

[54] **FUEL ECONOMIZER SYSTEM FOR A GASOLINE ENGINE**

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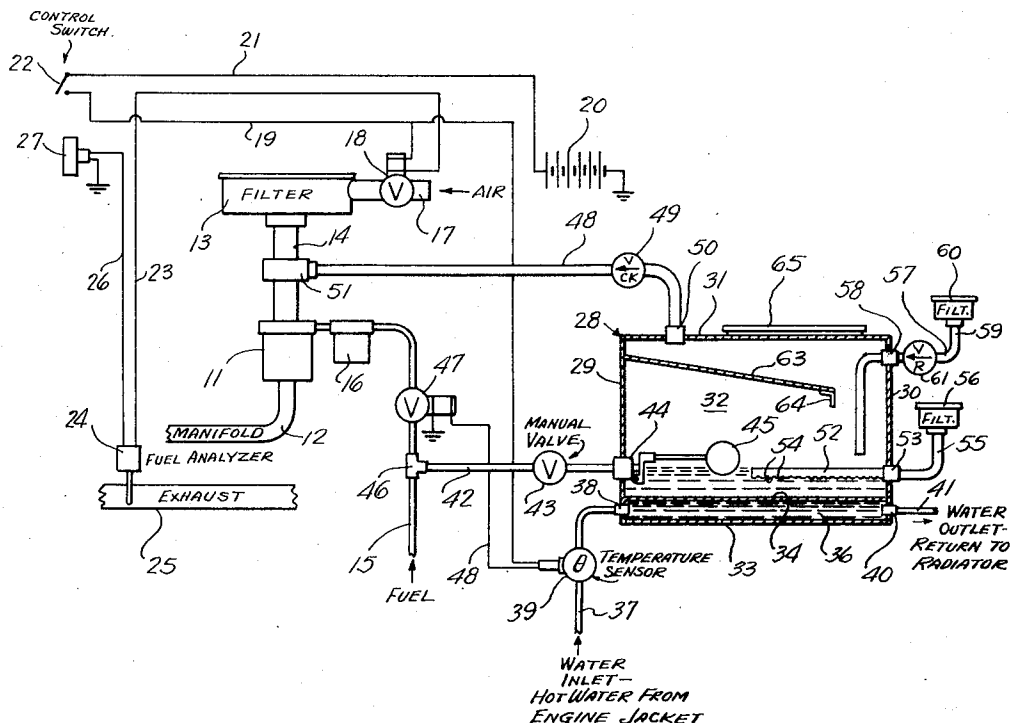
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[57] **ABSTRACT**

A fuel economizer system for a gasoline engine. A heat sensor in the engine exhaust line controls valves in the normal intake and fuel supply conduits to cause them to close as the engine warms up. A mixture of gasoline vapor and air is supplied to the carburetor from an auxiliary tank supplied with gasoline from the main supply line through a replenishing float valve in the auxiliary tank. The gasoline in the auxiliary tank is heated by a jacket supplied with hot fluid heated by the engine. Air is injected into the gasoline through a multiple-hole terminal nozzle immersed in the gasoline, acting as an agitator, creating a gas-and-air vapor mixture in the upper portion of the auxiliary tank. The air is furnished to the nozzle through a conduit provided with an intake filter.

11 Claims, 1 Drawing Figure



FUEL ECONOMIZER SYSTEM FOR A GASOLINE ENGINE

This invention relates to fuel-economizing systems for gasoline engines, and more particularly to a fuel-economizing attachment for an internal combustion engine such as that employed with a motor vehicle, utilizing the heat developed by the engine to preheat the fuel mixture supplied thereto.

A main object of the invention is to provide a novel and improved fuel-economizing system for use with a gasoline engine to provide more complete combustion of the gasoline, to improve the efficiency of the engine, and to improve gasoline mileage without affecting power or speed, the system employing relatively simple parts, being easy to install, and being relatively compact in size.

A further object of the invention is to provide an improved fuel-economizing attachment for a gasoline engine, such as that employed with a motor vehicle, the attachment involving inexpensive components, being reliable in operation, acting to reduce harmful emission of unburned and noxious fumes from the engine exhaust system, and also acting to reduce emission of carbon monoxide gases from the engine exhaust system heretofore caused by incomplete combustion of gasoline vapor.

