United States Patent

Johnson

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[54] LIQUID FUEL AND AIR MIXTURE CHARGE FORMING DEVICE

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[52] **U.S. Cl.** **261/129,** 261/142, 261/16, 261/39, 261/43, 123/119

[51] **Int. Cl.** **F02m 9/08,** F02m 13/00, F02m 37/12

[58] **Field of Search** ....261/127, 129, DIG. 51, 39.1, 261/16, 67, 76, 43, 142; 123/119 C; 230/52

[56] **References Cited**

UNITED STATES PATENTS

1,121,137	12/1914	Schoonmaker	123/119 C
1,142,824	6/1915	Lund	261/129
1,147,608	7/1915	Clark	261/DIG. 51
1,897,967	2/1933	Bruckner	261/DIG. 51
2,552,056	5/1951	Orr, Jr.	261/39.1
2,630,102	3/1953	Osburn	230/52 X
2,965,083	12/1960	Percival	123/119 C
3,212,760	10/1965	Hogg, Sr.	261/67 X
3,236,214	2/1966	Johnson	261/16 X
3,373,978	3/1968	Ellis	261/76 X

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[57] **ABSTRACT**

A charge forming device for increasing the combustibility of a volatile fuel including a valve unit for mixing compressed air and fuel. The resultant mixture is conducted along a path including metering valves responsive to a throttle setting. The mixture flow is subjected to heat and then metered through a valve responsive to the temperature of the heated mixture. The resultant metered fuel mixture is then injected into the intake manifold of an internal combustion engine, the latter including an independent parallel path of forced air. A vacuum actuated air compressing pump compresses the air to a preselected pressure and the intake of the pump is connected to the intake manifold. The exhaust of the pump is connected to a compressed air storage tank and the tank includes an exhaust port. A pressure regulator is connected to the exhaust port of the storage tank. An adjustable verturi regulator is inserted between the valve responsive to the temperature of the mixture and one of the metering valves. A second embodiment of the present device includes the aforementioned construction in addition to a conventional carburetor system which furnishes the intake manifold with an independent parallel supply of carbureted fuel. The mixture forming unit in this embodiment includes a two port inlet T-connector. The first inlet port receives fuel and the second inlet port receives compressed air. The outlet port of the T-connector delivers the mixture to the metering valves.

