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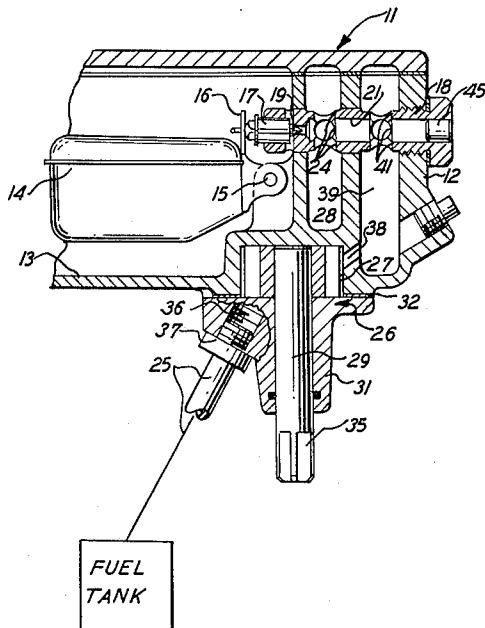
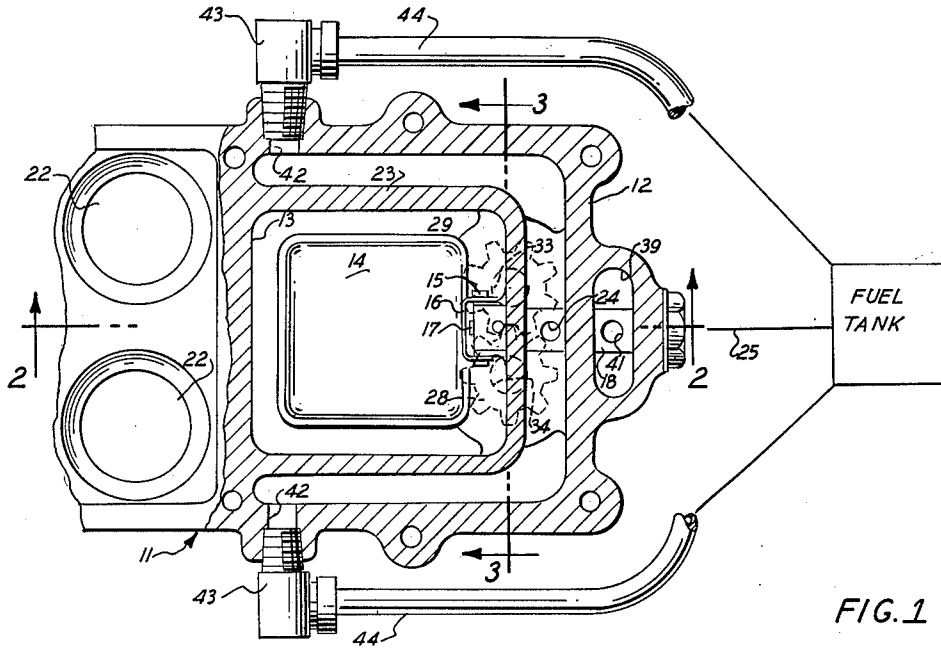
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3,196,926

FUEL SUPPLY SYSTEMS

Filed May 28, 1962

2 Sheets-Sheet 1



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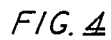
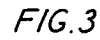
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FUEL SUPPLY SYSTEMS

2 Sheets-Sheet 2



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3,196,926

FUEL SUPPLY SYSTEMS

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4 Claims. (Cl. 158—36.3)

This invention relates to fuel supply systems for internal combustion engines, and more particularly to fuel supply systems that insure a supply of low temperature fuel to the fuel introducing device of the engine at all times.

The high volatility that makes gasoline a desirable fuel for internal combustion engines also creates several problems with its use as a fuel. The low boiling point of gasoline frequently results in a condition known as "vapor lock." Vapor lock occurs when gasoline vaporizes in the fuel lines, fuel pump or fuel bowl of the engine's charge forming device. This problem is particularly acute in motor vehicles where the engine is confined within a vehicle body.

The rate of air flow through the engine compartment when the vehicle is moving normally maintains a temperature low enough to prevent vapor lock. Under certain conditions, however, the engine compartment temperature becomes excessive and, unless some means is provided of cooling the fuel, vapor lock will occur. Engine compartment temperature may become excessive during extended idle periods or under a condition known in the art as "soak." Soak periods are times when a thoroughly heated engine is shut off and permitted to radiate its heat into the engine compartment.