A still further object of the invention is to provide an improved fuel economizer for gasoline engines, such as the type employed with motor vehicles, the economizer employing intake air as an agitating means to form gasoline vapors, and employing hot water from the engine's cooling system to heat the gasoline and to facilitate the formation of the gas-air vapor mixture supplied to the engine carburetor.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawing, wherein the single FIGURE is a diagrammatic view of a typical fuel economizer system constructed in accordance with the present invention and installed on a motor vehicle employing a conventional gasoline engine.

Referring to the drawing, 11 designates a conventional carburetor employed with the engine of an automobile, for example, the carburetor being connected between the conventional intake manifold 12 and air cleaner 13, the air cleaner 13 being connected to the carburetor 11 by an air conduit 14. The carburetor 11 is supplied with liquid fuel from a conventional gasoline supply conduit 15 leading to a gasoline bowl chamber 16.

The air cleaner unit 13 is provided with an air intake conduit 17, and in accordance with the present invention, a solenoid valve 18 is provided in the conduit 17, the solenoid element of the valve having one terminal thereof connected to a wire 19. The wire 19 is connected through a main control switch 22 and another wire 21 to the ungrounded terminal of the vehicle battery 20. The main terminal of the solenoid element of valve 18 is connected by a wire 23 to one terminal of a conventional temperature sensing impedance unit 24 whose sensing element is mounted in the exhaust conduit 25 of the vehicle. The remaining terminal of element 24 is connected by a wire 26 to one terminal of a current indicating device 27, the remaining terminal of said indicating device 27 being connected to ground.

The impedance device 24 is of a type whose resistance decreases responsive to increasing temperature at its sensing element, so that with switch 22 closed, the solenoid valve 18, which is open when the engine is cold, becomes gradually energized as the temperature of the gases in the exhaust conduit 25 rises, thereby operating the valve toward closure as the current through its solenoid element increases. Eventually, as the engine reaches its normal steady state working temperature, the valve 18 becomes substantially closed, cutting off the flow of air through the conduit 17. The increase in current in the circuit of the solenoid valve element 18 is indicated on the meter 27, which therefore serves as a fuel analyzer gauge.

Designated at 28 is an auxiliary tank which is mounted in any suitable location on the vehicle, said tank having opposite end walls 29 and 30 and having a top wall 31, as well as vertical longitudinal walls 32 and a bottom wall 33. Secured in the lower portion of tank 28 and spaced above bottom wall 33 is a horizontal partition wall 34, defining a heat exchange chamber 36 between partition wall 34 and bottom wall 33. The chamber 36 is adapted to receive hot fluid from the engine, for example, either the cooling water from the engine cooling jacket or the hot gases from the engine exhaust. In the typical embodiment illustrated in the drawing, the system is arranged so that water from the engine's cooling system is circulated through the heat exchange chamber 36. Thus, a conduit 37 connects a suitable port in the engine water jacket to one end of chamber 36 at 38, the conduit 37 being provided with a conventional temperature responsive impedance device 39 having a sensor element exposed to the water passing through conduit 37 toward fitting 38. The opposite end of chamber 36 is connected by a suitable fitting 40 and conduit 41 to the return line leading to the engine radiator.

As in the case of temperature-sensing unit 24, the temperature-responsive impedance device 39 is preferably of a type whose resistance decreases with increase of temperature.

The liquid fuel line 15 is connected to the lower portion of tank 28 through a conduit 42 provided with a manual valve 43 and through a float valve unit 44 mounted in end wall 29. Float valve 44 is of a conventional needle-valve type provided with a float element 45 whose position changes with change in liquid level in the tank and which cooperates with the needle valve mechanism to maintain a predetermined substantially constant level of liquid in tank 28. Thus, the float valve unit 44 acts to maintain a substantially constant level of gasoline fuel in the lower portion of tank 28 and the element 45 acts to replenish this level when it drops substantially below its intended value. Under normal conditions, the valve 43 is left open, but may be closed if it is desired to close conduit 42 and thereby cut off communication between fuel line 15 and tank 28.

