A Practical Guide to 'Free Energy' Devices

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US Patent 5,782,225 21st July 1998 Inventor: Allen Caggiano

VAPORISATION SYSTEM

ABSTRACT

A fluid vaporisation system comprising a first fluid inlet for receiving a first fluid, a second fluid inlet for receiving a second fluid, and a first discharge aperture for discharging the first fluid and the second fluid. A first connecting passage connects the first fluid inlet and the second fluid inlet in fluid communication with the first discharge aperture, mixes the first fluid and the second fluid to define a fluid mixture, and delivers the fluid mixture to the first discharge aperture. A third fluid inlet receives a third fluid and a second discharge aperture discharges the third fluid. A second connecting passage in heat transfer relationship with the first connecting passage connects the third fluid inlet in fluid communication with the second discharge aperture and delivers the third fluid from the third fluid inlet to the second discharge aperture to effect heat transfer from the third fluid to the fluid mixture such that the fluid mixture is discharged by the first discharge aperture in a vaporised state.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to a fluid vaporisation system and, more particularly, to a fluid vaporisation system which heats a mixture of fluids and delivers the mixture in a vaporised state. The fluid vaporisation system is particularly well adapted for heating a mixture of air and liquid fuel and delivering it to an internal combustion engine as a vapour.

2. Background of the Invention

In an effort to reduce pollution and conserve resources, continual efforts are being made to improve the performance of internal combustion engines, particularly in cars and other motor vehicles. Motor vehicle engines must operate as efficiently as possible while simultaneously minimising emissions and providing sufficient power. Toward these goals, it has been sought to provide the most efficient and complete combustion of the fuel/air mixture consumed by the engine. In order to improve combustion of the fuel/air mixture, one approach has been to heat the fuel/air mixture to a vapour state before the fuel enters the engine. However, this and other attempts to achieve improved engine performance and reduced emissions by vaporising the fuel/air mixture have suffered from a number of shortcomings.

Some attempts have suffered from an inability to sufficiently control the amount of vaporised fuel produced under all engine load conditions, especially under full load conditions. Other attempts have suffered from premature detonation of the vaporised fuel prior to reaching the engine and excessive accumulation of vaporised fuel outside of the engine causing safety concerns. Yet other attempts have suffered from the inability to produce sufficient vaporised fuel under engine loads greater than an idle condition.

Accordingly, an improved fluid vaporisation system is desired that provides a more optimal and effective fuel/air mixture to an engine and is capable of supplying a fuel/air mixture in a vaporised state such that fuel efficiency is increased while emissions and safety concerns are decreased.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a highly efficient fluid vaporisation system which employs a dual cross-counterflow heat exchanger to provide a fuel/air vapour mixture to an internal combustion engine to increase the fuel efficiency and decrease emissions.

It is another object of the present invention to provide a fluid vaporisation system for an internal combustion engine in which air flow, fuel flow, and coolant or exhaust gas flow are all independently controllable such that a fuel/air mixture flowing through the system is fully vaporised under all engine load conditions.

It is yet another object of the present invention to provide a fluid vaporisation system comprising a vaporising unit which is easily fabricated, assembled and disassembled to reduce manufacturing costs and facilitate field repairs.

It is a further object of the invention to provide a fluid vaporisation system which can precisely control the amount of fuel/air mixture introduced into the vaporising unit to adequately power an engine under any load condition.

It is a further object of the present invention to provide a fluid vaporisation system which can precisely control the flow of a fuel/air mixture within the system and allow for expansion of the heated fuel/air mixture therein.

It is a further object of the present invention to provide a fluid vaporisation system which can be utilised in both carburetted and fuel injected engines.

It is yet a further object of the present invention to provide a fluid vaporisation system with numerous safety features that eliminate the risks of predetonation and excessive fuel vapour accumulation.

The foregoing and other objects of the present invention are carried out by a fluid vaporisation system including a first fluid inlet for receiving a first fluid, a second fluid inlet for receiving a second fluid, and a first discharge aperture for discharging the first and second fluids. A first connecting passage connects the first fluid inlet and the second fluid inlet in fluid communication with the first discharge aperture, mixes the first fluid and the second fluid to form a fluid mixture, and delivers the fluid mixture to the first discharge aperture. A third fluid inlet receives a third fluid and a second discharge aperture discharges the third fluid. A second connecting passage in heat transfer relationship with the first connecting passage connects the third fluid inlet in fluid communication with the second discharge aperture and delivers the third fluid from the third fluid inlet to the second discharge aperture to effect heat transfer from the third fluid to the fluid mixture such that the fluid mixture is discharged by the first discharge aperture in a vaporised state.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing summary, as well as the following detailed description of the preferred embodiment of the invention, will be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there is shown in the drawings an embodiment which is presently preferred. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:

Fig.1 is a perspective view of a vaporising unit employed in a fluid vaporisation system according to an embodiment of the present invention;

