F. LUKE.

ECONOMIZATION OF HYDROCARBON ENGINE FUEL.

APPLICATION FILED JULY 25, 1918.

1,339,465. **Patented May 11, 1920.**

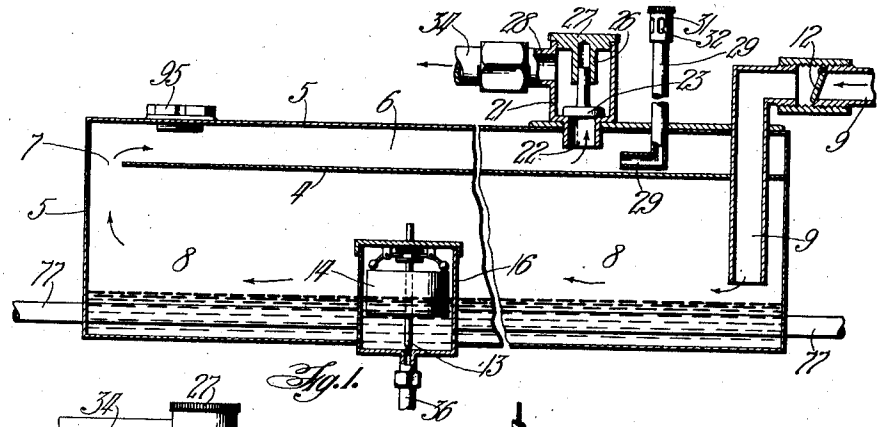

Fig. 1.

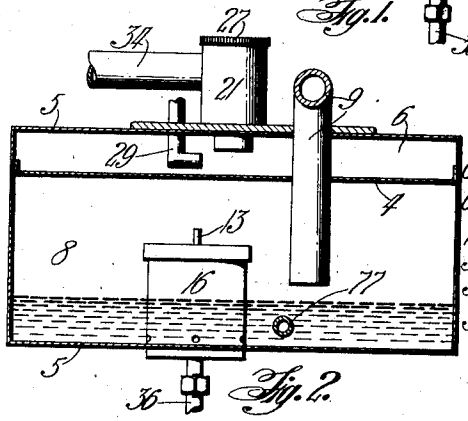

Fig. 2.

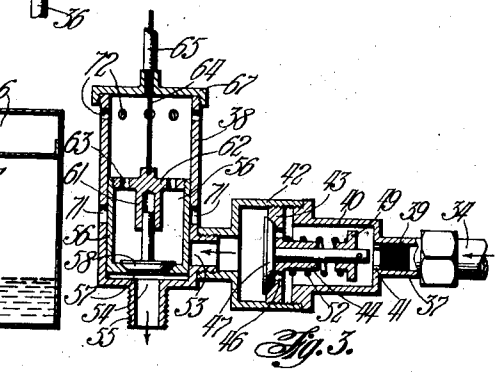

Fig. 3.

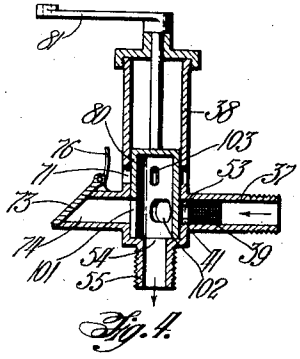

Fig. 4.

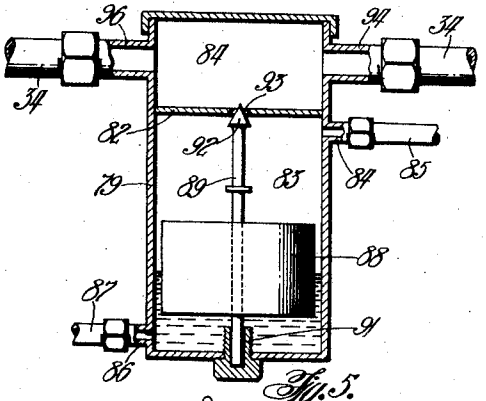

Fig. 5.

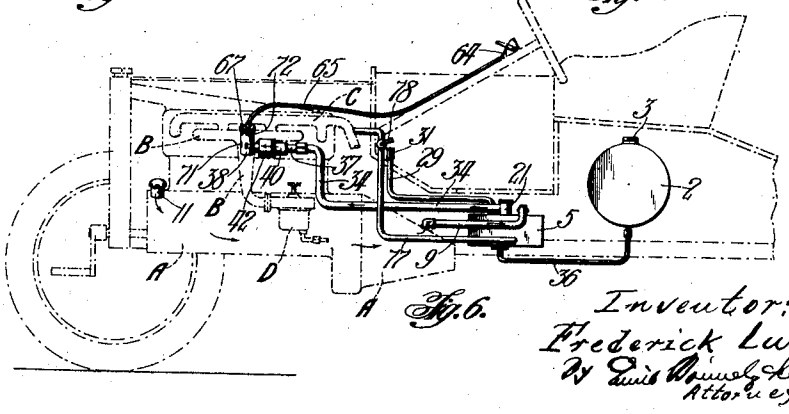

Fig. 6.

