June 13, 1967 — V. F. THOMPSON — 3,324,923

FUEL SUPPLY SYSTEM FOR VOLATILE FLUIDS

Filed Oct. 15, 1965

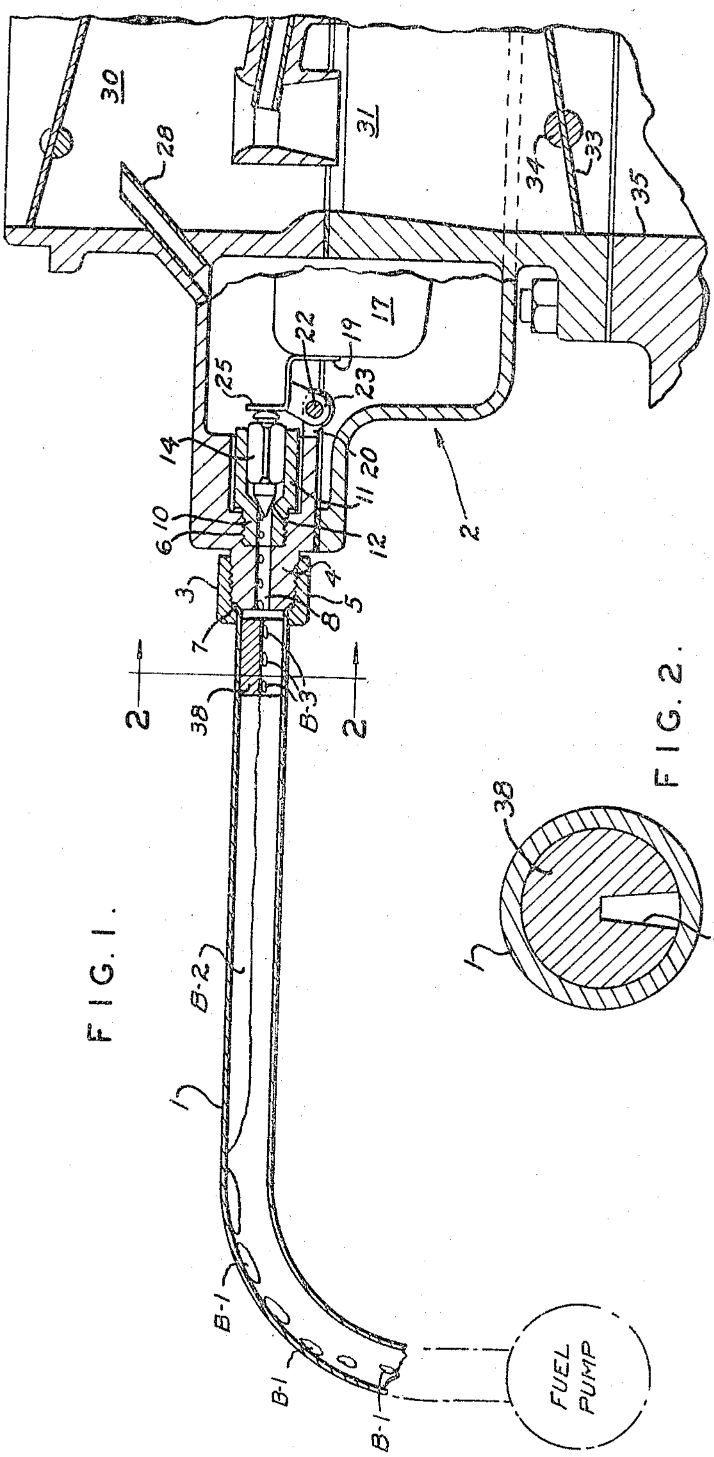

FIG. 1.

FIG. 2.

INVENTOR

Vernon F. Thompson

United States Patent Office
3,324,923
Patented June 13, 1967

3,324,923
FUEL SUPPLY SYSTEM FOR VOLATILE FLUIDS
Vernon Frank Thompson, 512 Larsen Lane,
St. Louis, Mo. 63126
Filed Oct. 15, 1965, Ser. No. 496,628
2 Claims. (Cl. 158—36.3)

This invention relates to fluid systems and more specifically to an improvement in systems for handling volatile fuels such as gasoline, especially in temperature ranges which now are normally prevalent in automotive practice.