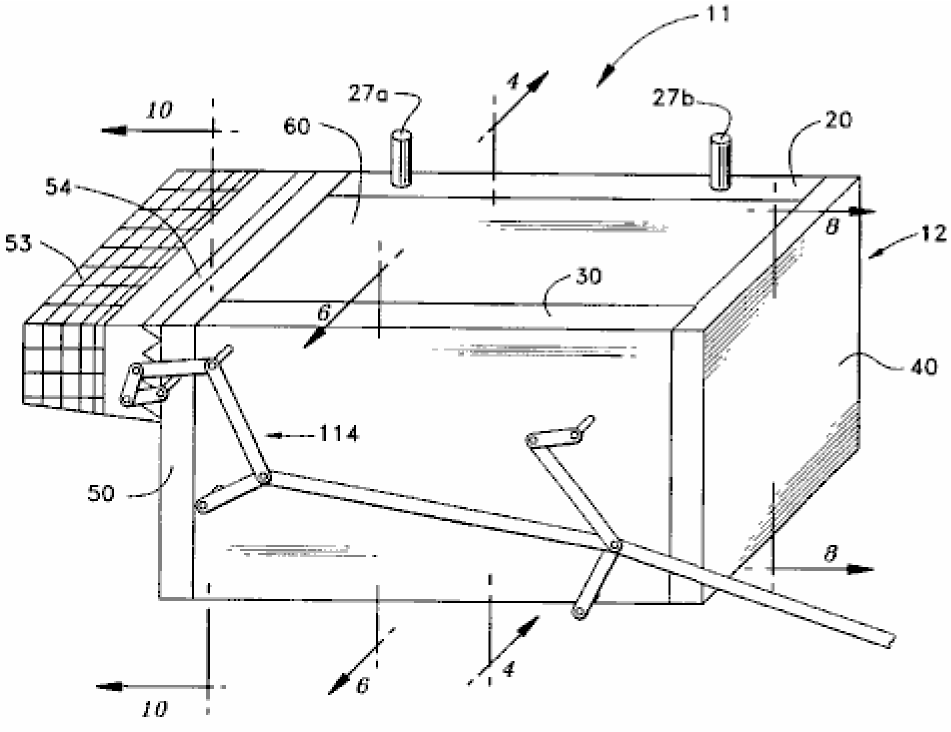

FIG. 1

Fig.2 is a perspective view of the vaporising unit of Fig.1 with the front outer plate assembly removed;

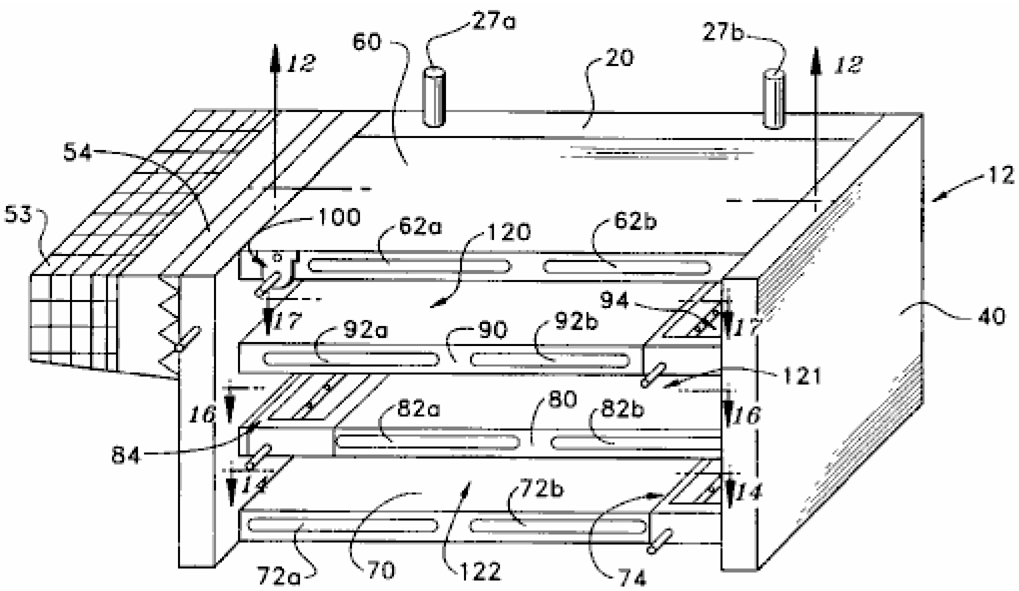

FIG. 2

Fig.3a is a block diagram showing the fuel circuit of the vaporising system

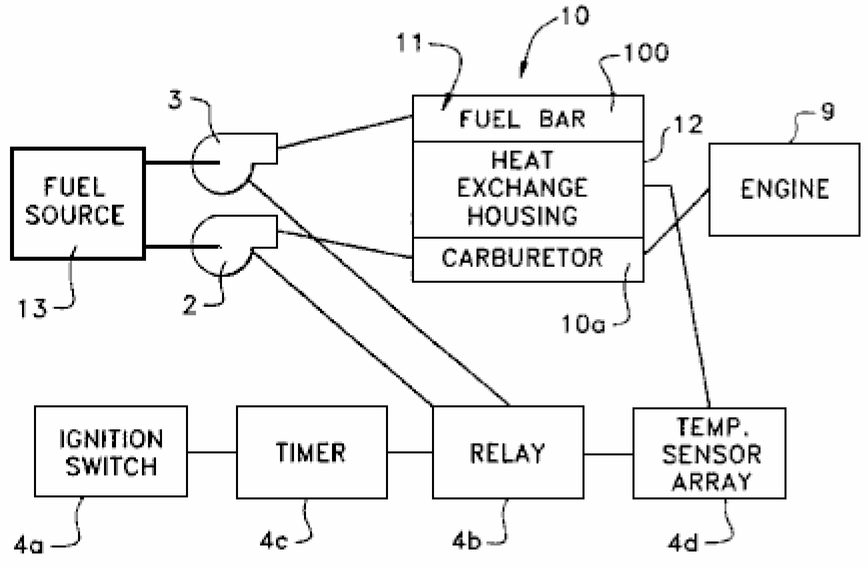

FIG. 3a

Fig.3b is a block diagram showing the hydraulic coolant circuit of the fluid vaporisation system

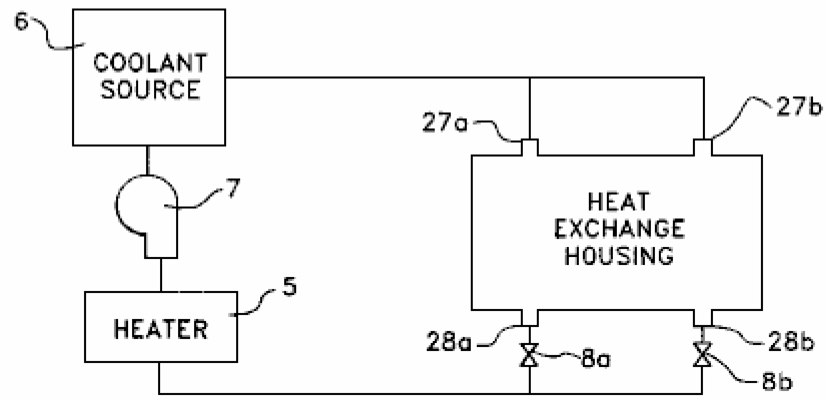

FIG. 3b

Fig.4 is a cross-sectional view of the back outer plate assembly, taken along line IV--IV of Fig.1.
Fig.5 is a cross-sectional view of the back outer plate assembly, taken along line V--V of Fig.4