It is, therefore, the principal object of this invention to provide a fuel feed system for an internal combustion engine that maintains a low fuel temperature throughout the system.

It is a further object of this invention to provide a proportioning means for a fuel feed system that permits excess quantities of fuel to be pumped by the fuel pump and returned to the fuel tank to maintain a low fuel temperature in the system.

Heretofore the fuel pump of the fuel supply system has been a separate element of the system. Because the fuel pump is a separate element in conventional systems and must be interposed in the fuel supply circuit, the use of at least two fluid tight fittings is required. If the fuel pump could be formed integrally with one of the other elements of the system, preferably the charge forming device, the use of additional fittings could be obviated insuring a leak proof system.

It is, therefore, a still further object of this invention to provide a charge forming device incorporating an integral fuel pump.

A fuel supply system for an internal combustion engine embodying this invention includes a fuel tank and a fuel introducing device for the engine. A fuel pump adapted to pump a quantity of fuel exceeding the requirements of the engine for its normal operation has its input side connected by conduit means with the fuel tank. Second conduit means interconnect the output side of the fuel pump with the charge forming device. Proportioning means are interposed in the second conduit means for diverting the excess portion of the fuel flowing in the second conduit means from the fuel introducing device back to the fuel tank. The provision of excess fuel flow insures that the temperature of the fuel in the system will approximate the temperature of the fuel in the fuel tank.

In an embodiment of this invention a cooling fuel jacket encircles the fuel bowl of a charge forming device. The excess quantity of fuel pumped is diverted to the cool-

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ing fuel jacket to draw the heat from the fuel in the fuel bowl.

In another embodiment of the invention bypass means are interposed between the output side of the fuel pump and the fuel introducing device. The bypass means includes proportioning means that divert the excess portion of the fuel pumped by the fuel pump to a fuel receiving chamber positioned externally of the fuel introducing device. The excess fuel pumped to the fuel receiving chamber flows from outlet means formed in the fuel receiving chamber through a conduit back to the fuel tank.

In a still further embodiment of the invention a charge forming device having an induction passage and a fuel bowl that discharges fuel into the induction passage is provided. A fuel pump is contained within the charge forming device and pumps fuel into the fuel bowl through conduit means extending from the discharged side of the fuel pump.

Further objects and advantages of this invention will become more apparent as this description proceeds particularly when considered in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a top plan view illustrating schematically the fuel supply system of an internal combustion engine incorporating an embodiment of this invention with portions shown in section and other portions broken away.

FIGURE 2 is a cross sectional view taken along line 2—2 of FIGURE 1.

FIGURE 3 is a cross sectional view taken along line 3—3 of FIGURE 1.

FIGURE 4 is a side elevational view showing schematically another embodiment of the invention with portions in section.

Referring now in detail to the fuel supply systems illustrated in the drawings and in particular to the embodiment shown in FIGURES 1—3, a portion of a charge forming device is indicated generally at 11. The charge forming device 11 has a body portion 12 formed to provide a fuel bowl 13. A float 14 is pivotally supported within the fuel bowl 13 upon the pin 15. A tang 16 formed upon the float 14 controls the position of a needle valve 17 interposed in the inlet fitting 18 threaded into the body portion 12. The needle valve 17 seats upon a shoulder 19 formed around the internal conduit 21 of the inlet fitting 18 to control the flow of fuel into the fuel bowl 13 and maintain a normal fuel level therein. Fuel may flow from the fuel bowl 13 and be discharged into induction passages 22 formed in the body portion 12 by suitable nozzles, flow controlling means and conduits (not shown).

Formed integrally within the body portion 12 is a cooling fuel jacket 23 that is positioned around three sides of the fuel bowl 13. The cooling fuel jacket 23 extends for substantially the same height as the fuel bowl 13. A plurality of metered openings 24 are formed in the portion of the inlet fitting 18 that extends through the cooling fuel jacket 23 (FIGURES 1 and 2). Because of the metered openings 24 and the needle valve 17, the inlet fitting 18 may function as proportioning means to direct a portion of the fuel flowing therethrough to the fuel bowl 13 and divert a portion of the fuel to the cooling fuel jacket 23.

