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M. ERIKSEN

2,746,440

CARBURETION APPARATUS

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FIG. 1

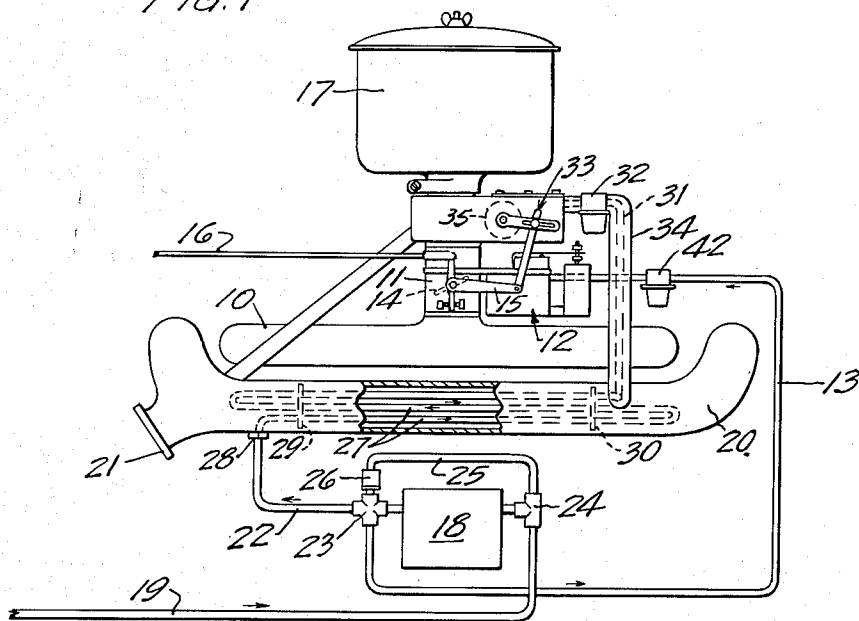


FIG. 2

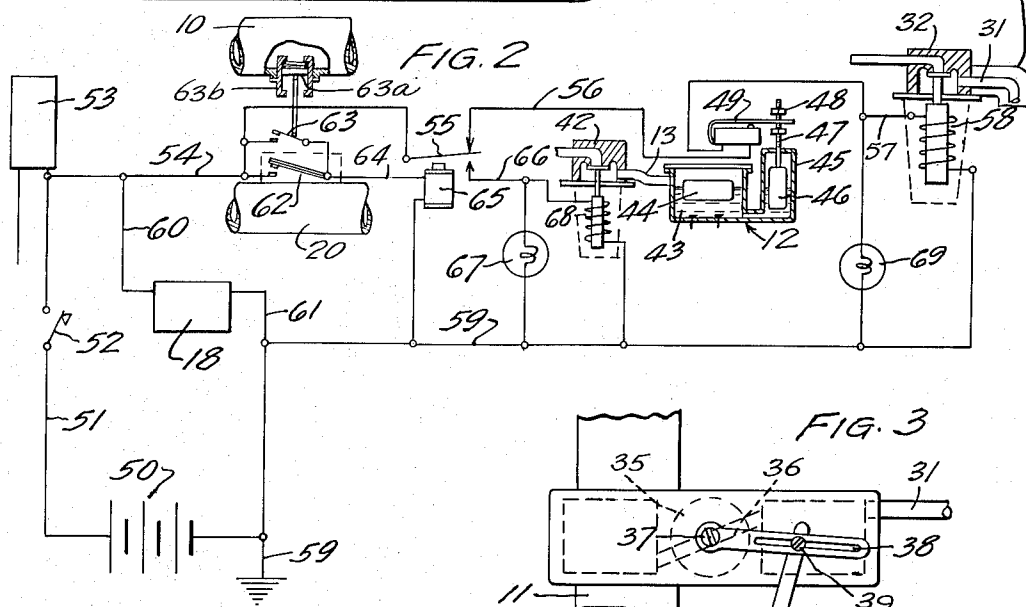
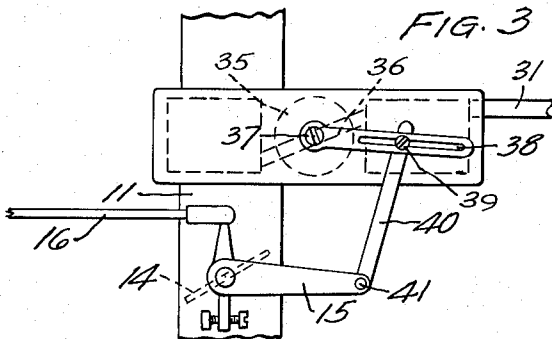


FIG. 3



INVENTOR
BY MORTEN ERIKSEN
Williamson, Williamson, Schroeder & Adams
ATTORNEYS

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CARBURETION APPARATUS

Morten Eriksen, Minneapolis, Minn.