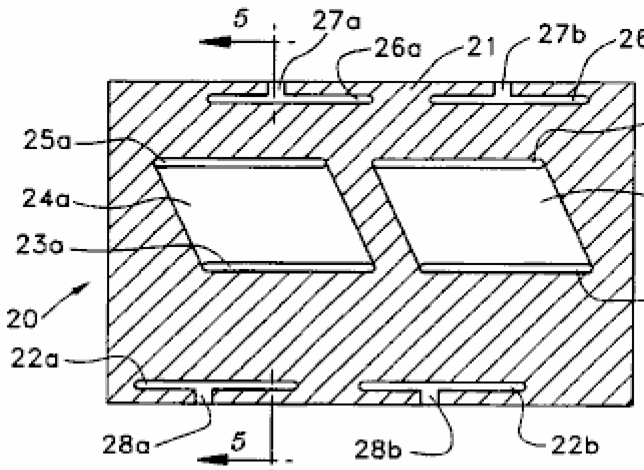

FIG. 4

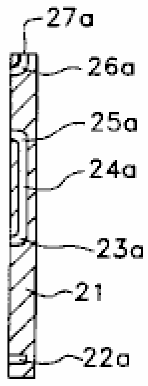

FIG. 5

Fig.6 is a cross-sectional view of the front outer plate assembly, taken along line VI--VI of Fig.1
Fig.7 is a cross-sectional view of the front outer plate assembly, taken along line VII--VII of Fig.6

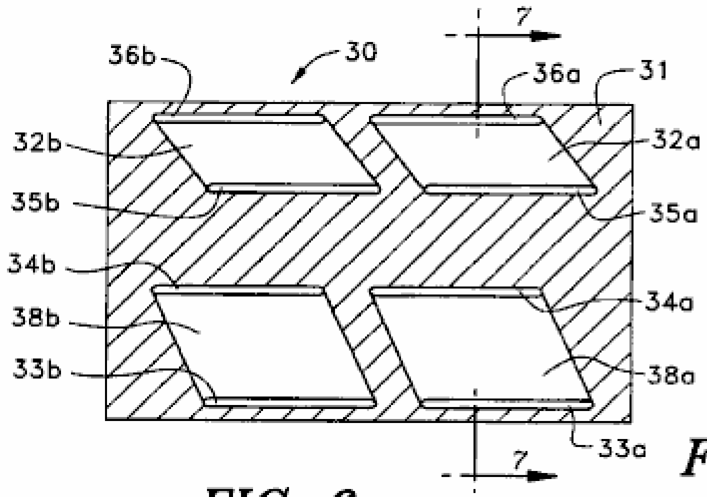

FIG. 6

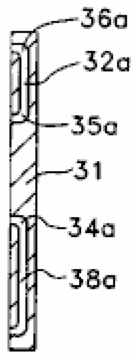

FIG. 7

Fig.8 is a cross-sectional view of the right side outer plate assembly, taken along line VIII--VIII of Fig.1
Fig.9 is a cross-sectional view of the right side outer plate assembly, taken along line IX--IX of Fig.8

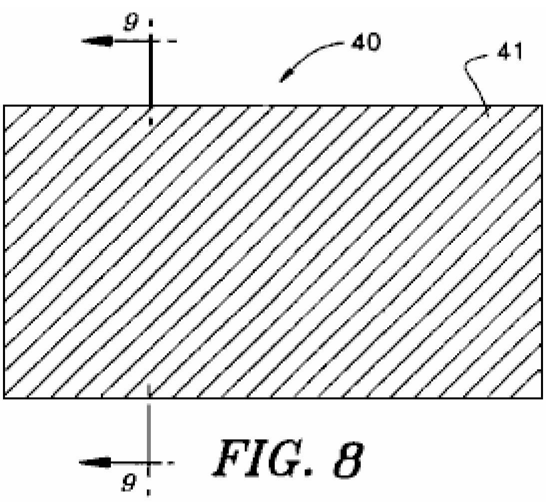

FIG. 8

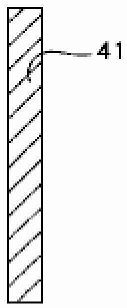

FIG. 9

Fig.10 is a cross-sectional view of the left side outer plate assembly, taken along line X--X of Fig.1
Fig.11 is a cross-sectional view of the left side outer plate assembly, taken along line XI--XI of Fig.10

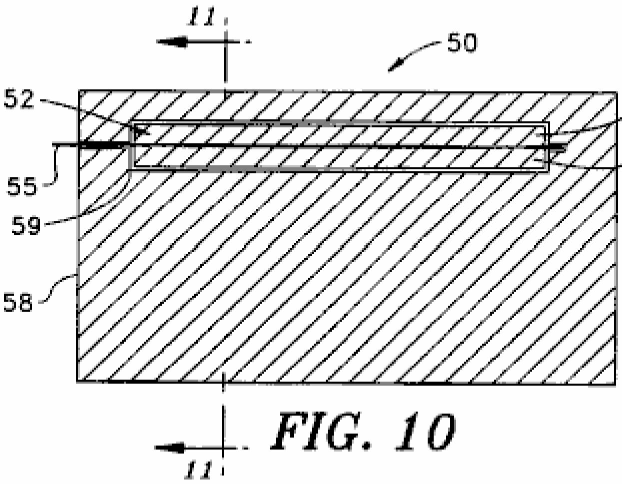

FIG. 10

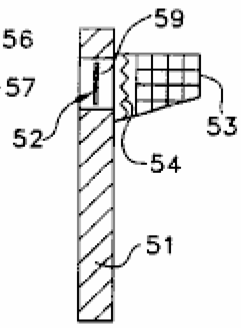

FIG. 11

Fig.12 is a cross-sectional view of the upper outer plate assembly, taken along line XII--XII of Fig.2
Fig.13 is a cross-sectional view of the upper outer plate assembly, taken along line XIII--XIII of Fig.12

