March 13, 1934. J. A. MATHES 1,950,806

GAS GENERATOR

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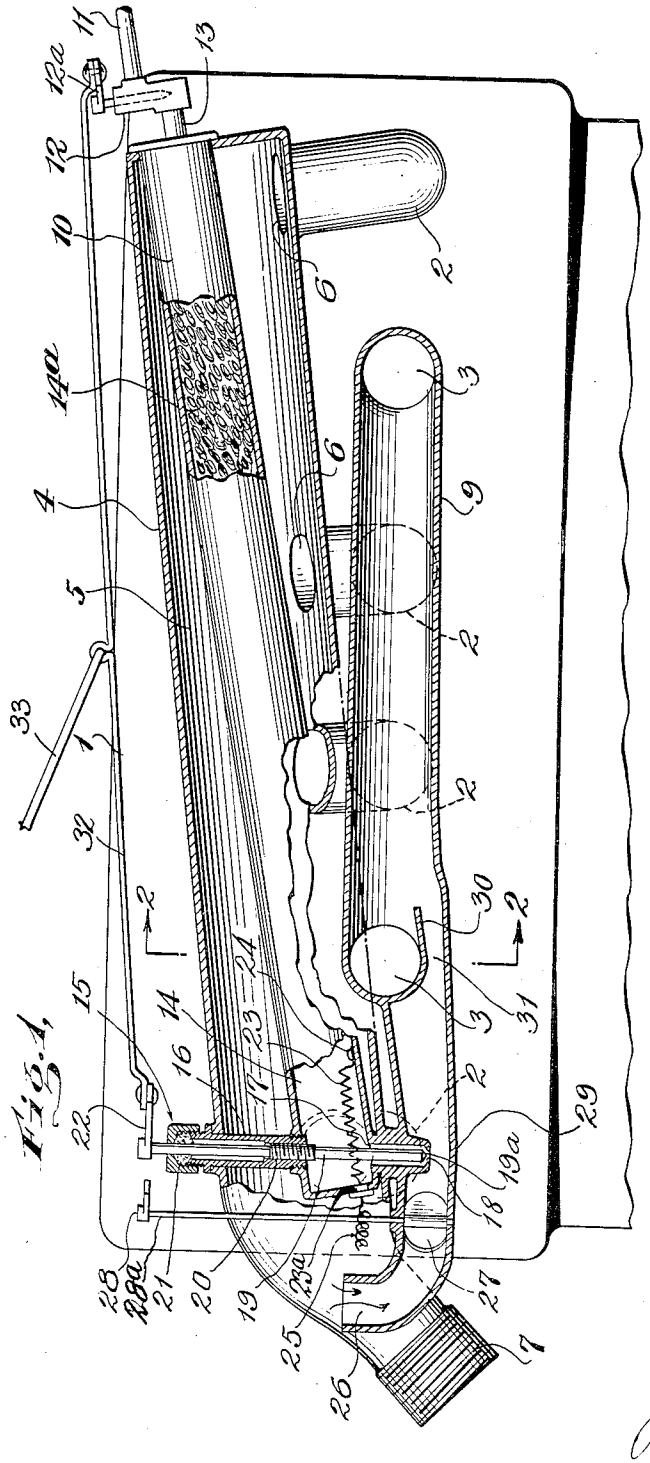


Fig. 1.

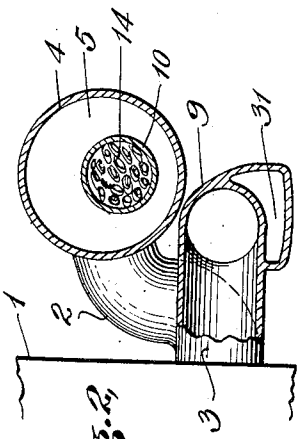


Fig. 2.

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GAS GENERATOR

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3 Claims. (Cl. 48—103)

My invention relates to liquid fuel vaporizing and air mixing means for internal combustion engines in which liquid fuel unmixed with air in a closed tube is converted into a thoroughly heated dry homogeneous vapor in an inclined vaporizing tube, heated by the exhaust gases of the engine in a jacket that serves the purposes of exhaust manifold, engine silencer, and provides means for confining the circulating exhaust gases around the surface of the vaporizing tube.