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7 Claims. (Cl. 123—133)

This invention relates to carburetion in an internal combustion engine and more particularly to a system for vaporizing liquid fuel and supplying the vaporized fuel in combustible mixture to the intake manifold of the internal combustion engine independently of the liquid fuel supply system.

It is an important object of the invention to provide a highly efficient liquid fuel vaporizing and carbureting apparatus by which an internal combustion engine may be started in a conventional manner, then, when the engine has become sufficiently warm from operation, be converted to a vapor or gaseous fuel supply which will operate in a mutually exclusive relation with the conventional liquid supply line.

Another object of the invention is to provide a simple and automatic gaseous fuel supply for a conventional internal combustion engine which will be usable with the conventional throttle to supply the gaseous fuel instead of liquid fuel, properly mixed with air, to the intake manifold of the engine.

It is a further object of the invention to provide means for intimately mixing gas and air, the gas being vaporized from the common source of liquid fuel and supplied to an automobile intake in preheated and controlled manner which makes for high mileage with a low gasoline consumption.

It is a still further object to furnish a safe control system to prevent accidental fire or explosion from preheated gas vapors, the system being used in a parallel fuel supply line which will be interrupted and replaced by liquid fuel supply through the conventional fuel system upon the happening of prescribed events such as the stopping of the motor or chilling of the exhaust manifold below a predetermined temperature.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to similar parts throughout the several views and in which:

Fig. 1 is a schematic view of a conventional internal combustion engine showing my vaporizing system attached thereto, unessential details being deleted from the view and other hidden parts being designated by dotted lines;

Fig. 2 is a diagrammatic representation of the electrical control system in connection with the mechanical parts which comprise my invention; and

Fig. 3 is an enlarged segmental view of the carburetor and mixing valve element showing in detail the adjustability of the links and arms which operate the rotary sleeve valve.

Referring now more particularly to the drawing, my vaporizer system is intended to be used in conjunction with the conventional carburetor system of an internal combustion engine and may be constructed as a dual-type carburetion or may be supplied as an attachment ensemble for adding to the conventional engine. The conventional engine is shown in Fig. 1 with special refer-

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ence to the fuel system, the engine head and block, as well as other parts unessential to an understanding of the engine, having been deleted for the sake of brevity and clarity. An intake manifold 10 has mounted thereon and in internal communication therewith, a carburetor 11 of standard design. The carburetor 11, in turn, has a gasoline float bowl 12 for supplying liquid fuel to the carburetor from a liquid supply line 13. The carburetor 11 also has an internal butterfly valve 14 which is operated by an external lever arm 15, generally actuated by a lever or a cable 16 which in turn is connected to a throttle (not shown) controlled by the driver of the engine. An air cleaner 17 is usually placed over the top of the carburetor so as to catch abrasive material which may be floating in the incoming air. The liquid fuel line 13 leads from a fuel pump 18 which is capable of maintaining a predetermined constant pressure of fuel in the line. The inlet of the fuel pump is, of course, connected to the supply line 19 which brings liquid fuel such as gasoline from a supply tank (not shown). Another conventional part of the engine which is important in practicing my invention is the exhaust manifold 20 which connects with the individual exhaust ports of the engine cylinders (not shown) and directs the exhaust gases to a common outlet 21 which in turn leads to the atmosphere through such other deleted parts as a muffler and an exhaust pipe.

My invention contemplates the addition of several parts and devices which will render the engine convertible to a gas-air mixture which is presently employed in conventional carburetion. A branch line 22 is placed in fluid communication with the outlet of fuel pump 18 through a fixture such as the cross member 23. The fluid supply line 19 may be furnished with a T 24 as shown. A by-pass line 25 interconnects the cross 23 and T 24 and a spring-loaded valve 26 is interposed in the by-pass line 25. The valve 26 is set to release at a pressure slightly higher than the cut-out pressure of the fuel pump 18 so that in normal operation the by-pass need never be employed. In the event, however, the back pressure in either of lines 22 or 13 exceeds the cut-out pressure of the fuel pump 18 the fluid forwardly of the pump will be by-passed back to the supply line 19.