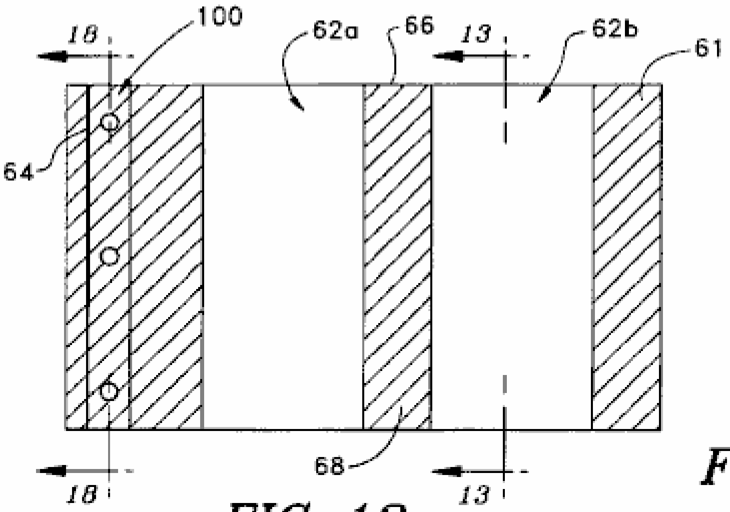

FIG. 12

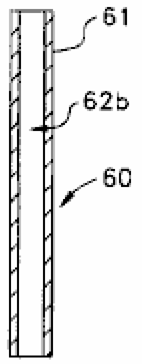

FIG. 13

Fig.14 is a cross-sectional view of the lower outer plate assembly, taken along line XIV--XIV of Fig.2
Fig.15 is a cross-sectional view of the lower outer plate assembly, taken along line XV--XV of Fig.14

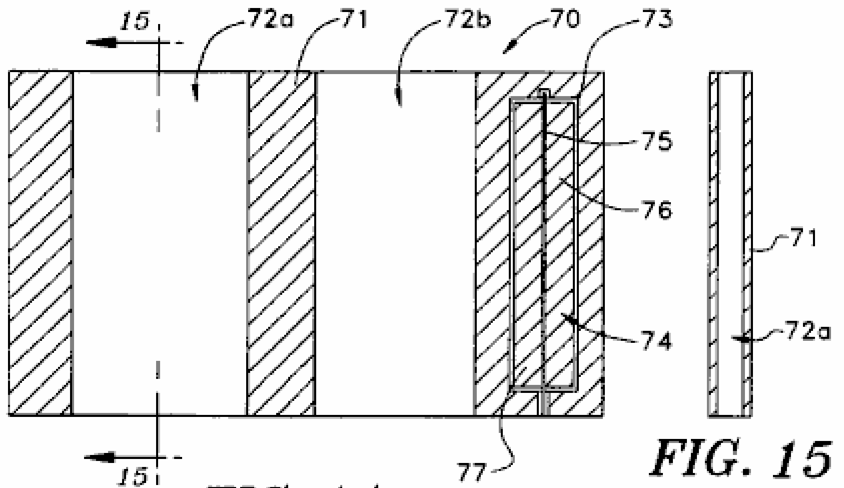

FIG. 14

FIG. 15

Fig.16 is a cross-sectional view of the lower inner plate assembly, taken along line XVI--XVI of Fig.2

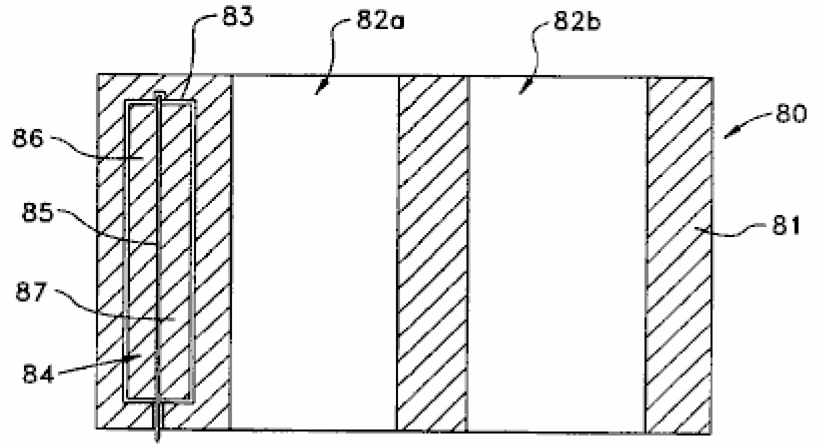

FIG. 16

Fig.17 is a cross-sectional view of the upper inner plate assembly, taken along line XVII--XVII of Fig.2

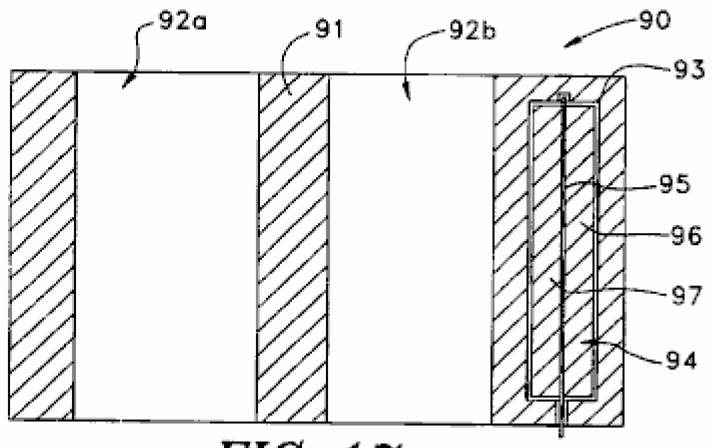

FIG. 17

Fig.18 is a cross-sectional view of the fuel bar assembly, taken along line XVIII--XVIII of Fig.12