Fuel may flow from the fuel tank, indicated schematically in FIGURES 1 and 2, through a conduit 25 to a fuel pump assembly indicated generally at 26. In the embodiment of the invention illustrated in FIGURES 1—3, the fuel pump assembly 26 is contained within the charge forming device 11. To this end the body portion 12 is formed to provide a cavity 27. The fuel pump illustrated is of the intermeshing external tooth gear type and comprises a driven gear 28 and an idler gear 29 positioned within the cavity 27. A cover plate 31 extends across the external opening of the cavity 27 and a

gasket 32 is provided around the periphery of the cover plate 31. Suitable means (not shown) are provided for securing the cover plate 31 and gasket 32 to the body portion 12 to form a fluid tight enclosure.

The idler gear 29 is rotatably supported within the cavity 27 upon a stub shaft 33 that is affixed to the cover plate 31. The gear 28 is affixed to a driving shaft 34 rotatably supported by the cover plate 31. The driving shaft 34 extends from within the charge forming device and is formed at its end with a male portion 35 of a socket assembly. The male portion 35 of the socket assembly may be secured to any suitable element to provide motive power for the fuel pump assembly 26. For example, the driving shaft 34 may extend into the internal portion of the engine to be driven by its camshaft. The male socket portion 35 can be received in a female socket portion formed in a worm gear that meshes with a worm wheel affixed to the camshaft.

A fluid inlet conduit 36 is formed in the cover plate 31, fuel pump assembly 26 and opens into the cavity 27. A fitting 37 is formed on the discharge end of the inlet conduit 25 and is threaded into the cover plate 31 to allow fuel to flow from the fuel tank into the cavity.

An outlet port 38 is formed in the body portion 12 and extends from the cavity 27 to an elongated fluid receiving cavity 39 formed within the body portion 12. The inlet fitting 18 passes through the cavity 39 and, within the cavity 39, is formed a plurality of inlet openings 41. Fuel may flow from the cavity 39 into the inlet fitting 18 through the inlet openings 41 and be discharged into the cooling fuel jacket 23 and the fuel bowl 13.

The operation of the embodiment shown in FIGURES 1-3 is as follows, fuel is drawn by the fuel pump assembly 26 from the fuel tank through conduit 25. The fuel pump assembly 26 is adapted to pump a quantity of fuel in excess of that required by the engine for its normal operation. Fuel is discharged from the pump 26 through the outlet port 38 into the cavity 39. From the cavity 39 fuel flows through the inlet openings 41 into the inlet fitting 18 and through its internal conduit 21. As the needle valve 17 is opened and closed by the float 14, fuel is discharged into the fuel bowl 13. The excess quantity of the fuel flowing is shunted through the metered openings 24 in the inlet fitting 18 to the cooling fuel jacket 23. The excess fuel flowing through the cooling fuel jacket 23 surrounds the fuel bowl 13 and provides insulation and cooling therefor.

One or more outlet openings 42 are provided in the cooling fuel jacket 23 at the upper portion thereof. Outlet fittings 43 are threaded into the outlet openings 42 and connected by outlet conduits 44 to the fuel tank. The excess fuel flowing into the cooling fuel jacket 23 will be recirculated to the fuel tank through the conduits 44. Because a major portion of the fuel circulating has been returned to the fuel tank, the temperature of the fuel in the system will approximate the temperature of the fuel in the fuel tank. A low fuel temperature throughout the system is thus maintained to preclude the possibility of vapor lock.

If desired the internal fuel pump assembly 26 shown in the embodiment in FIGURES 1-3 may be replaced by a conventional externally positioned fuel pump. The fuel pump should be, however, adapted to pump a quantity of fuel in excess of that required by the engine for its normal operation. The outlet side of the fuel pump may be directly connected to the inlet fitting 18 positioned in the carburetor body 12 by removing a plug 45 positioned therein.

Referring now to the embodiment shown in FIGURE 4, a fuel supply system comprising a fuel tank, fuel pump, fuel receiving chamber 61 and charge forming device 62 are shown schematically. The fuel pump is adapted to supply a quantity of fuel that exceeds the normal amount the charge forming device 62 furnishes to meet the requirements of the engine.

Fuel flows from the fuel tank to the inlet side of the fuel pump through a conduit 63. The discharged side of the fuel pump is connected to the charge forming device 62 by a conduit indicated generally at 64.