7 Claims, 6 Drawing Figures

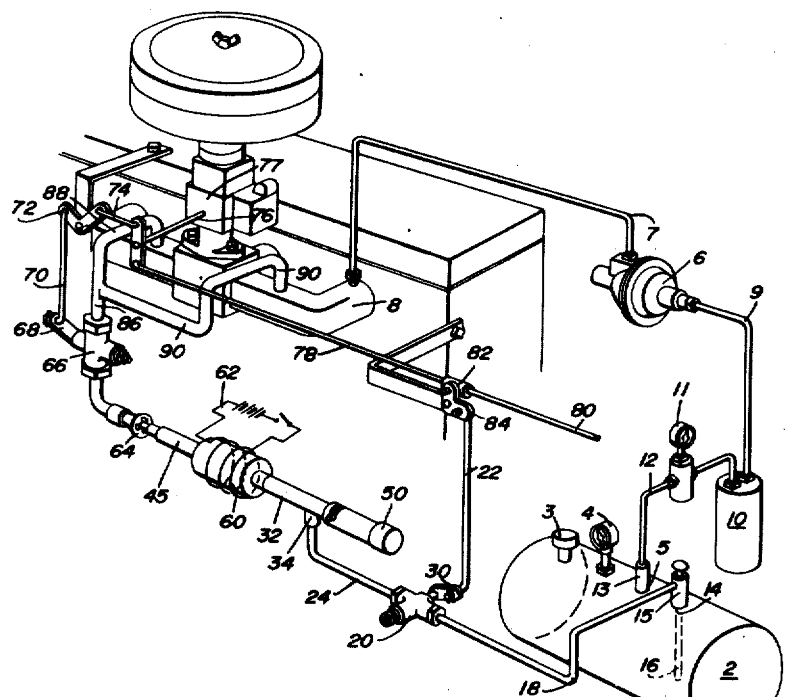

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Fig. 1

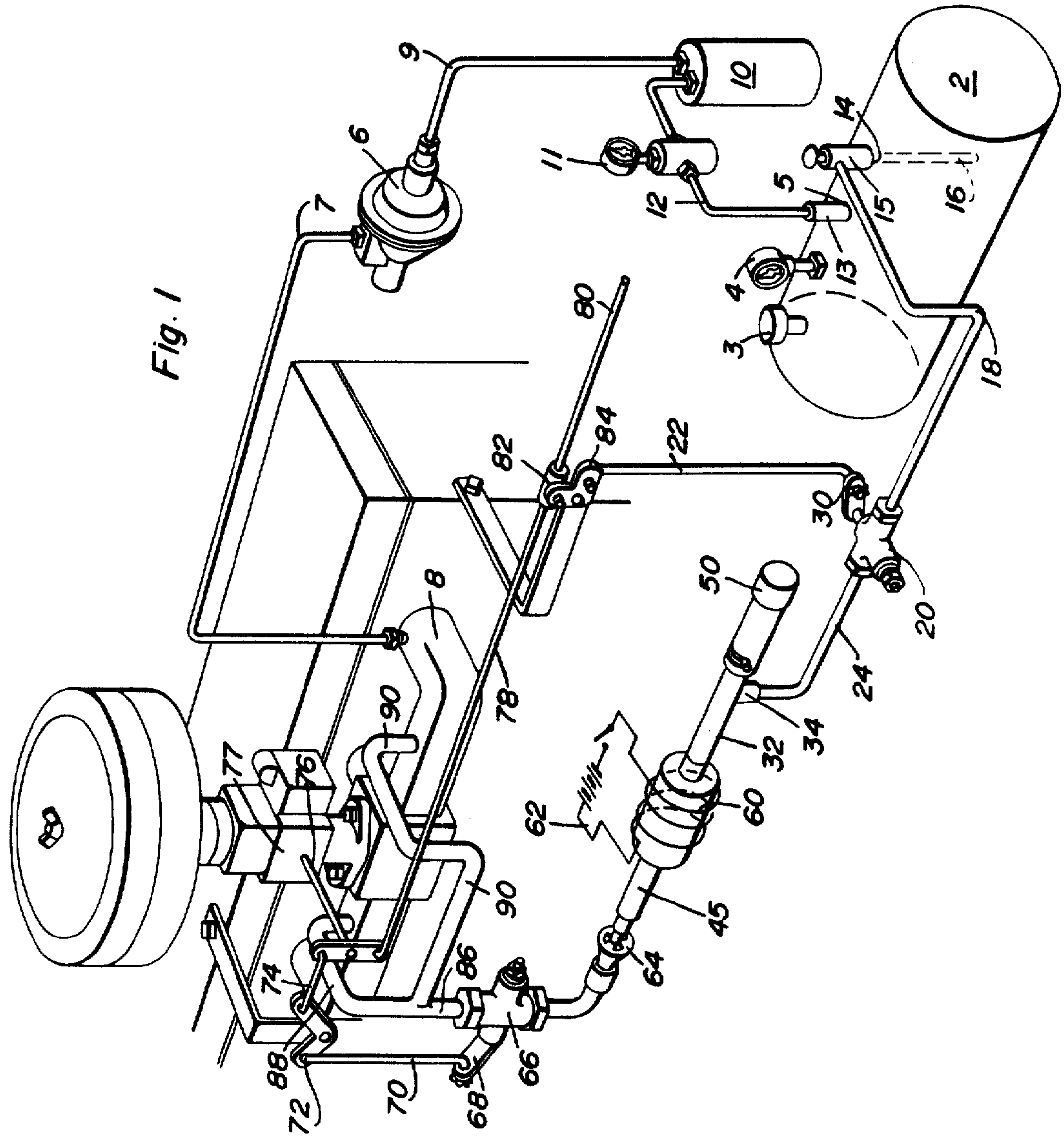
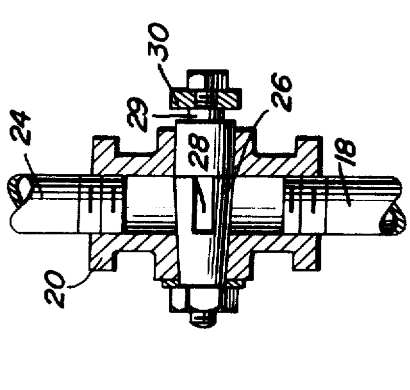