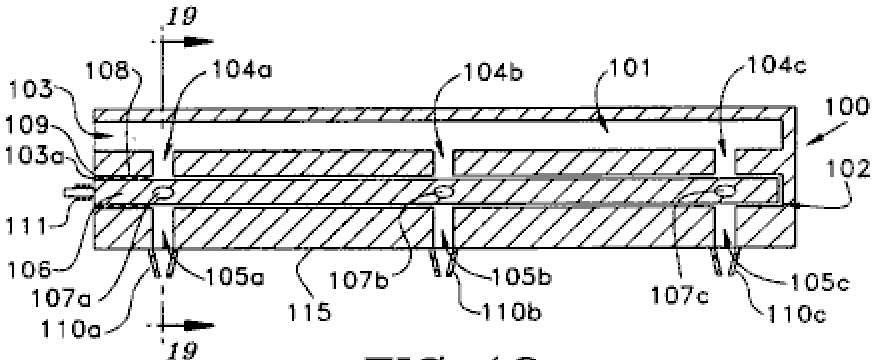

FIG. 18

Fig.19 is a cross-sectional view of the fuel bar assembly, taken along line XIX--XIX of Fig.18

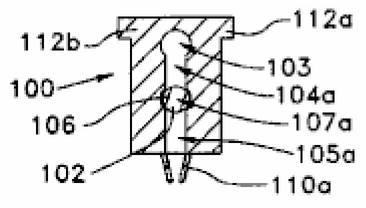

FIG. 19

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment of the vaporising system according to the present invention is described below with a specific application to an internal combustion engine, where the mixture of fluids is, for example, a mixture of air and liquid fuel which is heated and delivered by the fluid vaporisation system to the internal combustion engine in a vaporised state. However, it will be understood by those of ordinary skill in the art that the present invention is also suitable for other applications requiring the input of fluids in a vaporised state, such as, for example, heating oil fuel processors, air conditioning systems, refrigeration systems and ice storage tanks. It will further be understood that the fluids could be one or more types of liquids or a combination of one or more types of liquids and gases.

Certain terminology is used in the following description for convenience only and is not intended to be limiting. The words right, left, rear, front, upper, lower, inner and outer designate directions in the drawing to which reference is made. Such terminology includes the words above specifically mentioned and words of similar import.

Referring now to the drawings in detail, wherein like reference numerals are used to designate identical or corresponding parts throughout all of the views, **Fig.3a** and **Fig.3b** show a fluid vaporisation system, generally designated **10**, according to an embodiment of the present invention. The fluid vaporisation system **10** is applied in connection with an internal combustion engine and comprises a vaporising unit **11** connected to the carburettor **10a** of an engine **9**. In the present embodiment, the mixture of fluids comprises, for example, a mixture of a liquid fuel, such as hydrocarbon fuel, and air.

As shown in **Fig.1** and **Fig.2**, the vaporising unit **11** comprises a heat exchange housing **12** and a fuel bar assembly **100** for controlling the amount of fuel entering the vaporising unit **11** as further described below. The heat exchange housing **12** is preferably formed of plated, die cast, or extruded aluminium, and is sufficiently sealed such that the air and fuel being mixed and vaporised within the housing do not escape from it. It is understood that the fluid vaporisation system of the present invention could be manufactured from other materials such as iron, copper, stainless steel, or highly thermally conductive polymers depending on the application. The heat exchange housing **12** includes a rear outer plate assembly **20**, a front outer plate assembly **30**, a right side outer plate assembly **40**, a left side outer plate assembly **50**, an upper outer plate assembly **60**, a lower outer plate assembly **70**, a lower inner plate assembly **80**, and an upper inner plate assembly **90**. The plate assemblies **60** and **70** comprise upper and lower plates **61** and **71**, respectively, and the plate assemblies **20**, **30**, **40** and **50** comprise side plates **21**, **31**, **41** and **51**, respectively, connecting the upper plate **61** and the lower plate **71** in spaced relation so as to define an airtight sealed chamber. The plate assemblies **80** and **90** comprise intermediate plates **81** and **91** disposed within the sealed chamber and connected to the side plates **40** and **50**. As shown in **Fig.1**, vaporising unit **11** is linked to a conventional progressive linkage **114** which controls the operation of the fuel bar assembly **100** as further described below.

As best shown in **Fig.4** and **Fig.5**, the side plate or rear outer plate **21** of the rear outer plate assembly **20** includes a left inlet **28a**, a right inlet **28b**, a left discharge outlet **27a**, and a right discharge outlet **27b**. The left and right inlets **28a** and **28b** open out from the bottom wall of the plate **21**, and the left and right outlets **27a** and **27b** open out from the top wall of the plate **21**. The left inlet **28a** connects to a left lower channel **22a**, and the right inlet **28b** connects to a right lower channel **22b**. The left lower channel **22a** and the right lower channel **22b** have openings in the inner wall of the plate **21**. The left discharge outlet **27a** connects to the left upper channel **26a** and the right discharge outlet **27b** connects to a right upper channel **26b**. Left upper channel **26a** and right upper channel **26b** have openings in the inner wall of plate **21**. Plate **21** also includes a left medial cavity **24a** and a right medial cavity **24b** positioned at an intermediate portion of the plate **21**. The left medial cavity **24a** connects with a left upper medial channel **25a** and a left lower medial channel **23a**. The right medial cavity **24b** connects with a right upper medial channel **25b** and a right lower medial channel **23b**. Medial channels **23a**, **23b**, **25a** and **25b** all open out from the inner wall of the plate **21**.