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UNITED STATES PATENT OFFICE.

FREDERICK LUKE, OF GEELONG, VICTORIA, AUSTRALIA, ASSIGNOR OF ONE-FOURTH TO HENRY ISAAC GRAWCOUR, OF GEELONG, VICTORIA, AUSTRALIA.

ECONOMIZATION OF HYDROCARBON-ENGINE FUEL.

1,339,465. Specification of Letters Patent. Patented May 11, 1920.

Application filed July 25, 1918. Serial No. 246,749.

To all whom it may concern:

Be it known that I, FREDERICK LUKE, a subject of the King of Great Britain and Ireland, and a resident of the city of Geelong, in the county of Grant, State of Victoria, Commonwealth of Australia, whose post-office address is Moorabool street, in the said city of Geelong, have invented certain new and useful Improvements Connected with the Economization of Hydrocarbon-Engine Fuel, of which the following is a specification.

This invention relates to either portable or stationary hydro-carbon engines for motor vehicles or for other purposes and has for its object the provision of means for materially reducing the consumption of gasolene or other fuel used. It is applicable to either gravity or pressure fed engines and may be readily applied to existing as well as to new machines.

According to the invention the volatile fumes arising from the liquid fuel in the main fuel tank or reservoir or in a subsidiary tank, hereinafter referred to as a generator, instead of remaining stagnant and useless in the upper part thereof are conveyed to the induction pipe or intake of the engine to form the explosive charge. The fumes are carried to the engine by a current of air, which is induced into the upper part of the tank or generator and is drawn over the top of the fuel therein by the suction of the engine, the air thus becoming impregnated with the fumes arising from the liquid. An important feature resides in the fact that this current of air is preferably heated before being drawn into the tank or generator and this heating is preferably performed by drawing the air through the crank case or base of the engine so that it becomes heated and enriched before entering the fuel tank.

Means are also provided to admix a regulable quantity of air with the fumes before leaving the generator and before entering the engine so that the explosive mixture may be weakened or strengthened as desired. The admission of the mixture to the engine and the regulation of its strength may be easily controlled from the dashboard or steering wheel of a motor vehicle or from any other convenient position, either by the hand or foot of the driver.

The invention has proved highly satisfactory in actual running tests and by preheating the air by its passage through the crank case as above mentioned. It has been found that the use of a carbureter may be entirely dispensed with, the engine being run solely on the fumes and air supplied by the invention.

Referring to the drawings which form a part of this specification—

Figure 1 is a sectional view of a subsidiary feed tank or generator showing the air inlet pipe, the fumes outlet pipe and the mixture regulating pipe. Portions are broken away for the convenience of illustration.

Fig. 2 is a cross section of the generator taken transversely to Fig. 1.

Fig. 3 is a sectional view showing the cylindrical control valve, the back fire release valve, and other parts which are located at the induction pipe or intake of the engine.

Fig. 4 shows a modified form of control valve and release valve.

Fig. 5 is a sectional view of a receptacle which may be employed for feeding a carbureter by the suction of the engine through the fumes pipe when a forced feed is necessary.

Fig. 6 is a diagrammatic view showing the invention applied to the engine of a motor vehicle.

In the drawings, 2 indicates the main fuel tank or reservoir which may be located in any suitable position and is provided with a filler 3. The main tank supplies liquid fuel to a subsidiary tank or generator 5. Near the top of said generator is a diaphragm or partition 4 which forms between said diaphragm and the top of the generator a fumes compartment 6. At one end of the diaphragm is an opening 7 which establishes communication between the lower or liquid compartment 8 of the generator and the fumes compartment 6.

Passing into the top of the generator near one end thereof is a hot air inlet pipe 9 which depends into the liquid compartment 8 and communicates with one end of the crank case or base A (Fig. 6) of the engine. Atmospheric air is admitted to the other end of the crank case or base through the ordinary breather tube 11 (Fig. 6) or

any other suitable vent. Within the pipe 9 is a non-return valve 12 opening toward the generator.

Attached to the top of the generator near the pipe 9 is a back-fire valve casing 21. This has a branch 22 which communicates with the fumes compartment 6 and is normally closed by a non return back-fire valve 23. This valve closes by gravity and is provided with a stem accommodated by a guide 26 depending from the cap 27 which is screwed or otherwise attached to the casing 21. Leading from the back-fire valve casing is a branch 28 to which is connected a fumes pipe 34.

Entering the fumes compartment 6 in close proximity to the branch 22 is an atmospheric air inlet pipe 29 which is provided with a rotary sleeve 31 having air inlet holes 32 or other suitable means whereby a regulable quantity of cold air may be conveniently admitted to the fumes compartment by the driver or attendant.