Fig. 3



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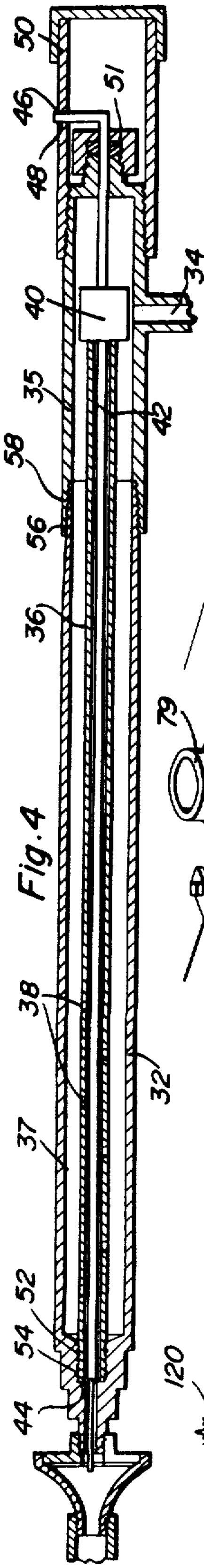

Fig. 4

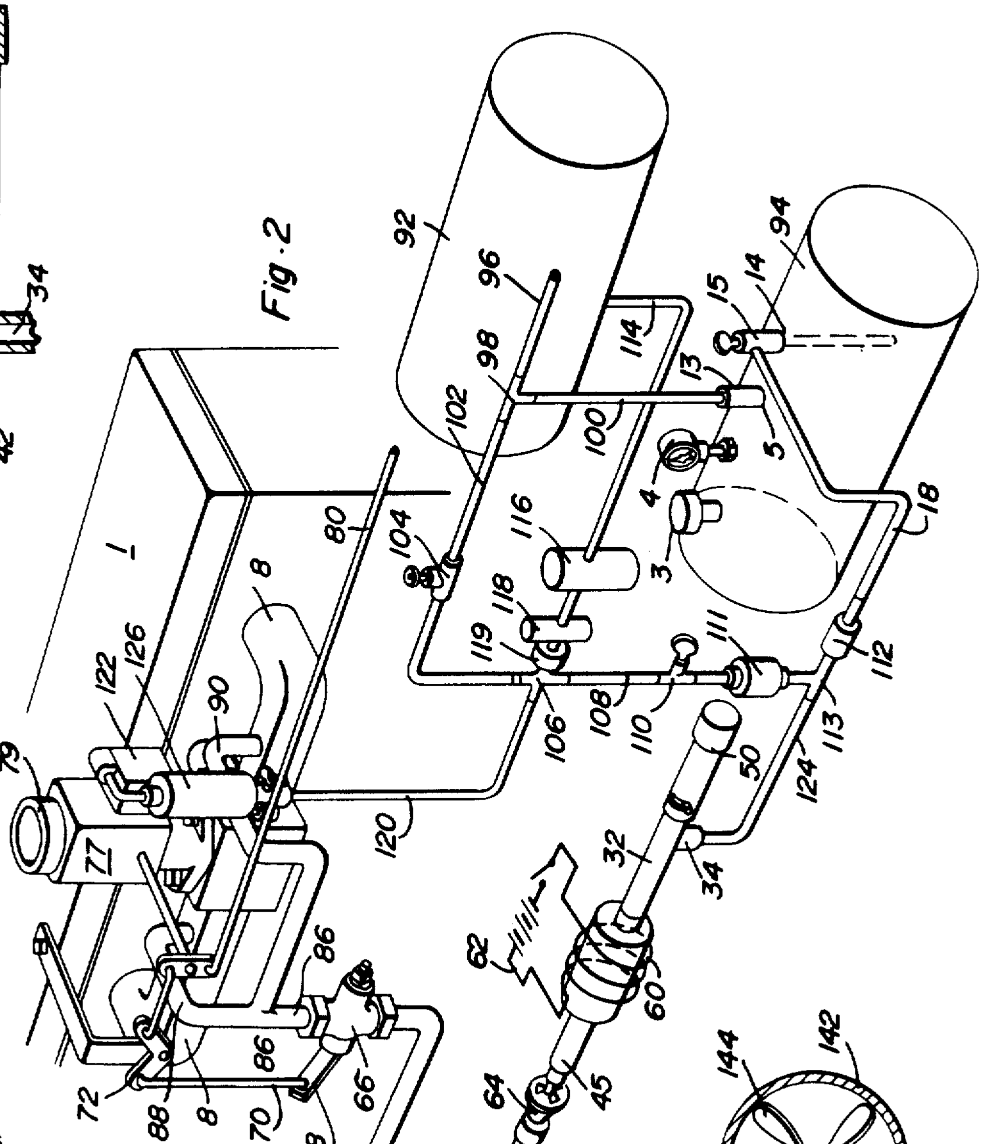

Fig. 2

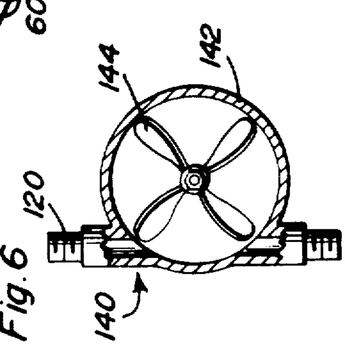

Fig. 6

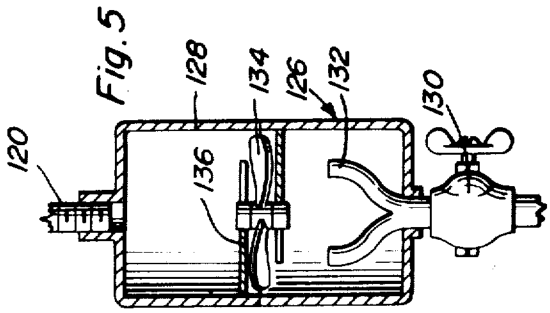

Fig. 5

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LIQUID FUEL AND AIR MIXTURE CHARGE FORMING DEVICE

The present invention relates to the field of internal combustion engine charge forming devices and more particularly to such a device operating upon a heated fuel-air mixture. The prior devices form a liquid fuel mixture which is incapable of being fully combusted by a conventional internal combustion engine. As a result of incomplete combustion, fumes are generated and discharged into the atmosphere which cause the pollution thereof. In addition, incomplete combustion lowers the fuel burning efficiency that an internal combustion engine would be capable of if complete combustion could be obtained.

In brief summary of the invention, air is compressed and is mixed with a fuel. The resultant fuel is metered by a flow control valve which delivers the metered mixture to a thermostat control valve, the latter being subjected together with the mixture passing therethrough to the heat of a heating element. The heated mixture is metered by the thermostat control valve which passes the resultant flow through a venturi regulator causing the addition of air to the conducted heated mixture. Outflow from the venturi regulator is fed through a flow control valve which responds to a throttle setting, and is subsequently fed into the intake manifold of an engine. An independent flow of air passes through a throttle valve