As shown in **Fig.6** and **Fig.7**, the side plate or front outer plate **31** of the front outer plate assembly **30** includes a left lower cavity **38a**, a left upper cavity **32a**, a right lower cavity **38b**, and a right upper cavity **32b**. The left lower cavity **38a** connects with a left lower cavity lower channel **33a** and a left lower cavity upper channel **34a**. The right lower cavity **38b** connects with a right lower cavity lower channel **33b** and a right lower cavity upper channel **34b**. The left upper cavity **32a** connects with a left upper cavity lower channel **35a** and a left upper cavity upper channel **36a**. The right upper cavity **32b** connects with a right upper cavity lower channel **35b** and a right upper cavity upper channel **36b**. Channels **33a**, **33b**, **34a**, **34b**, **35a**, **35b**, **36a**, and **36b** all open out from the inner wall of the plate **31**.

Fig.8 and **Fig.9** show cross-sectional views of the right side plate assembly **40**. In the present embodiment, the right side plate assembly **40** is a solid side plate **41**.

Referring now to **Fig.10** and **Fig.11**, the left side outer plate assembly **50** includes a left side plate **51** and an inlet channel **59** extending through it. An air damper assembly **52** is rotatably located within the inlet channel **59** for controlling the volume of air that enters through inlet channel **59**. The damper assembly **52** includes a central rod **55** and radially extending vanes **56** and **57**. The central rod **55** extends past a frontal edge **58** of the plate **51** for attachment to the progressive linkage **114** shown in **Fig.1**. Rotation of the damper assembly **52** is controlled by the progressive linkage **114** to regulate the amount of air drawn through the heat exchange housing **12**. Preferably, an air filter **53** is attached to the inlet channel **59** for removing contaminants from the incoming air. The air filter **53** can also contain an air heating coil **54** for raising the temperature of the air entering the air filter.

Referring now to **Fig.12** and **Fig.13**, the upper plate **61** of the upper outer plate assembly **60** is provided with a left side channel **62a**, a right side channel **62b** and fluid inlet or bore **64**. The left side channel **62a**, the right side channel **62b** and the bore **64** extend through the entire height of the plate **61** from an upper end **66** to a lower end **68** of the plate **61**. A fluid bar assembly **100** is located within the bore **64** as further described below.

As shown in **Fig.14** and **Fig.15**, the lower plate **71** of the lower outer plate assembly **70** is provided with a left side channel **72a** extending through the entire height of the plate **71** and a right side channel **72b** extending through the entire height of the plate **71**. The plate **71** further includes a discharge opening **73** within which is disposed a damper assembly **74**. The damper assembly **74** comprises a central rod **75** and radially extending vanes **76** and **77**. The damper assembly **74** is rotatably mounted within the discharge opening **73**, and the central rod **75** extends past a frontal edge of plate **71** for attachment to the progressive linkage **114** as described above for the damper assembly **52**. It is also desirable to provide a drain (not shown) on both the right and left sides of the plate **71** to allow for draining of any fluids that collect therein.

Referring now to **Fig.16**, the intermediate plate **81** of the lower inner plate assembly **80** includes a left side channel **82a** extending through the entire height of the plate **81** and a right side channel **82b** that also extends through the entire height of the plate **81**. The plate **81** further includes a discharge opening **83** within which is disposed a damper assembly **84**. The damper assembly **84** comprises a central rod **85** and radially extending vanes **86** and **87**. The damper assembly **84** is rotatably mounted within the discharge opening **83**, and the central rod **85** extends past a frontal edge of plate **81** for attachment to the progressive linkage **114** as described above for the damper assembly **52**.

As shown in **Fig.17**, the intermediate plate **91** of the upper inner plate assembly **90** includes a left side channel **92a** extending through the entire height of the plate **91** and a right side channel **92b** also extending through the entire height of the plate **91**. Plate **91** also includes a discharge opening **93** within which is placed a damper assembly **94**. Damper assembly **94** comprises a central rod **95** and radially extending vanes **96** and **97**. Damper assembly **94** is rotatably mounted within the discharge opening **93** and the central rod **95** extends past a frontal edge of the plate **91** for attachment to the progressive linkage **114** as described above for the damper assembly **52**.

When assembled, as shown in **Fig.1** and **Fig.2**, the plate assemblies **20**, **30**, **40**, **50**, **60**, **70**, **80** and **90** constitute the heat exchange housing **12** of the vaporising unit **11** and provide three passageways in it: an upper passageway **120**, a middle passageway **121**, and a lower passageway **122**. The upper passageway **120** is defined by the lower side of the upper outer plate assembly **60** and the upper side of the upper inner plate assembly **90**. The middle passageway **121** is bounded by the lower side of the upper inner plate assembly **90** and the upper side of the lower inner plate assembly **80**. The lower passageway **122** is defined by the lower side of the lower inner plate assembly **80** and the upper side of the lower outer plate assembly **70**. The upper passageway **120**, the middle passageway **121**, and the lower passageway **122** define a "first" continuous connecting passage having a serpentine shape which connects the fluid inlet or bore **64** of the upper plate **61** and the inlet channel **59** of the left side plate **51** in fluid communication with the discharge opening **73** of the lower plate **71**. Preferably, the height of each passageway varies to accommodate expansion of the fluid travelling in it as a result of heating. For example, when the vaporising unit **11** is employed in combination with a hydrocarbon fuel-burning internal combustion engine, it has been found that the optimum height for each passageway is as follows:

If the height of the upper passageway **120** equals x, then the height of the medial passageway **121** equals 1.25x, and the height of the lower passageway **122** equals 1.5x.