The fluid line 22 leads into a tubular portion such as the coil or switch back 27 through an orificed fitting 28 in the exhaust manifold 20. The tubular coil 27 may be supported within the exhaust manifold 20 by perforated plates or supports 29 and 30 which hold the coil 27 in place but still allow exhaust gases to move through freely. The coil 27 is in heat exchanging relation with the exhaust gases from the engine. It is to be understood that the coil 27 can be positioned anywhere in the proximity of the engine provided the coil can pick up by heat transfer sufficient heat to properly vaporize the liquid fuel. The outlet of the coil 27 leads through the wall of the exhaust manifold 20 and through a connecting tube 31 to a gas cut-off valve 32 and thence to the mixing valve element 33. The tube 31 is preferably housed within an outer bleed tube 34 which, in turn, is in communication with the exhaust manifold 20. The bleed tube also may surround the mixing valve element 33 in fluid tight relation therewith but having thermal-interconnection so as to maintain the tube 31, the gas cut-off valve 32 and the mixing valve element 33 hot enough to prevent condensation of gaseous vapors, especially in the wintertime. The bleed line may terminate at a point of relatively different pressure, such as into the atmosphere directly or into another portion of the exhaust manifold as shown. It is, of course, not essential that a high velocity of exhaust gas proceed through the bleed line in order to maintain the proper temperature. A certain degree of thermal conductance will occur between the exhaust manifold 20 and the bleed line 34 secured thereto.

The mixing valve element 33 may be so constructed as to interfit in the juncture between the air cleaner 17 and the carburetor 11, the air cleaner thus being raised slightly by the height of the mixing valve element 33 as shown. The element 33 has a feed valve such as a rotary sleeve valve 35 shown in Figs. 1 and 3. The gas admitted through valve 35 is thoroughly intermixed with air in the portion of the element 33 which lies beyond the valve 35. Tangential mixing or baffling may be used to effect the mixture of gases, all as it well known in the art and I do not wish to be restricted to any particular type of mixing in the mixing valve element 33.

The valve 35 has an outwardly terminating axial extension to which is secured an adjustable arm 36. The arm 36 is secured for rotatable adjustment by means of screw 37. The arm 36 is slotted at 38 for adjusting, by such means as pivot screw 39; one end of a pivotal link 40 being in turn pivotally attached at 41 to the arm 15 which actuates the conventional valve of the carburetor 11. It will be observed that the same actuation through throttle connection 16 which opens the carburetor valve for acceleration will also open the valve 35 for the same purpose (though fuel can only be supplied through one or the other).

In order to disrupt flow of liquid fuel through line 13, a liquid shut-off valve 42 is provided. After passing through valve 42 the liquid enters float bowl 12. This float bowl is preferably of special construction, having a conventional chamber 43 and a float 44 which maintains a constant level of fuel in the bowl through mechanism not shown. A separate chamber 45 is in fluid communication with the first chamber 43 and a separate float 46 has an extension 47 with an abutment 48 which is adapted to close electrical switch 49 as shown in Fig. 2. The electrical contact is thus accomplished outside of the float chambers to minimize danger of fire.

The circuit diagram for controlling the fuel system is shown separately and diagrammatically in Fig. 2. The conventional battery is shown at 50, one pole being grounded and the other connected through lead 51 and ignition switch 52 to the coil 53. A further lead 54 from low voltage line 51 extends to the relay switch 55 then through lead 56 when solenoid 65 is re-energized. The circuit continues through the float bowl switch 49, through lead 57 and solenoid 58 to ground 59. Solenoid 58 is within the gas cut-off valve 32 of Fig. 1 and serves to open the valve 32 whenever energized, that is, when the ignition switch 52 is closed, when relay switch 55 is in the upper closed position with both switches 62 and 63 open as shown in Fig. 2 and when switch 49 is also closed in response to a lowered predetermined height of fluid in the float bowl. Fuel pump 18 is energized below a predetermined pressure and if ignition switch 52 is on, leads 60 and 61 complete the circuit. A bimetallic switch 62 is responsive to a predetermined temperature of the exhaust manifold 20, remaining closed until the temperature is reached, then opening as shown. A switch 63 is in parallel circuit with switch 62 and is actuated by such means as piston 63a in cylinder 63b which in turn is interposed across the wall of, and responsive to vacuum of the intake manifold 10, the switch 62 opening whenever the engine is running and producing an intake vacuum. Either of the parallel switches when closed will energize the lead 64 and relay coil 65 through ground 59. When coil 65 is energized the switch 55—56 becomes opened and the switch 55—66 is closed, thus energizing the signal such as light 67 and solenoid 68 through ground connection 59. Solenoid 68 is located in liquid shut-off valve 42 and when energized maintains valve 42 open, permitting liquid fuel to be pumped into float bowl 12. Another signal such as light 69 is in parallel with solenoid 58 and is energized whenever gas shut-off valve 32 is opened.