and is deposited within the intake manifold thereby subjecting the heated mixture to an additional source of air. In an alternate embodiment of the invention, the aforementioned structure is utilized in addition to a conventional carburetor system which adds carbureted fuel to the mixture deposited within the intake manifold. The present method and apparatus for charge forming results in a more thoroughly combustible charge which develops fewer polluting hydrocarbon fumes than generated by prior devices. Accordingly, among the more salient objects of the present invention is to provide:

- a charge forming device which thoroughly aerates a fuel prior to delivery to an intake manifold;
- a charge forming device which preheats a fuel-air mixture prior to ignition;
- a charge forming device for an internal combustion engine which decreases the quantity of polluting hydrocarbon fumes produced from the combustion thereof;
- a device for increasing the miles per gallon ratio obtainable by an internal combustion engine.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals referred to like parts throughout, and in which:

FIG. 1 is a group perspective view of the present charge forming device in which the carburetor controls inlet of air only.

FIG. 2 is a group perspective view of the charge forming device when combined with a conventional carburetor.

FIG. 3 is a longitudinal sectional view of a flow control valve.

FIG. 4 is a longitudinal sectional view of a thermostat control valve.

FIG. 5 is a sectional view of a fuel thrust device incorporated into the fuel line.

FIG. 6 is a sectional view similar to FIG. 5 showing another embodiment of the fuel thrust device.

