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THERMOELECTRIC ANTIPERCULATOR DEVICE FOR THE FUEL
SYSTEM OF AN INTERNAL COMBUSTION ENGINE
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FIG. 3

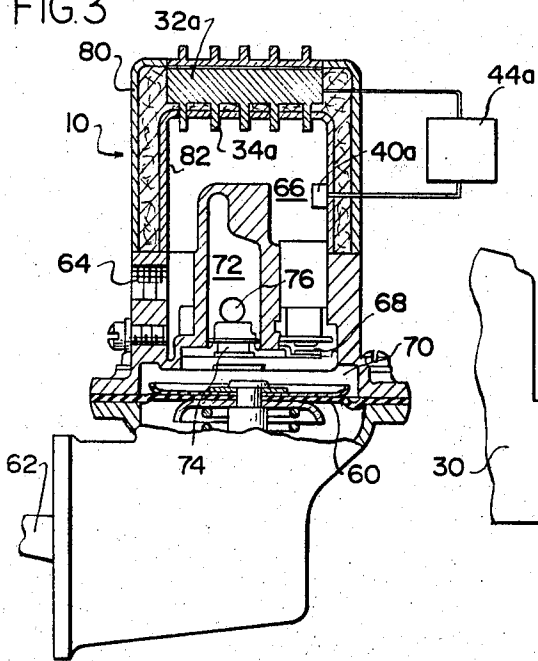


FIG. 2

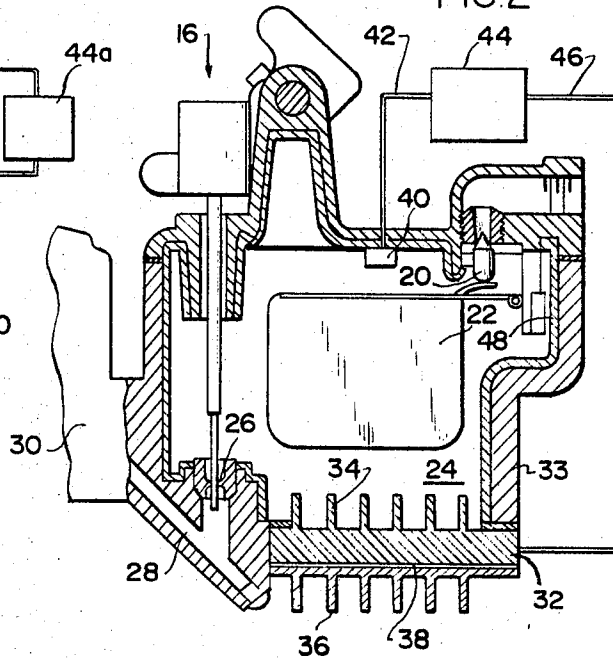


FIG. 1

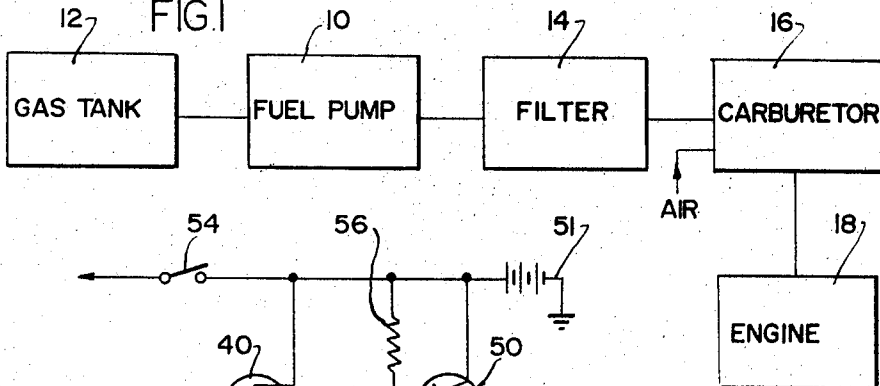
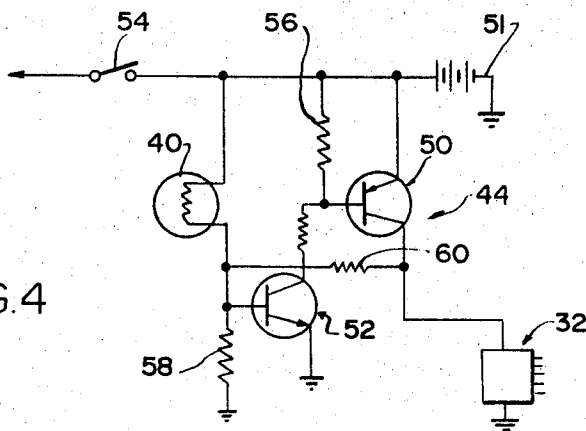


FIG. 4



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THERMOELECTRIC ANTIPERCULATOR DEVICE FOR THE FUEL SYSTEM OF AN INTERNAL COMBUSTION ENGINE

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4 Claims

ABSTRACT OF THE DISCLOSURE

A thermoelectric cooling device is mounted in the wall of the intake chamber of a fuel pump and in the float bowl of a carburetor to control the ambient temperature within the respective enclosures to eliminate perculating the fuel therein. A temperature sensitive resistor mounted within each of the enclosures is responsive to ambient temperature changes within the enclosure to vary the current through the thermoelectric cooling element to maintain the temperature of the enclosure below the boiling point of the fuel.

