank. Also, the unburned fuel from a Diesel engine generally has air bubbles therein and prior systems have necessarily had to return the unburned fuel to the fuel tank to remove the bubbles since the engine would not operate if air bubbles existed in the fuel. Further yet, the unburned fuel could not be returned directly to the engine even if it were free of air bubbles since it is hot and the engine would not operate efficiently with hot fuel. Here again, the return flow must go to the fuel tank so as to be cooled by admixing it with a large volume of fuel.

Fuel consumption for Diesel engines thus has not heretofore been capable of accurate measurement because obviously a meter hooked in the outflow of the tank would not only measure the fuel burned by the engine but also the fuel which is returned unburned.

Features of the present system may also be applied to other uses such as in systems to cool liquids used with machine tools. Existing systems are not adequate since they require bulky cooling media and in some cases an immense quantity of cooling liquid is needed.

According to the invention and forming a primary objective thereof, a liquid treating system is employed having novel cooling and treating means.

The invention has efficient application in conjunction with the liquid cooling systems of machine tools as well as with fuel systems of Diesel engines. In this latter use, a fuel system is provided which has means for returning the unburned fuel to the fuel line rather than to the fuel tank, thus making it possible to accurately measure fuel consumed by the engine and at the same time not interrupt the main flow of fuel. The system is capable of removing air bubbles if such exist in the return flow, and also it is capable of cooling the return flow to ambient temperature.

Another object is to provide a novel valve meter housing structure for use in apparatus of the type described, such valve meter housing having various embodiments capable of operation with pressure systems, hand operated systems, or other systems, merely by interchanging accessory parts of the housing.

Another object is to provide in an apparatus of the type described novel bubble removing apparatus, such apparatus employing means located adjacent to the inlet of returned unburned fuel to the tank and capable of being impinged by such returned fuel to remove the bubbles, said apparatus also including a novel float operated valve mechanism for maintaining a selected liquid level in the tank arranged to maintain separate systems for the main flow of fuel to the engine and the return flow so that the main flow is not interrupted. Means are also provided at the bottom of the tank for collecting and draining off water or heavier than fuel substances which may settle to the bottom.

The invention will be better understood and additional objects and advantages will become apparent from the following description which illustrates preferred forms of the device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic view of a fuel measuring system of the present invention;

FIG. 2 is a cross sectional view of a return flow treating tank means employed in the system;

FIG. 3 is a cross sectional view of a housing structure in which is incorporated a valve and flow meter and connecting passageways, taken on the line 3—3 of FIG. 5;

FIG. 4 is a side elevational view of the valve and meter housing, reduced in size with relation to FIG. 3;

FIG. 5 is an enlarged horizontal sectional view of the valve and meter housing taken on the line 5—5 of FIG. 4;

FIG. 6 is a fragmentary sectional view similar to FIG. 3 but showing alternative valve operating means;

FIG. 7 is also a view similar to FIG. 3 showing still another form of valve operating means;

FIG. 8 is a perspective view, partly broken away, of a modified form of return flow treating tank;

FIG. 9 is a fragmentary sectional view taken of the line 9—9 of FIG. 8; and

FIG. 10 is a fragmentary sectional view taken on the line 10—10 of FIG. 9.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With particular reference to the drawings and first to FIG. 1, the invention is illustrated in conjunction with a Diesel engine 10 having a fuel line 12 leading to the engine from a fuel tank 14. Fuel line 12 has the usual fuel pump 16, and the injector of the engine, not shown, employs a fuel return line 18 which ordinarily, but not here, extends back into the fuel tank 14. As one part of the present invention, the fuel return line 18 is connected back into the fuel line 12 instead of into the tank and utilizes a return flow treating or holding tank 20 connected therein for serving several purposes, namely, to provide uninterrupted flow of the main fuel flow apart from the return flow, to remove bubbles if such are present in the return flow, and also to cool the return flow to a temperature for efficient usage by the engine. The invention also includes a valve and meter mechanism 22 connected into the fuel line 12 on the upstream side of the connection of return line 18 with the fuel line 12. A return line 24, as in conventional structure, also extends from the pump 16 to the main return line 18. As will be seen in greater detail hereinafter, the measuring system of the present invention is adapted for incorporation in existing fuel systems, namely, by cutting the fuel line 12 and installing the valve meter housing 22 therein. The return line 18 is disconnected from the fuel tank and is connected to the fuel line 12, the tank 20 being connected in the line 18 as will be more apparent hereinafter.