Referring specifically to FIG. 1 of the drawings, one embodiment of the invention is illustrated in FIG. 1 in conjunction with an internal combustion engine diagrammatically illustrated and denoted by reference numeral 1. A storage tank 2 is provided with a filler cap 3 and a pressure gauge 4 located within an upward tank wall portion. An inlet port 5 is also formed within an upward tank wall portion and receives compressed air as presently explained. A vacuum actuated air compressor pump 6 is driven by communication with the vacuum source in the intake manifold 8 through pipe section 7. The output of the pump 6 is connected to a pipe section 9 terminating in the inlet port of a compressed air tank 10. The outlet port of the tank is connected to a pressure regulator and gauge unit 11, the latter unit controlling the passage of compressed air from the tank through a pipe section 12. The opposite end of this pipe section terminates in the inlet port 5 of the tank 2 through a check valve 13 which prevents a backflow of material from the tank into the pipe section 12. An outlet port 14 is formed within the tank 2 for receiving a fuel outlet and air pressure control valve unit 15. This latter unit includes a feed pipe 16 immersed within the fuel contained in tank 2. This valve unit is constructed to mix fuel contained within the bottom of the tank and compressed air residing on the top of the tank in proportions governable by a valve adjustment. The fuel-air mixture formed in the valve unit 15 is delivered through a pipe section 18 to a flow control valve 20 which meters the mixture passing therethrough and delivers the same through a pipe section 24 to a thermostatic metering device explained hereinafter.

FIG. 3 of the drawings illustrates the component parts of the aforementioned flow control valve 20. A throttle linkage 22 shown in FIG. 1 effects the rotational displacement of an internal valve member 26. The latter member includes an apertured passageway 28 therethrough, the orientation of which controls the flow of liquid through the valve 20. Rotation of the interior valve member 26 is effectuated by the rotation of an integrally connected stem portion 29 appending from the valve 20 and connected to a linkage member 30, the latter being pivotally controlled by the throttle linkage 22.

Referring back to FIG. 1 of the drawings, pipe section 24 delivering the mixture from the flow control valve 20 terminates at the opposite end thereof in the fuel inlet 34 of a thermostat control valve 32.

The structure of the thermostat control valve 32 is shown in FIG. 4 of the drawings. The valve is divided into three principal sections: a T-connector 35 including the fuel inlet 34; an apertured tubular section 36 which fits concentrically within a sleeve 37, the inward end of the sleeve being connected with the T-connector 35; and a needle valve assembly 42 for controlling the flow through the valve. The tubular section 36 includes apertures 38 formed within the cylindrical wall thereof, these apertures being longitudinally aligned. A thermostat valve member 40 is inserted within the tubular section 36 and serves to regulate the flow of fuel through the inlet 34. The needle valve assembly 42 is disposed inwardly and concentrically with the sleeve and tubular sections. The outward end of the needle valve assembly protrudes from the outward end of the sleeve 37 thereby forming an orifice 44. In order to control the position of the needle valve which in effect governs the opening of the orifice 44, a pin 46 is attached to the opposite end of the needle valve and perpendicular thereto. A groove 48 is provided within a knob assembly 50, the groove being positioned over the pin 46 thereby permitting a rotation of the needle valve 42 as desired. The outward end of the T-connector 35 is disposed concentrically within the knob assembly 50. In order to prevent leakage of fuel out of the T-connector, a packing assembly 51 is disposed in a sealing relation to the outward end of the T-connector. The tubular section 36 is maintained within the sleeve 37 by means of a threaded section 52 on the tubular section which is engaged by a mating threaded section 54 within the interior outward end portion of the sleeve. In a similar manner, the sleeve 37 is maintained in concentric relation with the T-connector by means of a threaded end portion 56 on the inward end of the sleeve 37 and a mating interior thread section 58 on the T-connector.

