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CHARGE FORMING DEVICE FOR INTERNAL COMBUSTION ENGINES

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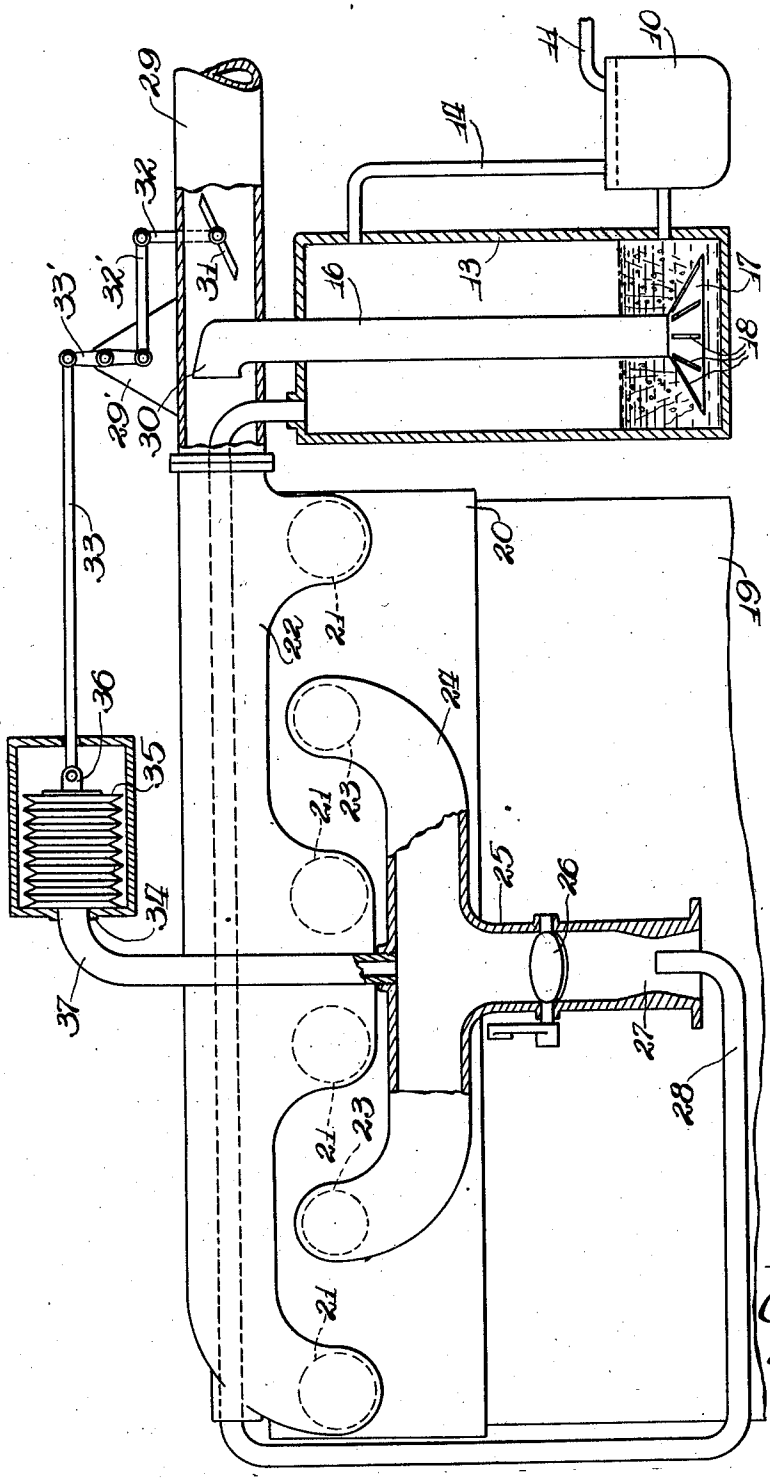

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CHARGE FORMING DEVICE FOR INTERNAL COMBUSTION ENGINES

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5 Claims. (Cl. 123—119)

This invention relates to a charge forming device for internal combustion engines. More specifically it relates to a vaporizing and charge forming device particularly adapted to utilize less volatile fuels than those ordinarily employed.

