May 7, 1957 R. C. ALDEN 2,791,186

LIQUID-FUEL SYSTEM

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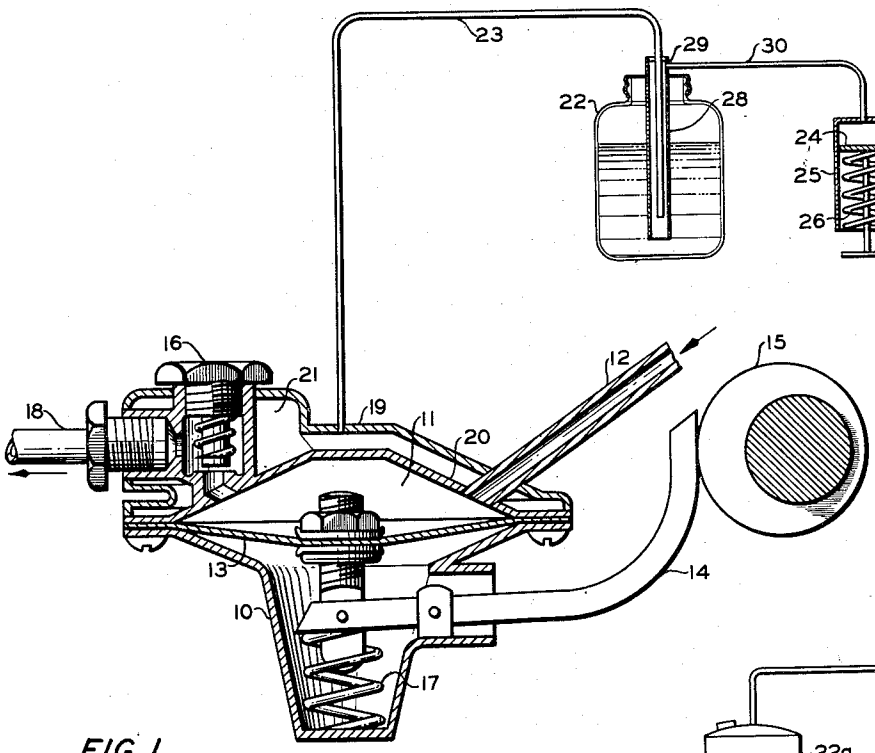

FIG. 1

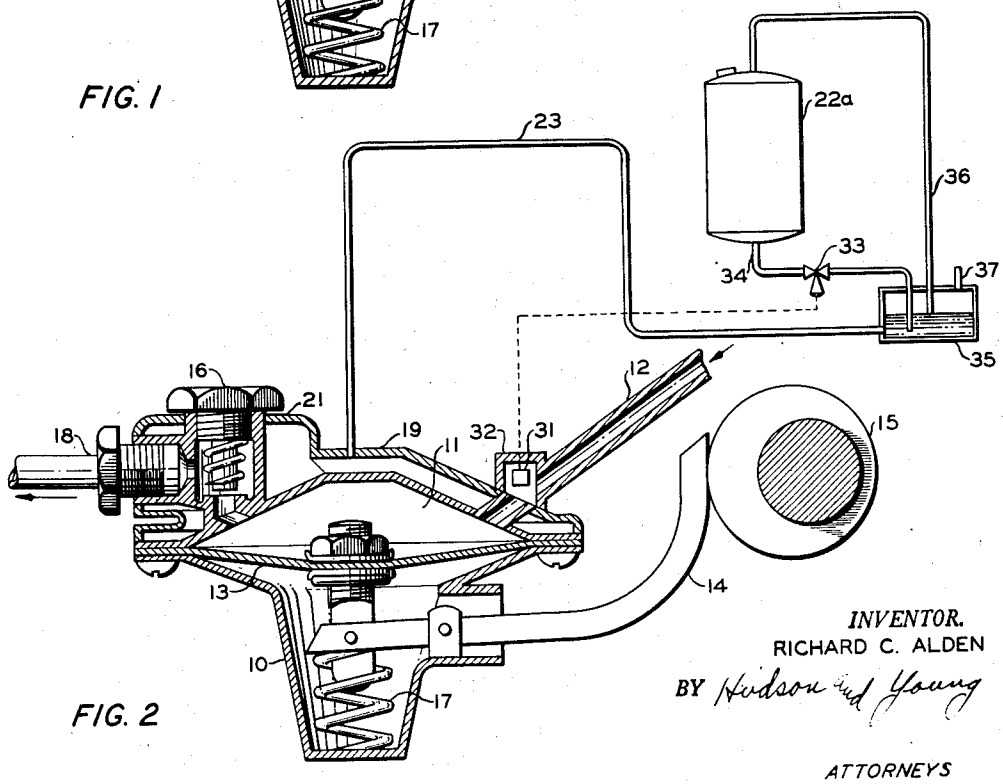

FIG. 2

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LIQUID-FUEL SYSTEM

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6 Claims. (Cl. 103—150)

This invention relates to an improved fuel system for use with an internal combustion engine using a liquid fuel. In one of its more specific aspects, it relates to a device for preventing the vaporization of liquid fuel between the fuel supply source and the carburetor of an internal combustion engine.