The vaporizing tube has a valve controlled inlet at the upper end, and a valve controlled outlet at the lower end from which heated vapor is discharged from the vaporizing tube into the intake manifold.

The vaporizing tube is inclined from the inlet and fuel supply end downwardly to the outlet and vapor discharge end, and all portions of the vaporizing tube are so constructed that practically no liquid fuel will remain in the vaporizing tube, but that gravity will cause the liquid to flow from all portions of the vaporizing tube to a lower level and onward to the outlet at the vapor outlet valve at the lower end of the vaporizing tube and into the inlet manifold.

In my patent of April 12, 1927, Pat. #1,624,270 application filed Sept. 27, 1920, I have shown two vaporizing tubes, the secondary vaporizing tube having an unrestricted outlet to the intake manifold, and the exhaust jacket is constructed as an independent device having only the one purpose without utilizing the combination features of exhaust manifold and muffler inclosing the vaporizing tube and an intake manifold that is of the simplest construction because of the thoroughly vaporized fuel provided by the other features of this invention.

In the accompanying drawing my invention is embodied in preferable form in construction in which, Fig. 1 is a side elevational view of the complete liquid fuel vaporizer with various parts partly broken away in section in applied position. Fig. 2 is a cross section on line 2—2 Fig. 1.

In the drawing 1 indicates the engine of a four cylinder type, on which is mounted the liquid fuel vaporizer comprising an inclined jacket and vaporizing tube, the upper end of which is in position at the front end of the engine, and is attached as a unit to the engine with the exhaust elbows—2—2—2—2 adjacent to the engine exhaust ports and adapted to convey exhaust gas from the engine through elbows—2—2—2—2 to the exhaust gas heating jacket chamber 5 of jacket 4. Formed as an integral part of jacket 4 is intake manifold 9 having openings 3—3 adapted to convey fuel-air mixture to the engine which is attached to the inlet ports of the engine in the usual manner. The exhaust gases are conveyed from the engine through openings 6—6 and the other two exhaust gas elbows into jacket chamber 5 of exhaust gas jacket 4 and pass from jacket chamber 5 through an annular opening longitudinally through threaded member 7, the only outlet from jacket chamber 5 for exhaust gases into the usual exhaust gas pipe that conveys the exhaust gases to the rear of the automobile.

This intake manifold is constructed in the usual manner excepting that the tubular section connecting the outlets 3—3 is formed in a shape that places the intake manifold nearer the exhaust gas jacket 4 and the mixing tube portion is much shorter with no Venturi tube.

The intake manifold in this raised portion receives more heat from the exhaust gas manifold or jacket 4, if the heat in not needed, the space between the intake manifold and jacket 4 is insulated with asbestos, and this elevated position for manifold 9 causes a more compact and attractive design for the device as a whole. If desired the intake manifold can be cast as a separate member and used as such on the engine. It is essential that the vaporizing tube have sufficient size to insure thorough and complete heating of the liquid fuel to convert the same to a thoroughly heated dry vapor (or steam) and that this heated dry vapor is discharged into the intake manifold when it reaches its highest temperature and that this heated vapor is not conveyed through a section of tube or conduit having a temperature less than this maximum before it is discharged into the intake manifold, vaporizers having a construction that ignores either of these two features deliver only a heated liquid to the intake manifold instead of a thoroughly heated dry vapor.

Formed as an integral part of jacket 4, is the cylindrical vaporizing tube 10 having a single unitary chamber where the liquid fuel is vaporized by receiving heat from the exhaust gases circulating in chamber 5 through wall 10, as shown in Fig. 2. The cylindrical vaporizing tube 10 is formed as an integral part of jacket 4 and is spaced apart from and centrally located in exhaust gas chamber 5 and substantially parallel excepting that at the lower end vaporizing tube 10 rests on the bottom wall of jacket 4 and at the upper end vaporizing tube 10 is in contact with the top wall of jacket 4. The purpose of this is to provide additional inclination of vaporizing tube 10 from the

horizontal without adding to the inclination of jacket 4, causing a more compact construction and adds to the general appearance.