As shown, conduit 42 communicates with fuel line 15 at a T-fitting 46. A solenoid valve 47 is included in conduit 15 between T-fitting 46 and the bowl element 16, the solenoid element of valve 47 having one terminal thereof connected to ground and having the other terminal thereof connected by a wire 48 to one terminal of the temperature-sensing impedance element 39. The remaining terminal of impedance ele-

ment 39 is connected to the battery wire 19. Thus, as in the case of solenoid valve 18, with switch 22 closed, when the engine is cold, valve 47, which is normally open, remains open and allows fuel to flow to bowl 16 and carburetor 11. As the engine warms up and the temperature of the water in conduit 37 increases, the resistance of the thermostat element 39 decreases, allowing the current through the solenoid element of valve 47 to increase, thereby operating the valve towards closure. As the engine reaches its working temperature, valve 47 is substantially closed, cutting off the flow of fuel to bowl 16.

The upper space in tank 28 is connected to the air conduit 14 by a conduit 48 provided with a check valve 49, the connection being made at top wall 31 by a fitting 50, said connection being located adjacent end wall 29, as illustrated. The connection of conduit 48 to conduit 14 may be made by means of a conventional block tee 51. Check valve 49 allows free flow toward the left, as viewed in the FIGURE, namely, toward conduit 14, but prevents reverse flow toward the right in conduit 48.

Mounted in the lower portion of tank 28 slightly below the predetermined liquid level therein maintained by float valve unit 44 is a longitudinally extending apertured nozzle member 52 said member being mounted in end wall 30 by means of a suitable fitting 53. The nozzle member 52 may comprise an elongated tube provided with a large number of jet orifices 54 in its lower portion, said orifices being immersed in the liquid in the lower portion of tank 28. An air intake conduit 55 is connected to the nozzle 52 at the fitting 53, the intake end of conduit 55 being provided with a conventional air filter 56.

As shown in the drawings, the conduit 55 has an upwardly extending vertical inlet end on the top end of which the filter 56 is mounted, the top end of the conduit 55 being a substantial distance above the liquid level in the tank 28.

An auxiliary air inlet conduit 57 is provided, connected to the space in tank 28 above said liquid level, the conduit 57 being connected to the tank through the upper portion of end wall 30, as by a conventional fitting 58. Conduit 57 has an upwardly directed inlet end portion 59 whose top end is provided with a conventional air filter 60. Conduit 57 is provided with a normally closed spring-loaded or counterbalance type of gate valve 61 which opens to allow air flow into tank 28 responsive to a predetermined degree of vacuum in the upper space in tank 28, namely, responsive to a predetermined pressure differential between the upper space in tank 28 and the atmosphere. As will be presently explained, this arrangement is to provide additional flow of air into tank 28 from the atmosphere when the engine operates faster, thereby requiring more air. This faster operation of the engine develops more vacuum in conduit 14, which is transmitted to the upper space in tank 28, thereby causing the above-described opening action of relief valve 61.

Designated at 63 is a baffle plate which is mounted in the upper space in tank 28 and which extends downwardly and toward the right, as viewed in the FIGURE, from end wall 29 toward end wall 30, overlying the float valve unit 44 and a substantial portion of the apertured tubular nozzle member 52. The right end

of the inclined baffle plate 63 may be secured to a transverse angle bar 64 secured in tank 28.

Top wall 31 may be provided with a suitable removable inspection cover 65 for at times allowing access to the interior of tank 28, as required.

In operation, with switch 22 closed, when the engine is started and is relatively cold, valves 18 and 47 remain open, allowing normal intake of air into the carburetor through conduit 17 and conduit 14, and allowing normal intake of fuel to the carburetor from conduit 15 through bowl 16. As the engine heats up toward its normal working temperature, valves 18 and 47 gradually close. The gasoline in the lower portion of tank 28 is warmed from the heat delivered thereto from heat exchange jacket 36 and is thereby rendered relatively volatile. The vacuum from conduit 14 is transmitted to the upper space in tank 28, producing a degree of vacuum therein, which causes air to be drawn in through filter 56 and conduit 55 and to be injected into the warmed liquid fuel through the jet apertures 54 of nozzle member 52. The jets of air thus forced into the warmed liquid fuel produce a considerable amount of turbulence and agitation, causing the liquid to be vaporized and to mix with the air in the upper space of tank 28, being drawn upwardly above the baffle plate 63 and thence through conduit 48 and check valve 49 to the conduit 14, where it is allowed to pass into the carburetor 11 and thence to the engine through manifold 12. The preheating of liquid fuel and the premixing of the warmed liquid vapor and air provides more complete combustion of the fuel and greatly increases the efficiency of operation of the engine.