Leading into the bottom of the generator from the main fuel tank 2 is a liquid feed pipe 36 the exit of which is controlled by a needle valve 13. This is operated by a float 14 in a float chamber 16 at the bottom of the generator, wherein the liquid is thus maintained at a constant level.

The fumes pipe 34 leads to the fumes inlet branch 37 of a control valve casing 38. Inside the fumes inlet branch 37 is a wire gauze barrier 39. Stops 41 prevent the gauze being pushed too far into the branch 37. The fumes inlet branch 37 has an enlargement 40 which is connected to the control valve casing 38 by a suitable union 42 provided with a check valve seating 43 having a guide 44. Through the check valve seating 43 are fumes inlet holes 46 which are normally closed by a check valve 47 the stem of which passes through the guide 44 and is provided at its outer end with a collar 49. Between the collar and the valve seating is a closing spring 52.

The control valve casing 38 has a fumes inlet port 53 and a mixture outlet port 54 which has a mixture outlet branch 55 adapted to be screwed or otherwise connected to the induction pipe B or intake of the engine. Within the casing 38 is a cylindrical control valve 56 having at one end a gas release port 57 which is normally closed by a gas release valve 58. The stem of this valve passes into a guide 61 formed on a cap 62 which is screwed or otherwise attached to the other end of the cylindrical control valve 56. Formed through this cap are gas escape holes 63 and attached to it is a control wire 64 or other suitable means by which the control valve may be operated. The control wire passes through a flexible casing 65 to a convenient position for operation by the driver or attendant. A cover 67 closes the outer end of the casing 38 and is provided with a central hole to pass the control wire 64 or other connection. Formed through the wall of the casing 38 are air inlet holes 71 and gas escape holes 72.

As shown in Fig. 4 the gas relief valve may be in the form of a flap valve 73 covering a gas relief branch 74 which passes from the casing 38. This flap valve is provided with a limit stop 76 which insures it automatically closing. In some cases the check valve 47 may be dispensed with and the fumes inlet branch 37 formed directly on the control valve casing as in Fig. 4 which also shows the control valve in the form of a rotary plug 80 operated by a rod or other connection attached to the lever 81. The plug is provided with a relief port 101 which establishes permanent communication between the gas release branch 74 and the engine. It also has a fumes inlet port 102 which when open admits the fumes to the engine, and one or more air inlet ports 103 which, while the port 102 is still open, admits air with the fumes.

The generator is preferably provided with heating means such as a heating pipe 77 which leads from the exhaust pipe C of the engine and may be controlled by a tap 78 (Fig. 6) situated on the dashboard or any other convenient position. In lieu of the foregoing suitable electric heating devices may be employed.

In operation the control valve 56 is partly opened wherein the suction of the engine opens the valve 12 and induces a current of air through the engine base and the pipe 9 into the liquid compartment 8 of the generator above the liquid fuel therein. This liquid is supplied to the generator either by gravity or by the suction of the engine through the feed pipe 36 which pipe is closed by the needle valve 13 when the liquid in the generator reaches a predetermined level. A body of liquid of comparatively small volume, but large surface area, is thus maintained within the generator. As the induced air passes through the crank case or base of the engine it becomes heated and also enriched by contact with the oil and other vapors therein so that it enters the generator in a highly desirable form. As this air passes over the extended surface of the liquid fuel in the generator it becomes impregnated with the volatile fumes arising therefrom and after passing around the end of the diaphragm and circulating in the fumes compartment it escapes past the valve 23 into the fumes pipe. By adjusting the sleeve 31 the fumes may be diluted with cold air as desired before leaving the fumes compartment thereby regulating the strength of the combustible vapors. The fumes and air then pass through the fumes pipe 34 to the inlet branch 37 of the control valve cas-

ing 38. The check valve 47 being also opened by the engine suction allows the gases to pass through the holes 46 to the control valve. The control valve which is manually operated by the driver or attendant opens the fumes inlet port 53 in the casing 38 and also enables a further supply of atmospheric air to be admitted through the inlet holes 71 thus permitting the strength of the explosive mixture entering the engine to be readiy varied or the supply entirely cut off during running. The mixture after passing the control valve escapes through the mixture outlet branch 55 into the engine where it forms the explosive charge.

In case of the engine back-firing the relief valve 58 or 73 automatically opens and allows the gases of combustion to escape either by way of the holes 63 and 72 or out through the relief branch 74 of the control valve casing. The check valve 47 and gauze 39 prevent the effects of back-fire reaching the generator, while the back-fire valve 23 thereon acts as an additional protection in this regard.