Preferably this inclination is not less than two and one half inches to the foot which provides ample inclination for starting or running on down grade on the road and this steep inclination of the vaporizing tube 10, provides quicker action under all conditions.

At the upper end of vaporizing tube 10 is supply valve 12 having a supply pipe 11 and connecting pipe 13 both formed as a part of supply valve 12. Pipe 11 is adapted to connect to the fuel supply tank and pipe 13 has a threaded connection to the end of vaporizing tube 10 to be removable for access to the chamber of vaporizing tube 10 and the loosely folded copper fly screen wire 14^a that preferably fills the complete chamber of vaporizing tube 10 and acts as a heat distributor. Valve 12 has control lever 12^a that is controlled by the hand throttle lever by the driver.

At the lower outlet end of vaporizing tube 10 is outlet valve 16 having valve stem 19 adapted to raise and lower as lever 22 is turned a third of a revolution in threaded portion causing orifice 18 to be closed or opened by action of valve stem seat 19^a. Valve stem 19 has a loose fit at its lower end where it operates in bore 17 to provide room for the liquid fuel or the vapor discharging from orifice 18.

Member 32 having pivotal connection to lever 22 and control lever 12^a on valve 12 is adapted to cause supply valve 12 and outlet valve 16 to be operated in unison with the driver's hand throttle lever by rod 33 and other link and rod mechanism not shown in drawing.

The heated vapor when the engine is running or the cold liquid fuel in the starting operation leaves the lower end of the vaporizing tube 10 by way of orifice 18, and into intake manifold 9 where it is mixed with air controlled by butterfly valve 27 by turning lever 28 that is connected to butterfly valve 27 with the rod 28^a, and has mechanical connection to the driver's hand control lever.

The butterfly valve 27 is constructed the same as the usual butterfly valve and has the same purpose except that usually the butterfly valve is in the mixture stream, but in this device it is preferable to have it on the atmospheric side of the vapor fuel inlet to insure an abundance of suction from the cylinders in the intake manifold acting on the vapor in the vaporizing tube 10 at low idling speed, thereby using this suction to raise the liquid fuel from a supply tank below the vaporizer if desired.

The air controlled by the hand throttle butterfly valve 27 enters the intake manifold 9 through the annular opening 26. The intake manifold 9 at 29 has a bend forward to cause the air inlet opening end 26 to come in front of the exhaust gas jacket near threaded member 7.

The portion of the intake manifold 9 between butterfly valve 27 and the first outlet opening 3 has a flattened oval shape to provide a more compact design and to have the bottom of this portion nearer the heated jacket 4 and is shown at 31; lip 30 causes the fuel air mixture to have a less direct path to the first outlet opening 3 of manifold 9.

Intake manifold 9 has its lowest point at 29 designed to cause any liquid fuel that may enter the intake manifold during the starting operation to drain back to this point, where it is in heat receiving relation to the exhaust gases in jacket 4 and to the turbulent action of the vapor and air at this point.

The liquid fuel inlet valve 12 at the upper end of vaporizing tube 10, requires a less accurate control than the vapor valve 16 because the flow of liquid is regulated mainly by the suction of the engine cylinders that causes more or less pressure (absolute pressure) in vaporizing tube 10 and more or less resistance to the flow of liquid fuel through the liquid fuel orifice of valve 12. The flow of liquid through this valve 12 is at intermittent periods, and for this reason the temperature of the liquid fuel caused by the weather conditions or other reasons before it enters valve 12 has no effect on the accurate control of the vapor from outlet valve 16 which regulates the quantity of fuel vapor to the engine.

The electric element 23 for heating the small quantity of liquid fuel for starting in very cold weather is placed at the lower outlet end of vaporizing tube 10 at a position parallel and adjacent to the bottom of this portion of the vaporizing tube 10.

The electric element wire passes through insulation bushing 23^a in the end of vaporizing tube 10 and out through exhaust jacket 4 at some convenient point, to the storage battery. The electric element 23 is grounded at the other end 24 by a permanent attachment to the vaporizing tube 10.

The electric element consumes very little current as it is used a very short time for each starting operation, it also reduces the time the starter motor is in use by providing a heated charge of fuel.

This combined liquid fuel vaporizer device as described is complete, excepting for a check valve to prevent the flow of the liquid fuel from the supply tank into and through the vaporizer if the hand throttle control lever is left open or opened accidently when the engine is not running.