It is common practice to use an engine-driven pump for the purpose of forcing fuel to the carburetor of an automobile engine. The pump usually has a diaphragm which is flexed in one direction by a moving part of the engine to draw fuel from the supply tank to fill the suction pipe and pump chamber, and in the opposite direction by a spring which exerts a resilient pressure on the fuel, tending to force it into the carburetor as it is consumed. When the fuel spaces are full of fuel and while the temperature of the fuel remains below its vaporization point, the pump operates satisfactorily. However, during hot weather and especially in high altitudes and while the car is climbing heavy grades, vapor is sometimes generated in excess of the displacement capacity of the pump. This results in the fuel space becoming partially filled with vapor which displaces the liquid fuel and if not arrested, finally forms the commonly-known vapor lock. This difficulty becomes serious under certain conditions and causes the engine to lose power and sometimes stall because of insufficient fuel. Usually, it is necessary to either wait until the engine has cooled or to pour cold water on the components of the fuel system in order to condense the accumulated gasoline vapor.

The present invention provides a method of minimizing vapor lock in the fuel system of a reciprocating internal combustion engine. With the present invention, vapor lock is almost entirely eliminated by preventing any vapor from forming in the fuel pump through cooling of the critical parts of the fuel system. In this invention, the surfaces of the fuel pump adjacent to and in contact with the fuel are constructed with an outer jacket of porous metal having a series of aggregation of capillary tubes or holes through which water or another liquid contained within the jacket can diffuse onto the surface and provide a cooling effect by evaporation into the atmosphere. The water can be supplied to the jacket of the fuel pump either continuously from a reservoir or intermittently whenever vaporization of the fuel in the fuel pump has occurred or is about to occur. The control of the flow of water in intermittent operation can be either by manually regulating a valve in the water line between the reservoir and the water jacket of the fuel pump or by automatically regulating a control valve in the water line in accordance with a temperature-responsive element such as a thermostat located in the inlet of the fuel pump. The water or other liquid supplied to the fuel pump can have an anti-freeze solution admixed therein to prevent freezing of the system with the occurrence of low temperatures. It is preferable to construct the water jacket of a porous metal because most metals have a high heat conductivity; however,

other materials such as plastics, textiles, ceramics, etc. having a suitable porous structure can also be used.

The method of making porous metal articles is known as powder metallurgy and comprises placing metal powders in a mold, subjecting the powders to high pressure and heating the powder to a temperature below the melting point of the metal. The principle of powder metallurgy is based on the fact that, when a solid mass of a metal is crushed to a powder, the surface area of the particle is increased greatly in proportion to its mass. When the metal powder is heated, the surface of each particle will reach a semi-molten state at a temperature lower than the melting point of the metal and the particles will become fused together to form a solid body. Thus, the porous metal articles can be molded in the required shape or they can be machined from blocks of the porous metal.

Each of the following objects will be attained by at least one of the aspects of the invention.

It is an object of this invention to provide a liquid fuel system for an internal combustion engine which is substantially free from vapor lock.

It is another object to provide a porous metal water jacket for those portions of the liquid-fuel system wherein vaporization of the liquid fuel tends to occur.

It is still another object to utilize a porous metal for constricting a water jacket about a fuel pump wherein liquid fuel is used.

It is still another object to provide a means for cooling the liquid fuel supplied from the fuel supply tank to the carburetor of an internal combustion engine.

Other objects and advantages will be apparent to one skilled in the art upon studying the description of the invention and the attached drawing which is a part of this disclosure.

Figure 1 is a sectional elevation of a preferred form of the invention applied to the fuel pump of an internal combustion engine.

Figure 2 is a modification of a preferred form of the invention.

In Figure 1 of the attached drawing a preferred embodiment of my invention is shown employing a manual means of controlling the application of water to the water jacket attached to a diaphragm-type fuel pump 10. Fuel enters pump chamber 11 of fuel pump 10 by fuel line 12 after passing through a fuel strainer and sediment bowl (not shown). Pump chamber 11 is enlarged by the deflection of flexible diaphragm 13 downward through the action of pump arm 14 which is activated off the eccentric 15. The fuel drawn into pump chamber 11 by this suction stroke is forced through delivery valve 16 from pump chamber 11 by the return of diaphragm 13 through the action of compression spring 17 which was compressed on the suction stroke. The fuel flows by line 18 from fuel pump 10 to the carburetor (not shown). Water jacket housing 19, constructed of a porous metal and containing many fine capillary holes through which water can diffuse to the outer surface, is attached to housing 20 of pump chamber 11 in such a manner as to form a water cavity 21.