With reference to FIGS. 3, 4, and 5, the valve meter housing 22 incorporates a flow meter 26 of conventional construction. The valve portion of the housing has a hollow interior including a bore 28 and upper and lower chambers 30 and 32, respectively, on opposite ends of the bore. Forming the operative part of the valve is a stem 34 of considerably less diameter than the bore 28 and movable axially therein. Secured to opposite ends of the stem 34 are diaphragms 36 and 38 which form outer end walls for the chambers 30 and 32, respectively. Diaphragms 36 and 38 are secured against shoulder portions 40 in the housing by hollow threaded end caps 42 and 44, respectively.

The diaphragms have tapered hubs 46 and 48, respectively, engageable with the end edges of the bore 28 to control the flow of fuel through the valve. The arrangement of the parts is such that the stem 34 and its diaphragms are movable axially a short distance, and the hubs of the diaphragms in such axial movement are arranged to have wedging sealing abutment against one or the other respective end edges of the bore 28.

The housing 22 is provided with an inlet passageway 50, best seen in FIG. 5, which leads to the central bore 28. Housing 22 also has an outlet passageway 52 which extends up from the chamber 32 and then to the exterior of the housing. Each of the passageways 50 and 52 has suitable exterior connections 54 for connection into the fuel line 12.

A passageway 56, FIG. 3, extends from the chamber 30 into the meter 26, and the meter has an outlet passageway 58, FIG.

5, which leads from the outlet of the meter around the housing directly to the outlet passageway 52.

In the operation of the valve, to be described in greater detail hereinafter, flow from the inlet passageway 50 can pass through the meter 26 when the valve stem 34 is lifted off the upper end of the bore 28, the lower tapered hub 48 of the stem in such position of said stem sealing the outflow of fluid to the chamber 32 and passageway 52. However, when the stem is disposed in a downward position, flow to the meter is shut off and flow is permitted directly out the passageway 52. Since the housing 22 is connected into the fuel line 12, fuel in this latter position of the valve will flow directly through the fuel line and be unmetered.

Valve stem 34 is normally held open for flow of fuel through the passageway 56 and the meter by a compression spring 62 disposed in the cap 44 and having abutting engagement between the cap and the lower end of the stem.

By the location of the meter and valve housing and the tank 20, as pointed out above, accurate fuel consumption is measured. That is, unburned fuel which is returned from the injector through line 18 passes through the tank 20 to remove the bubbles therefrom, and since the tank 20 feeds back into the fuel line 12 on the downstream side of the meter from the fuel tank 14, the flow from the fuel tank as recorded on the meter, will be the fuel actually consumed by the engine. According to one concept of the invention, full flow metering is accomplished for diesel engines.

The construction of the housing 22, in addition to providing full flow metering, facilitates adaptation of the apparatus to certain other conditions of control, now to be described. Such versatility of the apparatus is accomplished by the interchangeability of end caps 42 and 44. As an example and with reference to FIG. 6, a valve structure is designed for use with vehicle systems employing spring brakes, namely, a braking system which is released only when the vehicle has power but which are automatically set when the vehicle has lost power. In this embodiment, the cap 42 is maintained at the upper end but a spring 64 is disposed in said cap to urge the valve stem 34 downwardly, namely, to engaging position of the hub 46 with the top end of bore 28 to provide non-metering flow of fuel through passageway 50, bore 28, chamber 32 and passageway 52. The other end of the valve housing has a cap 66 provided with an inlet connection 68 for a line 70 leading from the pressure system which releases the brakes when the vehicle has power. Thus, as long as the vehicle power plant is operating, pressure in the line 70 moves the valve stem 34 upwardly, namely, in a position which provides for metering flow. FIG. 6 shows the valve stem forced upwardly for metering flow. As soon as the power is off and pressure in line 70 no longer exists, the spring 64 returns the stem to a position of non-metering flow of the fuel.