A principal object of the invention is to provide means for vaporization of a heavy fuel, means to separate the vapor from the liquid particles and to deliver the vapor to an engine manifold at a properly metered rate.

Another object is to provide a device in which hot exhaust gases from an engine may be utilized to vaporize a heavy fuel and to superheat the vapor prior to its mixture with air for combustion.

Another object is to provide means for regulating the amount of exhaust gas, and, at the same time, the amount of heat supplied to a vaporizing device by controlling a variable restriction in the exhaust discharge conduit of the engine.

Another object is to incorporate in a charge forming device a pressure responsive means actuated by pressure in the inlet manifold to regulate the amount of heat supplied to a vaporizing device.

These objects and others which will be apparent from the detailed description to follow are accomplished by an arrangement of elements as shown in the drawing, in which:

A single figure shows diagrammatically an engine with inlet and exhaust manifolds therefor and a vaporizing device associated with the manifolds.

In the conventional carburetors used on internal combustion engines to supply a combustible charge, the liquid must be carefully metered to obtain a satisfactory mixture over a wide range of load on the engine. In the use of so-called heavy fuels, that is,—fuels of a much less volatile nature,—it is very difficult to meter the liquid and to deliver it uniformly to the inlet ports of a multiple cylinder engine.

In applicant's construction to be hereinafter described many of the variables encountered in ordinary carburetion, such as viscosity, inertia, small orifices, jets, and the like have been eliminated.

In the drawing a constant level float chamber 10 supplied with fuel by a conduit 11 maintains a predetermined, uniform liquid level in the vaporizing chamber 13. Said chamber may be constructed in any suitable shape and is preferably insulated to prevent the transfer of heat therefrom. A balance tube 14 is provided between the float chamber 10 and the vaporizing chamber 13 above the liquid level therein. A vaporizing gas inlet conduit 16 extends into the vaporizing chamber 13 and terminates below the normal liquid level therein. A cone-shaped member 17, provided with a plurality of narrow openings 18, is secured to the lower end of the conduit 16 for distributing the vaporizing gas in a finely divided form at a number of locations under the liquid to be vaporized.

A block 19 of an engine is diagrammatically illustrated as well as the cylinder head 20, this engine being of the overhead valve type. A four-cylinder engine is illustrated, the exhaust ports 21 being shown in the dotted lines beneath the elbows of the exhaust manifold 22. Inlet ports 23 are shown in the dotted lines at the ends of an inlet manifold 24. Said ports are for the purpose of communicating with two adjacent cylinders, being of the type used in commercial four-cylinder engines. The inlet manifold 24 is formed with the usual riser 25, in which a throttle valve 26 is positioned. At the inlet side of the throttle valve 26 the riser 25 is formed with a venturi 27. A vaporized gas conduit 28 communicates with the throat of the venturi 27 for delivering thereto combustible gas which forms with the air drawn into the inlet riser a combustible mixture. An exhaust gas conduit 29, usually termed an exhaust pipe, is connected to the exhaust manifold 22. The vaporized gas conduit 28 extends through the exhaust manifold 22 for the purpose of superheating the vaporized gas from the vaporizer and communicates with the upper end of the vaporizer. The vaporizing gas conduit 16 extends into the exhaust pipe 29, having an open end 30 facing opposite the direction of gas flow, whereby the inertia of the flowing gas acts, in addition to pressure, to force gas through the vaporizing gas conduit 16. A throttle valve 31 is mounted in the exhaust pipe 29 at the discharge side with respect to the inlet end 30 of the conduit 16.

A lever arm 32 connected to the shaft of the valve 31 is connected by a link 32' with a lever 33' fulcrumed on a bracket 29' secured to the pipe 29. The lever 33' is connected by a link 33 to a pressure responsive device consisting essentially of a casing 34 and an expansible bellows 35. The shaft 33 extends slidable through an opening in the casing and is pivotally secured to a connecting member 36 secured to the bellows. The other end of the bellows is secured in a gas-tight manner to one end of the casing.

A conduit 37 connected with the inlet manifold 24 transmits the pressure therein to the interior of the bellows 35 through one end of the casing 34.