Most fuels and especially gasolines are a blend of many constituents, some of which are very volatile. The boiling points of many of these constituents are in a range of temperatures far lower than those which often prevail adjacent an engine, or in an engine compartment (in automotive practice often referred to as under hood temperatures).

In automotive practice, the fuel system includes a fuel tank at the rear of the vehicle, which location exposes it to heat radiating from the roadway and heated air from the engine compartment. A fuel line from the tank connects with a fuel pump in the engine compartment. This pump may be, and usually is, engine driven or mounted on the engine where it is exposed to heat radiated from the engine, heated air in the engine compartment, and possibly, heat conducted from the engine on which the pump is mounted. A fuel line from the pump transfers the fuel to the carburetor, and it is usually in this line, and in the pump, where the fuel vapors collect. It is not uncommon for fuel vapors to build up above pump output pressures in this transfer line if the engine is stopped after reaching operating temperatures. This can occur winter or summer because fuels blended for winter temperatures contain more volatile constituents than fuels blended for summer temperatures.

Many fuel systems now use a vapor-fuel return line from the pump to the tank controlled by a temperature responsive metering device to bleed off the fuel vapor that is bound to form in the pump and lines. However, whether such a vapor return line is used or not, all of the fuel vapor is not eliminated and some inevitably reaches the carburetor inlet valve. Often the transfer line is itself exposed to heat and gas accumulates where it connects with the carburetor at the inlet side of the carburetor fuel inlet valve. The vapor collects, especially at low flow velocities. Many little bubbles of vapor forced through the line from the pump break down the surface tension of the liquid fuel surrounding each small bubble and join to form one large bubble which may range in size up to several inches in length. If the size of the bubble expands to fill the line, the source of liquid fuel is cut off. The bubbles may be under at least pump pressure and are a potential cause of a vapor-lock condition which can produce engine failure.

It must be recognized as fact that a carburetor calibrated to deliver a proper proportion of liquid fuel to air cannot handle fuel in gaseous form to also deliver a proportional flow of gas to air. Consequently, when the fuel inlet valve opens and the gas bubble blows into the fuel bowl of the carburetor, the gas is not metered, but blows through the inside vent of the carburetor causing the mixture to become too rich. If the mixture is too rich to be ignited by a spark the engine obviously stops.

It is one of the objects of this invention to provide a system for supplying liquid fuel to an engine to avoid engine stalls due to fuel vapor collected in the system.

It is another object of this invention to provide a system for supplying liquid fuel to an engine which is capable of dividing the large bubbles of gas accumulating

in the system into small bubbles in a liquid stream so as to avoid a large amount of gas being discharged at one time to a fuel metering device such as a carburetor for an engine.

FIG. 1 is a view of a portion of the transfer fuel line between the pump and the carburetor and a portion of a carburetor in vertical section. The carburetor shown is a single barrel down-draft type and will serve for purposes of illustrating the invention.

FIG. 2 is a transverse section taken on the line 2—2 of FIG. 1.

Referring to FIG. 1, a portion of the transfer fuel line **1** is shown connected at one end with the carburetor **2**. This line **1** usually extends over the top and down the side, or end, of the engine and connects with a fuel pump. This figure of the drawings shows a horizontal run of the line at the top of the engine and a part of a bend in the line. The rest of the bend and the run to the pump are omitted since the portion illustrated is sufficient for an explanation of this invention.

The fuel line **1** is connected to an externally threaded nipple **4** on the body of the carburetor **2** by a coupling sleeve **3**, internally threaded at **5**. The end of the coupling is flanged at **7** to clamp the end of the fuel line **1** to make a fluid tight joint. The passage **8** is a bore in the nipple **4** which is enlarged to form a threaded seat **6**. The threaded end **10** of the cage **11** of a fuel inlet valve is secured in the threaded seat **6**.

The fuel inlet valve cage **11** has an inlet passage terminating in a seat **12** which passage forms a continuation of passage **8** and may have the same bore size. A needle valve **14** of conventional type is slideable in cage **11**.