Referring now to **Fig.12**, **Fig.18** and **Fig.19**, a fluid bar assembly **100** is positioned within the bore **64** of the upper outer plate assembly **60**. The fuel bar assembly **100** comprises an upper blind bore **101** and a lower blind bore **102**. The upper blind bore **101** opens at an inlet end **103** and the lower blind bore opens at an inlet end **103**, both located at the left end of the fluid bar assembly **100**. Upper ports **104a**, **104b**, and **104c** connect the upper blind bore **101** in fluid communication with the lower blind bore **102**. Lower ports **105a**, **105b**, and **105c** connect the lower blind bore **102** to a lower surface **115** of the fluid bar assembly **100**. A rod **106** is positioned inside the lower blind bore **102** and is mounted for rotational movement. The rod **106** has bores **107a**, **107b**, and **107c** extending through it in spaced relation to establish fluid communication between the ports **104a**, **104b**, **104c** and the ports **105a**, **105b**, **105c**, respectively, upon rotation of the rod **106**. Positioned on the outer circumference of the rod **106** are O-ring gaskets **108** and seals **109** to prevent leakage of fluid from the outlet end of bore **102**. A return spring **111** is provided for returning the rod **106** to a normally closed position where the rod **106** blocks the passage of fluids to the ports **105a-105c**. Positioned at the outlet ends of the ports **105a**, **105b** and **105c** are nozzles **110a**, **110b**, and **110c**, respectively.

Preferably, as shown in **Fig.19**, the fluid bar assembly **100** is provided with protrusions **112a** and **112b** formed along the top edge of the fluid bar assembly **100**. Mating grooves (not shown) cut in the plate **61** receive the protrusions **112a** and **112b** of the fluid bar assembly **100** and facilitate the removal of the fluid bar assembly **100** from the plate **61**. It should also be understood that the fluid bar assembly **100** can be formed integrally with the plate **61**, with rod **106** permitted to rotate freely relative to the plate **61**.

The operation of the fluid vaporisation system **10** according to the present invention will be described with an internal combustion engine with reference to **Fig.3a** and **Fig.3b**. In such an application, the mixture of fluids to be delivered to the internal combustion engine in a vaporised state comprises a mixture of liquid fuel and air.

As shown schematically in **Fig.3a**, the vaporising unit **11** of the present invention is attached to the bottom part of a conventional carburettor **10a**. The top part of the conventional carburettor, including the casing which contains the choke assembly, is removed prior to attachment of the vaporising unit **11**. In this arrangement, the air damper assembly **74** positioned in the lower outer plate assembly **70** functions as the carburettor choke assembly.

As shown in **Fig.3b**, high temperature coolant from a coolant source **6**, preferably engine coolant, is pumped via a pump **7** to a coil heater **5**. Heater **5** heats the engine coolant to approximately 180 degrees F. when, and if, required. Upon exiting the coil heater **5**, the high-temperature coolant travels to inlet valves **8a** and **8b** such as, for example, conventional mechanical or electronic ball valves, which control the amount of coolant passing through it into the left and right inlets **28a** and **28b**, of vaporising unit **11**. Upon entering vaporising unit **11**, the high-temperature coolant travels in two adjacent paths defined by the various plate assemblies **20**, **30**, **40**, **50**, **60**, **70**, **80** and **90** as described below.

The first path is serially defined by the left inlet **28a** and the left lower channel **22a** of the rear outer plate **20**; the left side channel **72a** of the lower outer plate **70**; the left lower cavity lower channel **33a**, the left lower cavity **38a**, and the left lower cavity upper channel **34a** of the front outer plate assembly **30**; the left side channel **82a** of the lower inner plate assembly **80**; the left lower medial channel **23a**, the left medial cavity **24a**, the left upper middle channel **25a** of the rear outer plate assembly **20**; the left side channel **92a** of the upper inner plate assembly **90**; the left upper cavity lower channel **35a**, the left upper cavity **32a**, and the left upper cavity upper channel **36a** of the front outer plate assembly **30**; the left side channel **62a** of the upper outer plate assembly **60**; and the left upper channel **26a** and the left outlet **27a** of the rear outer plate assembly **20**. It is apparent from the above description that the first path defines a "second" continuous connecting passage having a serpentine shape for connecting the left inlet **28a** in fluid communication with the left outlet **27b**.

The second path is serially defined by the right inlet **28b** and the left lower channel **22b** of the rear outer plate **20**; the left side channel **72b** of the lower outer plate **70**; the left lower cavity lower channel **33b**, the left lower cavity **38b**, and the left lower cavity upper channel **34b** of the front outer plate assembly **30**; the left side channel **82b** of the lower inner plate assembly **80**; the left lower medial channel **23b**, the left medial cavity **24b**, the left upper medial channel **25b** of the rear outer plate assembly **20**; the left side channel **92b** of the upper inner plate assembly **90**; the left upper cavity lower channel **35b**, the left upper cavity **32b**, and the left upper cavity upper channel **36b** of the front outer plate assembly **30**; the left side channel **62b** of the upper outer plate assembly **60**; and the left upper channel **26b** and the right outlet **27b** of the rear outer plate assembly **20**. It is apparent from the above description that the second path defines a "third" continuous connecting passage having a serpentine shape for connecting the right inlet **28b** in fluid communication with the right outlet **27b**.

The inlet valves **8a** and **8b** are regulated, for example, by two independent thermostats (not shown) which are submerged in the coolant paths on the lower outer plate assembly **70**. The foregoing construction facilitates maintaining, under all load conditions, a constant temperature across the first and second coolant paths and the upper, middle and lower passageways, thus preventing a drop in temperature which will cause the vapour fuel to undergo condensation and greatly decrease the fuel efficiency and increase exhaust pollutants. Coolant exiting from the outlets **27a** and **27b** is then returned to the engine coolant source **6.** It will be understood by those skilled in the art, that the engine coolant may be substituted with hot engine exhaust gases if desired. It is apparent from the above description that the first and second coolant paths within the heat exchange housing **12** are capable of being independently regulated, and facilitate a dual cross-counterflow arrangement for optimum heat exchange with respect to the fuel/air mixture travelling through the vaporising unit **11** as described below.