Background of the invention

It is known that evaporative emission of hydrocarbons from automobile engines contribute greatly to smog conditions in big cities. The greatest part of these emissions is due to the perculating or boiling of the gasoline from the carburetor float bowl.

Furthermore, when the engine and/or gasoline is hot, and the car is idling or stopped, there is a possibility that the fuel will boil within the intake chamber of the fuel pump, resulting in vapor lock of the pump. Likewise, if the vent valve in the fuel bowl of the carburetor does not function properly during the soak period with the engine shut down, pressure can build up in the bowl and blow gas into the engine manifold thereby flooding the engine and requiring extensive cranking to start.

Summary of the invention

It is an object of this invention to eliminate boiling of the fuel in the carburetor bowl of an internal combustion engine thereby reducing the amount of hydrocarbon emitted therefrom.

It is another object of this invention to reduce the chances for vapor lock in the fuel pump of an internal combustion engine.

It is a further object of this invention to prevent flooding of an internal combustion engine due to perculation in the carburetor bowl after the engine has been shut down.

In one embodiment of this invention, thermoelectric cooling elements are respectively mounted in a wall of the intake chamber of a fuel pump in an internal combustion engine and in a wall of the carburetor float bowl. A temperature sensitive resistor mounted in each of the enclosures is responsive to temperature changes therein to control a semiconductor switch, which is operable to control the current through the thermoelectric cooler element. Therefore, as the ambient temperature within the enclosures of the fuel pump and carburetor bowl rises, the resistance of the temperature sensitive resistor decreases operating the semiconductor switch to increase the current flow through the cooler element. The energized cooler elements remove heat from the enclosures and discharges it through a heat sink to the atmosphere thereby maintaining the temperature of the gasoline below the boiling point to prevent perculation and/or evaporative emissions from the enclosures.

Description of the drawing

FIG. 1 is a block diagram illustrating a basic fuel system for an internal combustion engine;

FIG. 2 is a side elevation view in cross-section of a carburetor of an internal combustion engine in accordance with this invention;

FIG. 3 is a side elevation view partially in cross-section of a fuel pump for an internal combustion engine in accordance with this invention; and

FIG. 4 is a schematic wiring diagram illustrating operation of the device of this invention.

Detailed description

Referring to the drawing, FIG. 1 illustrates a basic fuel system for an internal combustion engine wherein a fuel pump 10 draws gas from a tank 12 and passes it through filter 14 to the carburetor 16. Air is mixed with the fuel in the carburetor 16 and is drawn therefrom into the internal combustion engine 18. When the engine is hot, especially during the warm summer months, the fuel, following engine shut down, has a tendency to boil and evaporate from the carburetor bowl of the fuel system. This evaporation puts hydrocarbons into the air adding significantly to smog conditions in big cities. This invention describes a unique device for preventing evaporation of the gasoline from this device when the engine is stopped and also during engine operation.

FIG. 2 represents a typical float-type carburetor 16 for an internal combustion engine. It includes an inlet valve 20 that is operated by a float mechanism 22, which controls the amount of gasoline within the float chamber or reservoir 24. The fuel is drawn from the chamber 24 through metering valve 26 and through the venturi tube 28 into the pipe 30 where the gasoline mixture is mixed with air and delivered to the engine manifold for firing the cylinders.

In accordance with this invention, Peltier-type thermoelectric heat pump or cooler 32 is mounted in the bottom wall of the float bowl housing 33. Peltier thermoelectric heat pumps are known in the art to provide a low impedance electro-responsive means for heating or cooling at a given thermo-junction depending upon the polarity of the direct current flowing through the device.

Thermoelectric cooler element 32 has fins 34 which extend into the carburetor float bowl chamber 24 and which are in contact with the fuel in the float bowl. A thin sheet of material 38 which has good heat conducting properties but acts as an electrical insulator, for example, mica, is bonded to one side of a heat sink 36 and the other side is bonded to the thermal cooling element 32. The mica strip permits heat to be conducted therethrough to the atmosphere through the heat sink 36 thereby providing a path for eliminating the heat from the cooler element 32 as current passes through it. Because the strip 38 is a good electrical insulator, it reduces the chance of an inadvertent grounding of the cooler element through the heat sink 36.

Also mounted within the chamber 24 is a temperature sensitive resistor or thermistor 40. A connection 42 is made from the thermistor to a control circuit indicated generally at 44 which will be described in more detail in conjunction with FIG. 4. A second set of conductors 46 extend from the circuit 44 and connect that circuit to the cooler element 32.

A coating 48 of an insulating material such as urethane foam is placed on the interior surfaces of the walls of the casing 34 to insulate the chamber from heat radiating from the exterior of the casing into the chamber.