Referring to FIG. 1 it is seen that a cylindrical coil heating device 60 is disposed concentrically about the thermostat control valve 33. This heating device is energized by a battery, generator or alternator source 62. The heating device causes a temperature rise of the fuel-air mixture passing through the thermostat control valve which regulates the flow of mixture into the fuel inlet in accordance with the temperature of the heated mixture contained therein. It is appreciated that a number of thermostat control valves may be used in a parallel connection thereby permitting a greater flow of mixture therethrough. The heated flow delivered from the thermostat control valve is received by a venturi regulator **64**, of the type used on conventional kitchen gas ranges. This regulator adds air to the fuel-air mixture in accordance with the rate of flow therethrough. The regulator conducts the flow of mixture to a flow control valve **66** which is variably settable in response to a throttle connection **68**, the latter being driven by a throttle linkage **70**, the opposite end of which is attached to a bell crank **72**. The bell crank is actuated by a throttle linkage member **74** linked to a butterfly valve rod **76** fastened at one end thereof to the linkage member **74**. The opposite end of the rod **76** is disposed within a throttle valve assembly **77** which includes a butterfly valve similar to those utilized in conventional carburetors. The linkage member **74** is itself actuated by a horizontally disposed rod **78** at one end thereof. The opposite end **80** of this rod is connected to an engine accelerator. An adjustment of the throttle valve assembly **77** varies the rate of air flow through the valve assembly from an atmospherically exposed barrel **79** which is protected by a conventional air cleaner, at the upper end thereof. The opposite end of the valve assembly opens into the intake manifold **8**. Accordingly, the vacuum created within the intake manifold causes a flow of air through the throttle valve assembly **77** in accordance with the restriction created by the butterfly valve positioned therein. Thus, it is appreciated that an independent source of airflow is provided for the intake manifold through the throttle valve assembly **77**. An intermediate length of the accelerator rod **78** is fixedly attached to a bell crank **82** at one end thereof. The opposite end **84** of the bell crank is connected to the throttle linkage **22** which controls the first-mentioned flow control valve metering mixture flow to the thermostat control valve as explained hereinbefore. Accordingly, the linear displacement of the accelerator rod **78** simultaneously affects the setting of both control valves **20** and **66** and throttle valve **77**. The outflow from the second control valve **66** is delivered through pipe section **86** into two parallel pipe sections **88** and **90**, each pipe section delivering the flow of heated mixture therethrough into one branch of a conventional intake manifold. Accordingly, the intake manifold of the internal combustion engine **1** receives a source of heated liquid-air mixture through the heated metering apparatus explained hereinbefore as well as receiving an independent flow of air through the throttle valve assembly **77**. The resultant mixture which is deposited within the intake manifold is conditioned by virtue of the preceding apparatus without the aid of a carburetor to increase the combustibility of fuel intake.

A second embodiment of the present invention utilizes the heating and metering system substantially as explained hereinbefore and in addition employs a conventional carburetor assembly for supplying an intake manifold with an additional mixture supply. Referring to FIG. **2** of the drawings, a conventional fuel tank **92** provides a source of fuel to the internal combustion engine. A second tank **94** includes compressed air which is delivered through a pipe section **96**, the latter receiving compressed air from a source such as the vacuum actuated air compressor pump **6** of the previous embodiment. A T-connection **98** is provided along an intermediate length of the pipe section **96** whereby a portion of the compressed air supplied thereto is diverted through pipe section **100** to the compressed air tank **94** proper. The remaining compressed air flowing through the T-connector **98** is conducted along a pipe section **102** to a pressure regulator **104**, the output of which is delivered to a four-way T-connector **106**. This latter T-connector includes three outlet ports, the first being connected to a pipe section **108** which conducts compressed air through a manual valve **110** and a check valve **111** to another T-connector **113**. This latter mentioned T-connector receives two input flows and delivers one output flow as explained presently. The first input flow derived through pipe section **108** includes a liquid-air mixture delivered through one outlet of the T-connector **106**. The latter mentioned T-connector receives one flow of compressed air from the pressure regulator **104** and receives a second flow of fuel from the fuel tank **92** through a serial path including a fuel pump **116**, fuel filter **118**, and check valve **119**. A pipe section **114** conducts the fuel supply through this serial path and delivers the resultant flow to the T-connector **106**. Accordingly, the T-connector **106** accomplishes a mixing of fuel and air. The T-connector **113** which subsequently receives this fuel-air mixture also receives a source of compressed air from the compressed air tank **94** through a check valve **112**. The four way connector **106** mentioned hereinbefore includes a path from the fuel intake line **114** to the pipe section **120**, the opposite end thereof terminating within a conventional carburetor fuel intake port **122**. The outflow from the T-connector **113** directs the fuel-air mixture flowing therethrough to a pipe section **124** which delivers the mixture to the metered fuel inlet **34** of the thermostat control valve **32** wherein the mixture is heated as explained in connection with the first embodiment hereinbefore. The flow of heated fuel-air mixture from the thermostat control valve to the intake manifold is also identical to that of the first embodiment. Accordingly, it is appreciated that the second embodiment of the invention includes two independent fuel-air supplies. The first delivered through a conventional carburetor into an intake manifold and the second delivered through a heated metering system substantially as explained in connection with the first embodiment.