FIG. 7 shows the substitution of still different end caps to provide manual shut-off of metering flow. In this form of the invention, the upper cap 72 has a shaft 74, also seen in FIG. 4, projecting through one of its side walls and journaled therein. The shaft integrally supports a cam lever 76 in the cap positioned for engagement with the upper end of valve stem 34 and operative upon rotation of the shaft 74, namely, in a counter-clockwise direction, as viewed in FIG. 7, to force the stem 34 downwardly into a position of non-metering flow of the fuel through the fuel line 12. FIG. 7 shows the valve moved to non-metering flow by the cam. Shaft 74 is operative by an outside lever 78.

The lower end cap of the FIG. 7 embodiment comprises a cap 44' having a compression spring 62' therein which normally urges the valve to an upper metering position. By means of such structure, the metering flow can be manually controlled. This may be desirable in test performances of the engine or for any operation of the engine where metering flow is desired only at selected times.

Since the valve and meter housing throughout all the embodiments are of the same construction, such housing is adapted for use in any of the various functions illustrated in the embodiments of FIGS. 3, 6 and 7 merely by the interchangeability of selected end cap structures 42, 44 or 42, 66, or 72, 44'. It is evident that further embodiments of construction may be utilized particularly along the lines of the FIG. 6 embodiment wherein the line 70 may be from a brake system or power take-off arranged such that when such brake or power take-off is energized, the valve closes off the metering flow so that the fuel flow by-passes the meter. A vacuum system in the line 70 as illustrated in FIG. 6 would accomplish such operation or if pressure is involved in the brake or power take-off it would be merely necessary to switch the caps 42 and 66 of FIG. 6 end for end, it being assumed in all these embodiments that the threaded portions of the end caps and the threaded bores therefor are all the same size to provide the interchangeability.

The tank 20 of FIG. 2 has vertical fins 80 both on its interior and exterior surfaces to cool the returning fuel to ambient engine burning temperature. It has been found that such cooling effect on the fuel increases the efficiency of the engine by a marked degree. The tank has a top inlet connection 82, and disposed interiorly of the tank below the inlet is an angled baffle 84 against which the incoming fluid impinges. Such an angled baffle, as illustrated, efficiently removes the bubbles from the fuel. An upper vent 86 is provided in the tank to allow the escape of the air removed from the fuel.

Fluid level in the tank 20 is maintained at a selected level, such as the level 87, by a float valve assembly comprising a ball float 88 attached to an upright arm 90 pivotally connected to an outer end of a lever 92 in turn pivotally connected intermediate its ends to an ear projection 94 on an upright tubular valve housing 96 secured to the housing by a fitting 98 in turn connected to a tee 100 connected into the fuel line 12. Lever 92 operates a plunger 102 slidable in the upper portion of housing 96. A stem 104 is threadedly connected at its upper end to the plunger 102 and supports a cone-shaped valve 106 on its lower end which is engageable with a tapered valve seat 108 in the housing 96. Fluid inlet openings 110 are provided in the walls of the housing 96 above the valve seat 208 and below the plunger 102 for the ingress of fuel from the tank for discharge into the fuel line 12.