When low grade fuels are employed or the quality of the fuel in the generator deteriorates as its quantity diminishes, the tap 78 is opened to allow the hot gases from the exhaust pipe to pass through the heating pipe 77 thus heating the fuel in the generator and increasing its volatility and the combustibility of the fumes passing from the generator to the engine.

It has been found in practice that by passing the heated air from the crank case into the generator and thence to the induction pipe as above described the engine may be run entirely on the fumes and air without the use of a carbureter, but even without so previously heating the air highly satisfactory results may be obtained by merely drawing atmospheric air over the liquid fuel and thence into the engine. In this latter case the carbureter D may be brought into operation in the usual manner when required, the liquid fuel being supplied to it either from the main tank or the generator. Should the carbureter be supplied from a main tank which is so disposed that a forced feed is necessary the suction from the engine through the fumes pipe may be utilized for this purpose instead of the usual pressure feed connections. This is clearly illustrated in Fig. 5 wherein 79 indicates a receptacle which may be mounted in any convenient position at a higher level than the carbureter, it being divided by a partition 82 into a lower or liquid compartment 83 and an upper or fumes compartment 84. The liquid compartment 83 is provided with a liquid inlet branch 84 which is connected to a feed pipe 85 leading from the main reservoir. The liquid compartment is also provided with a liquid outlet branch 86 which is connected by a pipe 87 with the carbureter. Within the liquid compartment is a float 88 surrounding a spindle 89 the lower end of which moves in a guide 91. The upper end of the spindle 89 has a valve 92 thereon which valve opens and closes a port 93 formed through the partition 82. The fumes compartment 84 is provided with a fumes inlet branch 94 and a fumes outlet branch 96 which branches are connected to the fumes pipe 34 as shown. Thus instead of the liquid being forced under pressure from the main reservoir as in the ordinary pressure feed system it is sucked from the main reservoir through the feed pipe 85 into the liquid compartment 83 by the suction of the engine through the fumes pipe and the port 93. As the liquid in the compartment 83 fills and the float rises, the port 93 is closed by the valve 92. The liquid fuel in the compartment 83 then gravitates through the pipe 87 to the carbureter and as said compartment empties the float again falls and opens the port 93 to replenish the receptacle.

It will of course be clearly understood that the use of two separate tanks such as the main tank and the generator are not by any means essential. The generator can be entirely dispensed with and the heated or atmospheric air which enters through the pipe 9 can be drawn directly into the top of the main tank 2 which will then be provided with the fittings 21 and 29 and if desired the diaphragm 4 also. On the other hand the generator may be designed to take the place of the main tank in which case the needle valve 13 and feed pipe 36 will be eliminated and the generator charged with liquid by way of the filler 95 in the ordinary way. This will not of course provide for the liquid being kept at a constant level in the generator, but so long as the surface of the liquid is kept below the end of the air inlet pipe 9 the results will not be greatly affected.

Various other modifications and departures may obviously be made from the constructions illustrated and described without departing from the nature, spirit and scope of the invention and it is therefore intended and desired that the appended claims are to be interpreted as including such modifications.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. The combination of a liquid fuel container having a horizontal partition within it which divides its interior into a lower or fuel compartment, and an upper or fumes compartment, said compartments being disposed longitudinally of the container and being in free communication with each other at one end of the container; means at the

other end of the container for admitting air into the fuel compartment; an outlet pipe for the fumes leading from the fumes compartment adjacent the last-named end of the container; and means for creating a difference in pressure between the air inlet and the fumes outlet to induce a current of air to enter the fuel compartment and travel from end to end of the same in one direction to be impregnated with the vapors of the fuel, and thence to travel in the opposite direction from end to end of the fumes compartment and thence through the outlet pipe.

2. The combination of a liquid fuel container having a horizontal partition within it which divides its interior into a lower or fuel compartment, and an upper or fumes compartment, said compartments being disposed longitudinally of the container and being in free communication with each other at one end of the container; means at the other end of the container for admitting air into the fuel compartment; a valve casing mounted upon the top of the container adjacent its last-named end and communicating with the fumes compartment; a back-fire valve in said casing normally cutting out such communication; a fumes outlet pipe leading from said casing; and means for creating a difference in pressure between the air inlet and the fumes outlet to open said valve and cause a current of air to travel forward and backward throughout the entire length of the fuel and fumes compartments, then into and through said casing, and thence into and through said fumes pipe.

3. The combination of a gas generator; a gas outlet passage leading from said generator; a valve casing interposed in said passage and having air inlet and gas outlet ports; a cylindrical valve in said casing adapted to control the opening of said air inlet ports and the flow of the mixture through said passage; means for manually operating said valve; and a relief valve within said controlling valve and movable relatively to the same, said relief valve being normally closed but adapted to open automatically in the event of a back-fire in said passage to release the gases through said outlet ports.

In testimony whereof I affix my signature.

F. LUKE.

Witness:
CECIL MCCLASTIUR.