Operation of the invention may be best understood by referring to FIG. 4, which shows a control circuit 44

that includes a semiconductor switch composed of transistors 50 and 52. A control potential is connected to the semiconductor switch from the engine battery 51 before the ignition switch 54 so that operation of the control circuit 44 is independent of the engine ignition system. Biasing resistor 56 has a sufficient value to bias off PNP transistor 50 with the temperature in the bowl at a predetermined level selected to be below the boiling point of the fuel. However, as the temperature rises in the chamber 24, the resistance of thermistor 40, which is a negative temperature coefficient device, decreases causing an increase of current flow through resistor 58. This increased current flow biases on NPN transistor 52, which in turn draws sufficient current through resistor 56 to turn on transistor 50 thereby permitting current to flow in a direction through the thermal cooler 32 to draw heat from the chamber 24. The heat is conducted through the mica strip 38 to the atmosphere through the heat sink 36 thereby cooling the chamber 24. The resistor 60 provides a positive feedback in the thermistor circuit to insure a sharp triggering action for transistor 50. The values of the circuit components are chosen so that the temperature of the gasoline within the chamber 24 of the float bowl of carburetor 16 is maintained at a temperature below its boiling point to prevent vaporization of the gasoline.

FIG. 3 illustrates in more detail the fuel pump 10 shown in the fuel system of FIG. 1. The fuel pump 10 includes a spring loaded diaphragm 60 which is operated by a cam (not shown) actuated arm 62 in the conventional manner. Movement of the diaphragm 60 in one direction draws fuel from the gas tank through the inlet 64 into the inlet chamber or reservoir 66 and through the inlet valve 68 into the pump chamber 70. Movement of the diaphragm in the opposite direction moves the fuel from the pump chamber 70 into the outlet chamber 72 and through the outlet valve 74 and outlet 76 to the filter 14.

A problem has existed in fuel pumps of this type that when the engine is shut down after running for some time or during idling, and the fuel and engine are extremely hot, the fuel in the inlet chamber 66 evaporates so that the diaphragm 60 of the pump 10 loses suction causing a vapor lock of the fuel pump thereby starving the engine. In order to counteract this evaporation, the thermoelectric cooling element 32a, which is similar to the thermoelectric cooling element 32 described in conjunction with FIG. 2, is mounted in a wall of the casing 80 of pump 10. An insulating layer of urethane foam is deposited on the inner surface of the casing 80 between the casing and the walls of the casing 82 surrounding the inlet chamber 66. This provides insulation of the inlet chamber 66 from ambient temperatures surrounding the fuel pump.

A temperature sensitive resistor 40a is also positioned within the intake chamber 66 and is similar to the temperature sensitive resistor 40 in FIG. 2. A circuit 44a, which is similar to circuit 44 described in conjunction with FIG. 2, connects the temperature sensitive resistor 40a to the thermoelectric cooler 32a.

The fins 34a of cooler 32a extend into the chamber 66 and keep the ambient temperature therein at a predetermined level in the same manner as described for the thermoelectric cooler 32 to prevent the fuel within the chamber from boiling, thereby greatly reducing the chances of vapor lock of the pump.

It should be understood that although the temperature sensitive resistor elements 40 and 40a are each described as a negative temperature coefficient thermistor, a positive temperature coefficient device could be used by utilizing a semiconductor switch employing transistors of a different type. It is also contemplated within the scope of this invention that devices other than a thermistor controlled semiconductor switch could be used to control the flow of current through the thermoelectric cooler 32. For example, the other devices could include bimetallic or pressure switches, the former reacting to the temperature within the enclosures of the fuel pump and carburetor bowl and the latter being responsive to pressures built up in the enclosures due to temperature increases to vary the current through the cooler element.

What has been described, therefore, is a device for preventing the vaporization of the fuel in elements of a fuel system to which the fuel passes thereby reducing the emission of hydrocarbons in the air and preventing vapor lock.

What is claimed is:

1. A carburetor for an internal combustion engine, including in combination, a bowl for the engine fuel, a thermoelectric cooling element, means mounting said cooling element in said bowl, heat dissipating means, thermoconductive means coupling said cooling element to said heat dissipating means, and circuit means including a sensing element connected to said thermoelectric cooling element, said sensing element being responsive to the ambient temperature within said bowl to control the current through said circuit means and said thermoelectric cooling element thereby regulating the temperature of the fuel in the bowl to prevent the same from vaporizing.

2. The carburetor of claim 1 wherein said thermoelectric cooling element is mounted in a wall of said bowl and extends into the closure thereof, said heat dissipating means is a heat sink, and said thermoconductive means is a layer of material having good thermoconductivity properties and poor electrical conducting properties, said layer of material being connected between said cooling element and said heat sink so that the heat can be dissipated from said cooling element through said heat sink to the atmosphere surrounding the carburetor.

3. The carburetor of claim 1 wherein said sensing element is a temperature sensitive resistor, the resistance of said resistor varying in accordance with the temperature in said bowl thereby controlling the current through said circuit means.

4. The carburetor of claim 1 further including insulating means covering the interior walls of said bowl thereby insulating the closure of said bowl from heat in the air surrounding the same.

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