Water is supplied to water cavity 21 from water reservoir 22 through line 23. The water is forced from reservoir 22 by air pressure developed by the movement of plunger 24 in pressure cylinder 25 against the tension of compression spring 26. Plunger 24 is depressed manually by the operator, and check valve 27 in the piston of plunger 24 permits plunger 24 to be returned to its original position after the compression stroke. The air pressure developed in pressure cylinder 25 is transmitted to the outer concentric tube 28 of the gas-lift tube assembly 29 by line 30. The closure of gas-lift assembly

29 does not provide a seal for the water supply and thus allows air to enter so as to displace the water used in the porous water jacket. A vent can be provided in the closure of water supply if desired. Thus, in this embodiment, the operator manually transports water from reservoir 22 to water cavity 21 of fuel pump 10 whenever it is necessary to cool the critical parts of the fuel pump through evaporation of the water from the surface of water jacket housing 19.

In Figure 2 of the drawing, wherein similar reference characters designate similar parts in Figure 1, is shown an embodiment of this invention employing automatic means for regulating the flow of water to the fuel pump in accordance with the temperature of the fuel entering the fuel pump. This drawing is diagrammatic in nature and the components of the fuel system are not necessarily located in their proper spacial relationship. In this embodiment, however, the water supply is placed at a level above the fuel pump because the water flows by gravity from the supply to the water jacket. A thermostat 31, located in flow chamber 32 at the entrance of fuel line 12 into pressure chamber 11 of fuel pump 10, is employed to detect the temperature of the fuel entering the fuel pump and regulate the degree of opening of control valve 33 in water line 34. Water flows from reservoir 22*a* by gravity through line 34, float chamber 35, and line 23, to water cavity 21 of fuel pump 10. Float chamber 35 is provided with an air return line 36 attached to the top of reservoir 22*a* and an atmospheric vent 37 so that the regular flow of water to fuel pump 10 in accordance with the opening of valve 33 is maintained. In operation, the position of valve 33 is established by thermostat 31 so as to provide sufficient cooling of the critical parts of fuel pump 10 by the evaporation through the porous structure of water jacket housing 19.

The embodiments described in this invention are directed to the construction of the fuel pump with a water jacket of porous material. It is also within the scope of this invention to provide the carburetor bowl and other components of the fuel system in which the premature vaporization of fuel is likely to occur with a water jacket of porous metal or other porous material. In these constructions, the flow of water may also be regulated in the manner shown in the two embodiments of the drawing.

It is within the scope of this invention to eliminate cavity 21 in the porous metal jacket for the fuel pump and other components of the fuel system. In this modification a continuous porous metal covering will be employed and water will be introduced, from line 23, at the highest point of the porous metal evaporator and can be dripped or sprayed upon the surface of the porous metal or introduced into the interior of the porous metal jacket. In this modification the void spaces in the porous metal constitute the water jacket and the evaporation is, in effect, from the surface of the fuel pump itself.

Variations and modifications are possible within the scope of the disclosure of the invention, the essence of which is the provision of a porous metal water jacket surrounding those portions of the fuel system of an internal combustion engine wherein vaporization of the liquid fuel tends to occur so as to prevent the condition known as vapor-lock.

What is claimed is:

1. A fuel pump for an internal combustion engine comprising a housing member; a diaphragm positioned in said housing member so as to bisect said housing member and to form a fuel pump chamber in said housing member; means for flexing said diaphragm so as to alternately increase and decrease the volume of said pump chamber; valved fuel inlet and outlet means in said pump chamber; a porous metal water jacket encasing the portion of said housing member forming said pump chamber; and means for supplying water to said water jacket.

2. The fuel pump of claim 1 wherein the means for supplying water to said water jacket comprises a manually operated air-lift device in a water supply communicating with said water jacket.

3. The fuel pump of claim 1 wherein the means for supplying water to said water jacket comprises a water supply located at a level above said fuel pump; a conduit connecting said water supply to said water jacket; a valve in said conduit so as to control flow therethrough; and a temperature sensitive member exposed to the temperature of said fuel pump and operatively connected to said valve.

4. In a liquid fuel system for an internal combustion engine comprising a liquid fuel supply, a fuel pump and a carburetor; conduit means connecting said fuel supply to said fuel pump, and conduit means connecting said fuel pump to said carburetor the improvement comprising a porous metal water jacket encasing said fuel pump; a water supply; conduit means connecting said water supply to said water jacket; and means for supplying water from said water supply to said water jacket when fuel vaporizing conditions obtain in said fuel pump.

5. The fuel system of claim 4 wherein the means for supplying water to said water jacket comprises a manually operated air-lift device operatively connected to said water supply.

6. The fuel system of claim 4 wherein the means for supplying water to said water jacket comprises a valve in said conduit means connecting said water supply to said water jacket so as to control flow therethrough; and a temperature sensitive device subjected to the temperature of said fuel pump and operatively connected to said valve.

No references cited.