Referring again to **Fig.3a**, hydrocarbon fuel from a fuel source **13** is supplied to a high pressure fuel pump **3**. The high pressure fuel pump **3** pressurises the fuel to a desired pressure depending upon various factors including the number of chambers of the internal combustion engine **9** and delivers the high pressure fuel to the inlet end **103** of the upper blind bore **101** of the fuel bar assembly **100** shown in **Fig.18** and **Fig.19**. For example, the minimum required fuel pressure for a four cylinder engine is 100 psi, for a six cylinder engine it is 125 psi, for an eight cylinder engine it is 150 psi, for a ten cylinder engine it is 200 psi, and for a small aircraft engine it is between 200 to 300 psi. The pump pressure set point should be chosen so that vaporising unit **11** will only supply enough vaporised fuel/air mixture to the engine **9** sufficient for, for example, fifteen seconds use under full engine load.

Upon entering the fuel bar assembly **100**, the fuel travels through the upper ports **104a-104c**, through-bores **107a-107c** of the rod **106** and through the lower ports **105a-105c** and is discharged through the nozzles **110a-110c**. In one example of the present embodiment, the pressure of the fuel exiting the fuel bar assembly **100** is chosen to be approximately 1/3 the discharge pressure of the pump **3**.

It will be appreciated by those skilled in the art, that the rod **106** of the fuel bar assembly **100** acts as a rotatable throttle to control the amount of fuel flowing through the fuel bar assembly **100**. The rotation of rod **106** is controlled by the progressive linkage **114**. The progressive linkage **114** also controls the position of the air damper assemblies **52**, **74**, **84**, and **94** to regulate the amount of air drawn through the heat exchange housing **10** as described below. However, it will be understood by those skilled in the art, that other control mechanisms are suitable for controlling the fuel bar assembly and the damper assemblies. For example, the fuel bar assembly and damper assemblies could be controlled by an electronically controlled servo motor (not shown).

Air is drawn through the air filter **53** and heated by the heating coil **54** and the heated air flows through the damper assembly **52** of the left side outer plate assembly **50**. The flow of air then enters the left side of the upper passageway **120**. The incoming air mixes with the pressurised fuel exiting the fuel bar assembly **100** and travels along the length of the upper passageway **120**. The fuel/air mixture then passes through the damper assembly **94** and enters the medial passageway **121**. The fuel/air mixture travels along the length of the medial passageway **121**, passing through the damper assembly **84**, and enters the lower passageway **122**. Next, the fuel/air mixture travels along the length of the lower passageway **122** and exits the heat exchange housing **12** through the damper assembly **74**. The fuel/air mixture is sufficiently heated by heat transfer occurring between the high temperature engine coolant flowing through the first and second paths and the fuel/air mixture flowing through the passageways **120**, **121** and **122**. Preferably the fuel/air mixture will be almost completely (i.e., approximately 98% or more) vaporised and ready to be fed via the lower part of the carburettor **10a** to the cylinders of the internal combustion engine **9**.

Acceleration of the engine **9** is achieved by manipulation of the progressive linkage **114** (**Fig.1**) which rotates the rod **106** of the fuel bar assembly **100** allowing an increased flow of fuel into ports **105a-105c** and out through nozzles **110a-110c**, while simultaneously rotating the air damper assemblies **52**, **74**, and **94** which allow increased air and fuel/air mixture to pass through the vaporising unit **11**.

It will be appreciated that the damper assemblies not only provide for rapid acceleration and deceleration of the fuel/air mixture, but also function as independent flow rate regulators to maintain a constant ideal vaporisation environment within the heat exchange housing **12**. Furthermore, although the damper assemblies in the present embodiment are controlled mechanically by a progressive linkage **114**, it will be understood by those skilled in the art, that the damper assemblies may be controlled instead with electronic servo motors.

Start-up of the engine **9** is accomplished by turning an ignition switch **4a** to the ON position. A relay **4b** is energised and activates a low pressure fuel pump **2**. Fuel pump **2** pumps fuel to the lower part of the carburettor **10a** since the engine must start on liquid fuel and the vaporising unit **11** will not function effectively until it has reached a proper operating temperature. Accordingly, relay **4b** simultaneously activates the air heating coil **54** and the coolant heating coil **5** to rapidly achieve a minimum operating temperature (i.e., approximately 150 degrees F.) of the vaporising unit **11**. As the engine **9** achieves its normal operating temperature and thus raises the temperature of the engine coolant to approximately 190 degrees F., dependence on the air heating coil **54** and the coolant heating coil **5** is reduced. When the minimum operating temperature of the vaporising unit **11** is sensed by a temperature sensing array **4d**, the relay **4b** deactivates the low pressure fuel pump **2** and activates the high pressure fuel pump **3** which begins pumping fuel to the fuel bar assembly **100**. The vaporising unit **11** maintains its optimum operating temperature of approximately 190 degrees F. via the temperature sensing array **4d** which controls the temperature of the air heating coil **54** and the coolant heating coil **5**.

Stopping of the engine 9 is accomplished by turning the ignition switch **4a** to the OFF position, which activates a timer **4c**, deactivates the high pressure fuel pump **3**, and activates the low pressure fuel pump **2**. Timer **4c** keeps the engine **9** running for a sufficient time, approximately 15 seconds, to allow all of the vaporised fuel in the vaporising unit **11** to be consumed by the engine **9** and for the bottom part of the carburettor **10a** to fill with liquid fuel. This delayed shut-off process serves to eliminate accidental detonation of the vaporised fuel in the vaporising unit **11** after engine shut-off and prepares the engine **9** for a subsequent start-up.

From the foregoing description, it can be seen that the present invention comprises an improved fluid vaporisation system. It will be appreciated by those skilled in the art, that obvious changes could be made to the embodiment described in the foregoing description without departing from the broad inventive concept. For example, although the foregoing embodiment of the fluid vaporisation system has been described with a specific application to an internal combustion engine, it will be appreciated that the fluid vaporisation system is also well adapted for other applications, such as, for example, heating oil fuel processors, air conditioning systems, refrigeration systems and ice storage tanks. It is understood, therefore, that this invention is not limited to the particular embodiment disclosed, but is intended to cover all modifications thereof which are within the scope and spirit of the invention.