Within the float bowl **16** of the carburetor **2** is a float **17** secured to arm **19**. A bracket **20** formed integral with the body casting of the carburetor carries a hinge pin **22**. Bracket **19** has an eye **23** journaled on the hinge pin **22** and a finger **25** which presses needle valve **14** onto seat **12** as the float **17** raises with the fuel level in the bowl **16** all in the well known manner.

The carburetor **2** has an inside fuel bowl vent **28** projecting into mixture conduit **30** and the usual venturi-nozzle structure **31** and throttle valve **33** on throttle shaft **34**. In other words the carburetor intended to be illustrated here is a wholly convention device of its kind whose purpose is to provide a suitable fuel-air mixture to the engine manifold **35** on which it is mounted.

According to this invention the line **1** is provided with a slotted plug **38** which is frictionally retained in the line **1** as close to the passage **8** and seat **12** in valve cage **11** as is possible. Plug **38** is slotted from the bottom to form a sharp edged inverted weir as shown in section by FIG. 2.

The action of the inverted weir or plug **38** is schematically illustrated in FIG. 1 under conditions where the engine is operating and underhood temperatures are high. It will be understood that the engine is consuming fuel, the fuel pump is operating and that fluid conditions in the line **1** are not static. When these conditions prevail it is not uncommon for small bubbles B–1 of vapor to form and these small bubbles travel up the vertical run of line **1** to collect in the horizontal run forming a large bubble B–2. It is believed that the surface tension of the liquid fuel is not great enough to prevent the formation of large bubbles such as B2. Since the fluids in line **1** are under at least pump pressure (5 to 7 p.s.i. gauge) the vapor bubbles are compressed. Now if needle valve **14** opens to admit more liquid fuel into bowl **16**, it will be readily appreciated that gas alone or a mixture of gas vapors and liquid will be forced past seat **12**. Because the gas or vapors are compressed upstream of seat **12**, a sudden expansion of the vapors will take place downstream of seat **12** which will propel any liquid present at high velocity. Since the only escape route for the vapors is vent **28**, vapors moving at high velocity blow from the vent into the mixture conduit **30** of the carburetor. Often this gas discharge carries along some liquid fuel. The mixture becomes too rich to be ignited by spark and the engine stumbles or stalls. This sequence of events can be expected to occur when the throttle is opened to accelerate from a standing start, that is, assuming that vapor forming conditions obtain.

As illustrated in FIG. 1, when the vapor accumulates in bubble B–**2** so that the liquid level in line **1** falls slightly below the entering edge of the slot **40**, the vapor begins to leak past the sharp entering edge at the top of the slot in a thin stream which can be no wider than the slot **40**. Because the slot **40** is purposely narrow at its top, the stream of gas is broken up into small bubbles B–**3** which do not have sufficient energy when they expand downstream of seat **12** to cause any great amount of disturbance and pass out vent **28** at low velocities.

The successful operation of the slotted plug or inverted weir does not depend on the shape of the slot or its area. As long as the notch or slot has relatively sharp edges and the upper edges are spaced to allow only a thin stream of vapor to flow, the device operates as described. It is believed that the stream of vapor must be small enough so that surface tension of the fluid makes the vapor stream unstable. This may explain the reason why the vapor stream breaks up into a string of separate small bubbles.

What I claim and desire to secure by Letters Patent is:

1. In a fuel supply system for delivering volatile fluids to an engine having a fuel metering device with a fuel inlet valve, a fuel line having a near horizontal run connected at its outlet end with said fuel inlet valve and a source of fuel under pressure for said fuel line, the improvement comprising, a plug in said system located adjacent, and upstream of said inlet valve, said plug being slotted from its lower side to form an inverted weir with relatively sharp upper edges facing upstream and a through passage to said inlet valve of a width to divide gas flow around said edges into separate vapor bubbles.

2. A device for controlling vapor in a near horizontal passage of a fuel supply system for volatile fluids, comprising an inverted weir forming a barrier in said passage and a through slot in said weir defined by closely spaced relatively sharp upstream facing upper edges adjacent the top of said horizontal passage whereby an accumulation of gas above the fluid upstream of said weir will be divided into separate bubbles in the fluid stream on passing said edges.

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FREDERICK KETTERER, *Primary Examiner.*