As the fluid level in the tank 20 rises, the lever 92, operated by the float 88, moves the valve 106 to an open position, and thus as long as the float 88 is maintained at an upper level fluid will flow from the tank. As the fluid level lowers in the tank, however, the lever 92 pulls the valve 106 up against its seat 108 to close off the flow. Threaded support of the valve stem 104 provides selected adjustable positions of the valve with relation to the float 88 to control the level at which the fluid is maintained in the tank. It is desired that the tank be maintained at a selected level, namely, at about the level 87, shown in FIG. 2, for best cooling of the fuel as well as bubble removal. Also, it is apparent that since the main flow passes along the bottom of the tank, such main flow is isolated from the gravity return flow at the top of the tank and thus no interruption of the main flow exists. The present valve was designed for use with a suction flow of the main fuel but would operate as well on pressure systems by suitable reversal of some of its parts.

Tank 20 is provided with a sump 112 having a drain valve 114 associated therewith. Water or other heavier than fuel substances which may be in the fuel is collected in the sump 112 and may be drained off periodically. The ports 110 are spaced well above the bottom of the tank to prevent any large amounts of water which may settle to the bottom of the tank from being discharged back into the fuel line.

FIGS. 8, 9 and 10 illustrate a second embodiment of return flow treating tank. This embodiment employs a tank 20' having a valve housing 96' mounted therein which is similar to the FIG. 2 embodiment. A valve in this embodiment is operated by a ball float 88' and lever 92' as in FIG. 2, and such valve controls the flow of returned unburned fuel back into the fuel line 12. A modified form of means for removing the bubbles is present in the FIG. 8 embodiment. More particularly, the

cover for the tank has a depending integral projection **114**, FIGS. **9** and **10**, having a right-angle passageway **116** leading down from the top and having a discharge orifice **118** directed laterally out the side. The returned fluid in being discharged forcefully from the orifice **118** impinges against the inner surface of the tank to remove the bubbles. The tank **20'** has vertical reinforcing ribs **120** projecting inwardly from its inner surface, and in a preferred arrangement, the discharge orifice is directed at one of these ribs. The impingement of the fuel against one of the ribs **120** has been found to effectively remove the air bubbles from the fuel, even more so than impingement against a flat surface.

Tank **20'** as in the first embodiment has a vent **86'**, and the projection **114**, FIG. **10**, has a vertical passageway **122** leading down from the vent and terminating at a lateral passageway **124** also provided in the projection **114**. By the particular arrangement of passageways **122** and **124**, fuel in the tank cannot splash out the vent. Tank **20'** has a plurality of inner and outer cooling fins **80'** as in FIG. **2**.

The side wall portion of tanks **20** and **20'** is readily extrudable, with the top and bottom walls being later installed on the extrusion. By means of such structure, the tank may be conveniently provided in assorted lengths depending upon the capacity of cooling required, it only being necessary to cut the extruded portion to the desired length and then secure the top and bottom walls in place to form the product.

In some setups it may be desired to have a fuel return line from the fuel pump **16** to the tank **20'**, rather than from the pump back into the fuel return line **18** as in FIG. **1**. In such a case, the line **24'** leads to the tank **20'** from the pump and is connected into a passageway **126** in projection **114** similar to passageway **116**. Passageway **126** has a discharge orifice **238** directed oppositely from orifice **118** so that the fuel will be impinged against the opposite side of the tank from the injector return. In a preferred arrangement, the discharge orifices are located 90° around the tank from the inlet openings **110'** into the valve housing, thus insuring that no bubbles will get into openings **110'** if they should be projected downwardly toward the lower end of the tank.