As above explained, as the engine operates faster, more air is required, which is drawn through the auxiliary air supply conduit 59 and relief valve 61 into the upper space in tank 28.

As above mentioned, either the hot water from the engine jacket may be employed to warm the liquid fuel in tank 29, or alternatively, the hot exhaust gases from the engine may be employed as the heating medium for the fuel.

The temperature responsive devices 24 and 39 may be suitable temperature-responsive variable resistance devices, such as thermistors, or the like, or may be conventional temperature-sensing elements such as those employed in motor vehicles to sense temperature conditions such as engine temperature, or the like. Furthermore, the devices 24 and 39 may be temperature-responsive switch devices instead of impedances, closing at predetermined elevated temperatures.

While a specific embodiment of an improved fuel economizing system for an internal combustion engine has been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore, it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. In combination with an internal combustion engine having a carburetor, air intake means, an air supply conduit connecting said air intake means to said carburetor, a liquid fuel supply line, and a liquid fuel supply conduit connecting said supply line to said carburetor, normally open first valve means in said air in-

take means, normally open second valve means in said liquid fuel supply conduit, means to operate said first and second valve means towards closure responsive to a rise in engine temperature, an auxiliary tank, conduit means connecting said liquid fuel supply line to said auxiliary tank, means to maintain a predetermined liquid fuel level in said auxiliary tank, a heat exchange chamber in said auxiliary tank below said level so as to be immersed in the liquid fuel in said tank, means to circulate hot fluid from the engine through said chamber, an apertured nozzle in said tank located below said predetermined liquid level, air intake means connected to said nozzle extending outside the tank, whereby outside air can be admitted and be discharged through said nozzle to agitate the liquid fuel and form a fuel vapor and air mixture in the upper space in the tank, and conduit means connecting said upper space to said first-named air supply conduit.

2. The structural combination of claim 1, and wherein said means to operate said first and second valve means towards closure includes means responsive to the engine exhaust temperature.

3. The structural combination of claim 1, and wherein said engine has a liquid cooling system and said means to operate said first and second valve means includes means responsive to the temperature of the liquid of said cooling system.

4. The structural combination of claim 3, and wherein said hot fluid from the engine circulating through said chamber comprises liquid of said cooling system.

5. The structural combination of claim 1, and wherein said first and second valve means comprises respective solenoid valves.

6. The structural combination of claim 5, and wherein the first valve means is provided with an energizing circuit including a temperature-sensing current-modifying electrical element mounted so as to be exposed to the exhaust gases of the engine.

7. The structural combination of claim 6, and wherein the engine has a liquid cooling system and the second valve means is provided with an energizing circuit including a temperature-sensing current-modifying electrical element mounted so as to be exposed to the liquid of said cooling system.

8. The structural combination of claim 1, and wherein the first and second valve means comprise respective solenoid valves and the engine has a liquid cooling system, the first valve means being provided with an energizing circuit including a temperature-sensing current-modifying electrical element mounted so as to be exposed to the exhaust gases of the engine and the second valve means is provided with an energizing circuit including a temperature-sensing current-modifying electrical element mounted so as to be exposed to the liquid of said cooling system.

9. The structural combination of claim 8, and wherein said fuel level-maintaining means comprises a float valve in the connection between the liquid fuel supply line and said auxiliary tank.

10. The structural combination of claim 9, and wherein said auxiliary tank has opposite end walls, said float valve being located adjacent one end wall and said apertured nozzle being located adjacent the opposite end wall and extending substantially horizontally in the tank, and an inclined baffle plate mounted in said upper space and extending from said one end wall and being inclined downwardly toward said opposite end wall and overlying at least a portion of said nozzle, the last-named conduit means being in communication with the portion of said upper space above said baffle plate.

11. The structural combination of claim 9, and auxiliary external air intake conduit means connected to said upper space in the tank and including a normally closed relief valve opening responsive to a predetermined degree of vacuum in said upper space.

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