To insure quick acceleration and performance, it is important that the liquid fuel at all times is in the supply line at the liquid fuel supply valve at upper end of the vaporizing tube.

The check valve spring must have sufficient strength to prevent the flow of the liquid when engine is not running, as stated but it must not be strong enough to prevent the suction of the engine acting through the intake manifold and vaporizing tube, to cause the check valve to open and allow the liquid fuel to flow to the vaporizing tube when the engine is running under power or by the starter.

In the operation of this combined vaporizer, exhaust manifold, muffler and intake manifold device, constructed as a single unit and placed on a four cylinder automobile with the fuel supply tank above the vaporizer and for a winter start, the operation is as follows:

1st. Set hand throttle lever at usual starting position.

2nd. Hold electric switch that provides current for the heating element, on about five seconds and at same time hold primer starting knob out same length of time, to allow a small quantity of liquid fuel to flow into the vaporizing tube.

3rd. Step on the starter.

To start in any but cold winter weather, the operation is the same, minus the heating current.

The priming knob actuates a link and rod mechanism that lifts the automatic check valve from its seat and allows the liquid to run through

the vaporizing tube in just sufficient quantity for starting which is governed by the position of the hand lever at that time, which is connected to the liquid fuel inlet valve at upper end of vaporizing tube; this constant dripping of the liquid fuel on the electric element or into the intake manifold is the desired quantity and for the proper time for starting.

When the starter turns the engine the suction of the engine cylinders causes this quantity of liquid fuel to continue running into the vaporizing tube because the suction now holds the automatic check valve at open position.

This quantity of liquid is more than the quantity required for running the engine at this speed but this is necessary for starting conditions, but this quantity is decreased instantly when the first explosions take place, because the suction in the vaporizing tube is decreased and now as the explosions continue, the heat of the exhaust turns the liquid to a wet vapor for a few explosions and then to a dry vapor and the operation is now continuous.

Instead of using the priming mechanism to open the check valve, as explained, a few turns of the engine by the starter provides the starting charge of liquid fuel, after which proceed as explained for starting. Having thus described my invention, what I claim is:

1. A gas generator comprising an inclined liquid-fuel heating tube mounted in an exhaust gas chamber, said heating tube having a single unitary chamber of comparatively large cross-sectional area, a fuel-air mixing chamber, the upper end of said heating tube having a valve controlled inlet for liquid fuel only and a valve controlled outlet discharging heated vapor directly into said mixing chamber, said heating tube inclined from the inlet downward to the outlet to provide means of maintaining a quantity of heat in said tube in excess of the amount of heat required to vaporize the normal flow of liquid fuel into said heating tube, means for supplying liquid fuel to said tube and air to said mixing chamber.

2. A gas generator comprising an inclined liquid-fuel heating tube supported in an exhaust-gas manifold a fuel-air mixing chamber, said inclined tube having a supply valve for liquid fuel only at its upper end and a vapor discharge valve at its lower end adapted to communicate directly with said mixing chamber, all portions of the surface of said heating tube being in direct contact with the exhaust gases circulating through said manifold, said heating tube having a single straight chamber of comparatively large cross-sectional area and all portions from inlet to outlet inclined downward towards the outlet, a wire filling in said tube and means for supplying liquid fuel to said heating tube and air to said mixing chamber.

3. A gas generator comprising a heating tube having a single straight chamber, said tube mounted in the exhaust gas manifold, a fuel-air mixing chamber, said heating tube inclined from inlet end downward to the outlet end, a control valve for liquid fuel only at its upper end and a vapor discharge control valve at its lower end adapted to discharge heated vapor directly into said mixing chamber, said heating tube having a comparatively long chamber and a large cross-sectional area, said heating tube having all portions of its surface in contact with the exhaust gases in said exhaust-gas manifold, said heating tube inclined from inlet downward to outlet thereby providing means of distributing the liquid fuel over a large area of heated tube surface by gravity to facilitate rapid heating of the liquid fuel and the heating tube having a heating element adjacent its lower end and a light wire filling in said heating tube, means for supplying liquid fuel to the heating tube and air to said mixing chamber.

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