It is appreciated that the fuel-air mixture produced in the second embodiment may be derived from a single storage tank unit **2** as utilized in the first embodiment.

The fuel line **120** includes a fuel thrust device **126** disposed adjacent the inlet fitting or float blow **122** of the carburetor. FIG. **5** illustrates the structure thereof which includes a housing or casing **128** installed in line **120**. The inlet end of the housing **128** includes a valve **130** and a pair of spaced nozzles **132** which discharge fuel therefrom so that it impinges upon and thus rotates a multi-bladed rotor **134** supported by radial arms **136** for rotation about an axis concentric with the center of the housing.

FIG. **6** illustrates another embodiment of the thrust device **140** in which the fuel line **120** is tangential to a cylindrical disk-like housing **142** and the tips of a multi-bladed rotor **144** that is rotatable about an axis perpendicular to the path of movement of the fuel in fuel line **120**.

In each embodiment, the fuel or fuel and air is atomized thus providing more efficient performance to the engine either with or without the heater arrangement.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A charge forming device for utilization in an internal combustion engine comprising means for storing fuel, means for compressing air to a preselected pressure, means for mixing said fuel and said compressed air to form a mixture, means for conducting said mixture from said mixing means to an intake manifold of said internal combustion engine along a path including a plurality of means for selectively metering said mixture, means for heating said mixture along said conducting means, means for injecting said mixture into said intake manifold, and means for adding a selectively variable and independent source of air to said manifold, said plurality of means for selectively metering said mixture along said conducting means including a series connection of a first flow control valve means responsive to a throttle setting, a second flow control valve means responsive to the temperature of said mixture flowing therethrough, said second valve metering the outflow of mixture from said first valve means, and a third flow control valve means responsive to said throttle setting, said third valve metering the outflow of said second valve.

2. The apparatus of claim 1 together with a carburetor for supplying said intake manifold with a separate supply of carbureted fuel.

3. The apparatus of claim 1 wherein said means for mixing a portion of said fuel and said compressed air to form a mixture includes a two port inlet T-connector, the first said inlet port receiving fuel, the second said inlet port receiving compressed air, the outlet port of said connector delivering said mixture to said plurality of said means for selectively metering said mixture along said conducting means.

4. A charge forming device for utilization in an internal combustion engine comprising means for storing fuel, means for compressing air to a preselected pressure, means for mixing said fuel and said compressed air to form a mixture, means for conducting said mixture from said mixing means to an intake manifold of said internal combustion engine along a path including a plurality of means for selectively metering said mixture, means for heating said mixture along said conducting means, means for injecting said mixture into said intake manifold, and means for adding a selectively variable and independent source of air to said manifold, said means for compressing air to a preselected pressure including a vacuum actuated air compressing pump, the intake of said pump being connected to said intake manifold, the exhaust of said pump being connected to a compressed air storage tank, the latter including an exhaust port, and means for regulating the pressure of said compressed air exiting from said exhaust port, said plurality of means for selectively metering said mixture along said conducting means including a series connection of a first flow control valve means responsive to a throttle settling a second flow control valve means responsive to the temperature of said mixture flowing therethrough, said second valve metering the outflow of mixture from said first valve means, and a third flow control valve means responsive to said throttle setting, said third valve metering the outflow of said second valve.

5. The apparatus of claim 4 wherein said means for heating said mixture includes a heating member for raising the temperature of the mixture entering said second valve.

6. The apparatus of claim 5 together with an adjustable venturi regulator serially inserted between said second and said third valves for selectively adding air to the mixture flowing therethrough.

7. The apparatus of claim 6 wherein said means for compressing air includes a storage tank for storing said compressed air, said tank serially inserted between said vacuum actuated pump and said means for mixing a portion of said fuel and said compressed air.

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