The conduit 64 includes a tube 65 having an outlet coupling 66 that is threaded into a fitting 67 upon the charge forming device 62. A fitting 68 is formed at the inlet end of the tube 65 to permit connection with a flexible tubing that extends from the discharged side of the fuel pump. The fuel receiving chamber 61 comprises a cylindrical body portion closed at one end by a cap 69 at the other end by a head 71 formed integrally therewith. The tube 65 passes through an opening 72 formed in the head 71 and an opening 73 formed in the cap 69. Within the interior of the fuel receiving chamber 61, the tube 65 is formed with a plurality of metered openings 74. The openings 74 permit fuel to flow from the tube 65 into the fuel receiving chamber 61. An outlet port 75 is formed in the head 71 of the fuel receiving chamber 61 and has received therein an outlet pipe 76. The pipe is adapted to be connected to the fuel tank by a return conduit 77.

As has been noted the fuel pump is adapted to pump a quantity of fuel that exceeds the normal requirements of the engine. The excess fuel pumped into the tube 65 will be discharged through the metered openings 74 into the fuel receiving chamber 61. The excess fuel will then be returned through the conduit 77 to the fuel tank. By causing an excess quantity of fuel to flow through the system and by returning the excess fuel to the fuel tank, the temperature of the fuel circulating will approximate the temperature of the fuel in the tank. In this way a constant supply of low temperature fuel is provided to the charge forming device 62.

Although the fuel receiving chamber 61 and metered tube 65 are shown in conjunction with a specific type of charge forming device, it is to be understood that the invention may be practiced with a fuel injection nozzle or various other forms of fuel introducing devices for an engine. The excess quantity of fuel that is recirculated will provide a cool fuel supply for whatever form of fuel inducing device employed. This will preclude the possibility of vapor lock in the fuel supply system.

It is to be understood that the invention is not limited to the embodiments shown and described, but that other changes and modifications may be made without departing from the spirit and scope of the invention, as defined by the appended claims.

I claim:

1. A fuel supply system for an internal combustion engine comprising a fuel tank, a charge forming device having a fuel bowl, means for maintaining a uniform fuel level in said fuel bowl, a cooling fuel jacket around said fuel bowl in contact with a substantial area of the wall defining said fuel bowl, a fuel pump adapted to pump a quantity of fuel in excess of the requirements of the engine for its normal operation, first conduit means connecting the input side of said fuel pump with said fuel tank, means delivering fuel from the output side of said fuel pump to said fuel bowl and said cooling fuel jacket, and second conduit means for returning to said fuel tank the excess fuel pumped.

2. A fuel supply system for an internal combustion engine comprising a fuel tank, a charge forming device having a fuel bowl, means for maintaining a uniform fuel level in said fuel bowl, a cooling fuel jacket around said fuel bowl in contact with a substantial portion of the wall defining said fuel bowl, a fuel pump adapted to pump a quantity of fuel in excess of the requirements of the engine for its normal operation, first conduit means connecting the input side of said fuel pump with said fuel tank, means delivering fuel from the output side of said fuel pump to said fuel bowl and said cooling fuel jacket, means diverting the excess portion of the fuel pumped by said fuel pump to said cooling fuel jacket, and second

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conduit means interconnecting said cooling fuel jacket with said fuel tank for returning to said fuel tank the excess fuel pumped.

3. A fuel supply system for an internal combustion engine comprising a fuel tank, a charge forming device having a body portion forming a fuel bowl, a cooling fuel jacket formed around said fuel bowl in said body portion, said body portion having an upstanding wall separating said cooling fuel jacket from said fuel bowl, a fuel inlet for said fuel bowl and said cooling fuel jacket, said fuel inlet comprising an inlet fitting having an axially extending fuel passage, a fuel inlet side formed in said inlet fitting, said inlet fitting being received in said body and passing through said wall, said inlet fitting further having at least one radial opening into said cooling jacket, a fuel pump adapted to pump a quantity of fuel in excess of the requirements of the engine for its normal operation, first conduit means connecting the input side of said fuel pump with said fuel tank, second conduit means interconnecting the output side of said fuel pump with said inlet side of said inlet fitting, a fuel outlet in said cooling

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fuel jacket, and third conduit means interconnecting said fuel outlet with said fuel tank.

4. A fuel supply system as defined by claim 3 wherein a float controlled valve is positioned at the opening of said inlet fitting into said fuel bowl to control the level of fuel in said fuel bowl.

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