In the operation of my vaporizing system, the ignition 52 is first closed in the normal manner, causing the coil 53 to become conditioned for producing high voltage

spark to the spark plugs of the engine (not shown). The current continues from the low voltage line 51 through the fuel pump 18 which immediately begins to pump gasoline through the fuel supply line 19 and into the float bowl 12 and into the line 22. The pressure is quickly built up and when the predetermined cut-off point is reached, the fuel pump will be de-energized. Before the engine is started, both of the switches 62 and 63 are closed and hence the relay 65 is also energized, maintaining the switch 55—66 in closed condition. The solenoid 68 will thus be energized to maintain the cut-off valve 42 in open condition and permitting liquid fuel to flow into the float bowl 12. The gas cut-off valve 32 remains in closed condition as long as solenoid 58 is not energized. As soon as the engine starts the intake manifold produces a vacuum which will open switch 63. However, since bimetallic switch 62 remains closed until the exhaust manifold reaches a predetermined temperature, the circuit through relay 65 is maintained. Now, however, when the exhaust manifold becomes hot enough to break the switch contact 62, then the current through 65 will be interrupted and the relay switch will spring upwardly into the position shown in Fig. 2. However, since the float bowl switch 49 is normally in open position, the engine will continue running on the liquid fuel which remains in float bowl 12, the de-energized solenoid 68 having shut the liquid valve 42 to prevent further admission of liquid fuel. When the level of liquid fuel in float bowl 12 has dropped sufficiently the abutment 48 on float 46 will cause the float bowl switch 49 to be closed. This will complete the circuit through solenoid 58 which will then open the gas cut-off valve 32 and convert the carburetion system to a gas intermixing exclusively.

It will be noted that if the ignition switch 52 is turned off, or if either the vacuum switch 63 or the bimetallic switch 62 becomes closed, the system will immediately revert to the conventional liquid-type carburetion.

It may thus be seen that I have devised a simple and efficient apparatus for operating an internal combustion engine at extremely high efficiency, yet preserving the proper degree of safety during the operation thereof.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts without departing from the scope of my invention.

What I claim is:

1. A vaporizer system for an internal combustion engine having as conventional elements a source of liquid fuel, a fuel pump capable of maintaining a constant fuel line pressure irrespective of engine speed, a carburetor, a liquid fuel communication between said conventional elements, an intake manifold, an exhaust manifold and a throttle for said carburetor, said vaporizer system comprising, a branch line leading from said fuel pump outlet, a tubular portion in heat transferring relation with the exhaust manifold and in communication with said branch line, a mixing valve connecting in tandem with said carburetor and having a throttle linkage connected therewith, a gas conduit leading from said tubular portion to said mixing valve, a vapor cut-off valve interposed in said conduit for interrupting the flow of gas therethrough, and a liquid cut-off in said liquid fuel communication between said fuel pump and said carburetor whereby said vapor system will be operatively started when the exhaust manifold has reached a predetermined temperature, said supply of liquid fuel to the carburetor then being interrupted.

2. A vaporizer system for an internal combustion engine having as conventional elements a source of liquid fuel, a fuel pump capable of maintaining a constant fuel line pressure irrespective of engine speed, a float bowl, a carburetor, a liquid fuel communication between said conventional elements, an intake manifold, an exhaust manifold and a throttle for said carburetor

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system comprising a branch line leading from said fuel pump outlet, a tubular coil in heat transferring relation with the exhaust manifold and in communication with said branch line, a mixing valve connecting in tandem with said carburetor and having a linkage with said throttle for simultaneous actuation therewith, a gas conduit leading from said tubular coil to said mixing valve, a vapor cut-off valve interposed in said conduit for interrupting the flow of gas therethrough, and a liquid cut-off valve in said liquid fuel communication between said fuel pump and said float bowl responsive to a delay whereby said vapor system will be operatively started when the exhaust manifold has reached a predetermined temperature and when a predetermined length of time has elapsed for interrupting the supply of liquid fuel from said float bowl to the carburetor.