In accordance with the above, a system is provided for accurately measuring fuel consumption in Diesel engines. Such comprises a novel arrangement in the art in that the bubbles are effectively removed to provide efficient operation of the engine, and furthermore a precise metering of the Diesel fuel is accomplished since no bubbles are present in the fuel. Such a system amounts to a substantial improvement over other systems wherein unburned fuel is returned to the fuel tank, thus making it impossible to accurately measure the fuel actually consumed by the engine. The return fuel is cooled in the treating tank **20, 20'** an amount sufficient to be within an efficient combustible range in the engine. With the admixture of the discharge from such treating tank and the incoming flow from the main fuel tank **14**, a fuel flow temperature to the injector is maintained at a level conducive to efficient engine operation, regardless of the atmospheric conditions surrounding the tank. The cooling capabilities of the tank are determined by its size and other factors. The size of the tank may vary according to the requirements of the engine. All such improved functions are a result of the isolation of the gravity flow of the return in line **18** from the forced flow of main fuel in line **12** to the extent that the main fuel flow is not influenced or interrupted in any way by the return flow. The accurate measurement may be useful for computing tax owed on consumption of the fuel. The system also gives an accurate count of gallonage consumed by the vehicle, thus providing a positive check system against theft from storage tanks, as well as from the truck itself from fraud by lessees, and so forth. In addition, the condition of the engine can be tested by operating it for a designated time under a selected load or if desired preventive maintenance can be practiced on fuel consumption rather than mileage. By means of the embodiments shown in FIGS. **6** and **7**, certain control is available for providing a non-metering condition either automatically as in FIG. **6** or manually as in FIG. **7**. The principles of the invention may be used for other purposes than just for Diesel fuel systems. For example, the cooling tank may have use in a liquid cooling system for machine tools such as lathes, drill presses, and so forth. The construction of the tank accomplishes maximum cooling by its fin arrangement and consequently a small tank is capable of cooling a large quantity of liquid. The tank can thus be placed on or adjacent to the machine if necessary without being in the way. The system for cooling machine tools would be substantially identical to the system shown in FIG. **1**, with the machine tool being the infeed of the system in lieu of the Diesel engine **10**. A conventional cooling liquid would be employed, and the tank **14** may comprise the sump for the liquid.

It is to be understood that the forms of my invention herein shown and described are to be taken as preferred examples of the same and that various other changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention.

Having thus described my invention, I claim:

1. A fuel measuring system adapted for metering fuel consumed by an engine associated with a fuel tank, a fuel mixing device in the engine, a fuel line extending between the fuel tank and the fuel mixing device, the fuel mixing device being of the type which discharges unburned fuel, a fuel return line extending from the fuel mixing device to return the unburned fuel, said fuel measuring system comprising

a. means arranged to connect the fuel return line into the fuel line for feeding unburned fuel back into the fuel mixing device,

b. flow measuring means arranged to be connected in the fuel line between the fuel tank and the connection of the fuel return line with the fuel line,

c. and means arranged to be connected in one of the fuel line and fuel return line arranged to remove air bubbles from fuel return through said fuel return line.

2. The fuel measuring system of claim **1** wherein said means for removing air bubbles from the fuel which is being returned comprises a tank having projecting cooling fins to lower the temperature of fuel therein.

3. The fuel measuring system of claim **1** wherein said means for removing air bubbles from the fuel which is being returned comprises a tank having cooling fins projecting from both its inner and outer surfaces to lower the temperature of fuel therein.

4. The fuel measuring system of claim **1** wherein said means for removing air bubbles from the fuel which is being returned comprises a tank having a fuel inlet directed laterally toward the inner side surface of the tank for impingement of the fuel with such surface to remove the bubbles.

5. The fuel measuring system of claim **1** wherein said means removing the bubbles comprises

a. a tank,

b. a valve housing at the lower end of said tank having an inlet opening directed laterally into one side thereof,

c. and fuel inlet means in said tank for receiving fuel from which bubbles are to be removed,

d. said fuel inlet means being disposed around the tank from the said inlet opening to prevent existence of bubbles in the area of said inlet opening.

6. The fuel measuring system of claim **1** wherein said means for removing air bubbles from the fuel which is being returned comprises a tank having means at the bottom portion thereof for collecting water.

7. The fuel measuring system of claim **1** including valve means associated with said flow measuring means arranged to direct fuel flow through said flow measuring means in normal operation of the engine.

8. The fuel measuring system of claim **7** including

a. bypass means in said valve means arranged to direct fluid around said flow measuring means for non-metered flow,

b. said valve means having a pair of positions the first of which comprises a normal position directing flow of fuel through said measuring means the second of which directs flow through said bypass means.