3. A vaporizer system for an internal combustion engine having as conventional elements a source of liquid fuel, a fuel pump capable of maintaining a constant fuel line pressure irrespective of engine speed, a carburetor, a liquid fuel communication between said conventional elements, an intake manifold, an exhaust manifold and a throttle for said carburetor, said vaporizer system comprising a branch line leading from said fuel pump outlet, a tubular coil in heat transferring relation with the exhaust manifold and in communication with said branch line, a mixing valve connecting in tandem with said carburetor and having a linkage with said throttle for simultaneous actuation therewith, a gas conduit leading from said tubular coil to said mixing valve, a conduit communicating between the exhaust manifold and the atmosphere for bleeding a portion of the hot exhaust gases therefrom, said gas conduit being in heat transferring relation with said exhaust manifold conduit for maintaining the gas therewithin at an elevated temperature, a vapor cut-off valve interposed in said gas conduit for interrupting the flow of gas therethrough, and a liquid cut-off valve in said liquid fuel communication between said fuel pump and said carburetor responsive to a time delay whereby said vaporizer system will be operatively started when the exhaust manifold has reached a predetermined temperature and when a predetermined length of time has elapsed, said supply of liquid fuel to the carburetor then being interrupted.

4. The subject matter of claim 1, and a by-pass communicating with the outlet of said fuel pump and having therein a pressure release valve set to permit fluid fuel to be by-passed back to said liquid fuel supply line when a predetermined pressure has been attained in the pressure line leading from the fuel pump outlet which pressure is in excess of the predetermined pressure at which the fuel pump is set to operate.

5. A vaporizer system for an internal combustion engine having as conventional elements a source of liquid fuel, a fuel pump capable of maintaining a constant fuel

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line pressure irrespective of engine speed, a float bowl, a carburetor, a liquid fuel communication between said conventional elements, an intake manifold, an exhaust manifold and a throttle for said carburetor, said vaporizer system comprising a branch line leading from said fuel pump outlet, a tubular coil in heat transferring relation with the exhaust manifold and in communication with said branch line, a mixing valve connecting in tandem with said carburetor and having a linkage with said throttle for simultaneous actuation therewith, a gas conduit leading from said tubular coil to said mixing valve, a vapor cut-off valve interposed in said gas conduit for interrupting the flow of gas therethrough, a liquid cut-off valve in said liquid fuel communication between said carburetor and said fuel pump, an instrumentality for operating said liquid cut-off valve and a float bowl switch for delaying the opening of said vapor cut-off valve whereby said vaporizer system will be operatively started when the exhaust manifold has reached a predetermined temperature and when said float bowl switch has allowed a predetermined length of time to elapse, said supply of liquid fuel to the carburetor then being interrupted.

6. A vaporizer system for an internal combustion engine having as conventional elements a source of pressurized liquid fuel, a carburetor, a liquid fuel line leading from the source of pressurized liquid fuel to the carburetor, and an engine area subject to heat of combustion during operation of the engine, said vaporizer system comprising, a branch line leading from said source of pressurized liquid fuel, a tubular member secured in heat-transferring relation with said engine area subject to heat of combustion for vaporizing liquid fuel supplied thereto, a mixing valve connecting in tandem with said carburetor and having throttle means for actuation thereof, a gas conduit leading from said tubular member to the mixing valve, a vapor cut-off valve interposed in said conduit for interrupting the flow of gas therethrough, a liquid cut-off in said liquid fuel line between the source of fuel and said carburetor, and means in thermal association with the exhaust gases of the engine responsive to heat transfer therefrom to initiate a supply of vaporized fuel to said carburetor and to interrupt the supply of liquid fuel to the carburetor.

7. The subject matter of claim 6, and means responsive to change in gas pressure with stopping of engine operation to interrupt said supply of vaporized fuel to said carburetor and to re-establish the supply of liquid fuel thereto.

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