9. The fuel measuring system of claim 8 including means arranged to move said valve means to its second position for directing fuel through said bypass means.

10. The fuel measuring system of claim 8 including a hand operated member engageable with said valve means and arranged to move said valve means to its second position for directing fuel through said bypass means.

11. The fuel measuring system of claim 8 including

a. a diaphragm on said valve means operable upon change of pressure to move said valve means to its second position,

b. and means in said valve means arranged for connection to an outside source of pressure for operating said diaphragm.

12. The fuel measuring system of claim 8 wherein

a. said valve means comprises a housing;

b. cap means on said housing,

c. and control means in said cap means arranged operably to cause said valve means to be moved to its second position.

13. The fuel measuring system of claim 8 wherein

a. said valve means comprises a housing,

b. cap means on said housing,

c. and control means in said cap means arranged operably to cause said valve means to be moved to its second position,

d. said cap means being removably mounted on said housing whereby cap means having different means of control may be substituted one for another.

14. The fuel measuring system of claim 1 wherein said means for removing bubbles comprises

a. a tank,

b. inlet means for the fuel return line connected to the upper end of said tank,

c. baffle means in said tank disposed below said inlet means whereby returned fuel falls on said baffle means to remove air bubbles,

d. means defining an outlet opening in said tank, adjacent the lower end of the latter,

e. a valve housing in said tank having an outlet passageway including a tapered portion forming a seat,

f. a tapered valve supported movably under said seat and arranged for engagement with the latter upon upward movement thereof,

g. and float means arranged to operate said valve such that as said float means lowers with the liquid level in said tank, said valve closes against said seat whereby to control the liquid level in said tank.

15. The fuel measuring system of claim 14 comprising interconnecting means between said float including

a. a level,

b. means pivotally connecting said lever intermediate its ends to said valve housing,

c. link means on said float connected to one end of said lever,

d. and plunger means in said housing connected between said valve and the other end of said lever.

16. A fuel measuring system adapted for metering fuel consumed by an engine, the engine being of the type having a fuel tank, a fuel mixing device, a fuel line extending between the fuel tank and the fuel mixing device, means forcefully moving fuel through the fuel line, the fuel mixing device being of the type arranged to discharge unused fuel so that such unused fuel can be returned for burning, and a fuel return line extending from the fuel mixing device, said fuel measuring system comprising

a. means arranged to connect said fuel return line into the fuel line for feeding unburned fuel back into the fuel mixing device,

b. flow measuring means arranged to be connected in the fuel line between the fuel tank and the connection of the fuel return line with the fuel line,

c. and means arranged to be connected to the fuel return line providing non-influenced operation of the main forced fuel flow in the fuel line by the return flow in the fuel return line.

17. The fuel measuring system of claim 16 wherein said means which provide non-influenced operation of the main fuel flow comprises a return fuel holding tank for holding a reservoir of returned fuel between the return line and the connection of the fuel return line to the fuel line.

18. The fuel measuring system of claim 16 wherein said means which provide non-influenced operation of the main fuel flow comprises

a. a return fuel holding tank,

b. means connecting the return line to the upper portion of said tank for discharging unburned fuel into the latter,

c. and means arranged to connect the fuel line to the lower portion of said tank for discharging fuel from the tank into the fuel line,

d. said tank holding a reservoir of returned fuel between the return line and the connection of the fuel return line to the fuel line.

19. A fuel treating system for engines of the type having a fuel mixing device, a fuel tank, a fuel line extending between the fuel tank and the fuel mixing device, the fuel mixing device being of the type which discharges unburned fuel, a fuel return line extending from the fuel mixing device to return the unburned fuel, said fuel treating system comprising a return flow tank arranged to remove air bubbles from the returned fuel, means defining inlet means in said return flow tank connected to said fuel return line, and means defining outlet means in said return flow tank connected into one of said fuel return line and said fuel line, said inlet means allowing free return flow of unburned fuel into said return flow tank when said engine is operating.

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