In the operation of an engine equipped with the vaporizing and charge forming device above described a volatile liquid may be utilized for starting the engine, or it may be put into operation until warmed up by other suitable means. After the engine is in operation, hot exhaust gases being delivered through the exhaust manifold 22 and the exhaust pipe 29 are drawn through

the vaporizing conduit 16 and through liquid in the vaporizing chamber 13, forming a combustible gas at a rate proportional to the supply of sensible heat of the exhaust gases being delivered. The vaporized gases pass through the conduit 28 into the throat of the venturi 27, being mixed therein with air sufficient for proper engine operation. This combustible mixture is delivered through the inlet manifold 24 to the engine, the supply being regulated by the throttle valve 26.

Although the throttle valve 26 is the means by which the operator controls the supply of gases to the engine, an automatic control is incorporated in the system. The position of the valve 31 determines the pressure in the exhaust conduit and consequently affects the amount of exhaust gas delivered to the vaporizing chamber. It will be understood, therefore, that the amount of vaporizing gas passing through the vaporizing chamber and the amount of combustible gas formed therein is a result of the suction in the throat of the venturi 27 and the pressure in the exhaust conduit. In order to make this control automatic, the pressure responsive device is utilized. An increase in suction indicating closing of the throttle 26 in the inlet manifold 24 contracts the bellows 35 to move the throttle valve 31 to an open position, thereby reducing pressure in the exhaust conduit and decreasing the formation of combustible gas in the vaporizing chamber. When the throttle 26 is opened the valve 31 is closed thereby increasing the supply of combustible gas.

There is also another inherent controlling means in the device described, as the temperature of engine exhaust gas is proportional to the load on the engine. As the load on the engine increases, requiring as a result a richer and more plentiful supply of fuel, the sensible heat supplied to the vaporizer is increased, thereby increasing the gas vaporized and supplied to the inlet manifold.

By the methods of operation inherent in the vaporizer described and obtained by the controls incorporated therein, the charge forming system is to a large degree automatically acting to supply the required fuel to an engine over a substantial range in its requirements due to variation in load.

It is to be understood that applicant has shown and described only in a diagrammatic manner a charge forming system embodying a preferred form of his invention, but that he claims all modifications falling within the scope of the appended claims.

What is claimed is:

1. A charge forming device for internal combustion engines comprising, in combination with an inlet mixture conduit and an exhaust gas conduit, a vaporizing chamber, means for supplying liquid fuel thereto, means for delivering hot gases from the exhaust conduit to said chamber, means for delivering vaporized gases from said chamber to the inlet conduit, and means for regulating the vaporized gas supplied to the inlet conduit by means operated by the suction in the inlet mixture conduit.

2. A charge forming device for internal combustion engines comprising, in combination with an inlet mixture conduit and an exhaust gas conduit, a vaporizing chamber, means for supplying liquid fuel thereto, means for delivering hot gases from the exhaust conduit to said chamber, means for delivering vaporized gases from said chamber to the inlet conduit, a throttle valve positioned in the inlet mixture conduit, and means for regulating the amount of vaporized gas supplied to said conduit by suction operated means communicating therewith between the throttle valve and the inlet to the engine.

3. A charge forming device for internal combustion engines comprising, in combination with an inlet mixture manifold and an exhaust gas manifold, a vaporizing chamber, means for maintaining liquid fuel at a predetermined level in said chamber, means communicating with the exhaust manifold for delivering hot exhaust gases beneath the surface of the liquid in the vaporizing chamber, a throttle valve in the exhaust manifold at the discharge side of the communication with the vaporizing chamber, a venturi formed in the intake to the inlet manifold, a vaporized gas conduit leading from the vaporizing chamber to the throat of said venturi, a throttle valve positioned between the venturi and the inlet to the engine, a pressure responsive device connected to the throttle valve in the exhaust conduit, and means for connecting said device with the inlet manifold at the engine side of the throttle valve whereby the pressure in the inlet manifold regulates the throttle in the exhaust conduit thereby governing engine operation by back pressure on the exhaust conduit and regulating the rate of fuel supply by regulating the amount of vaporizing gas supplied to the vaporizing chamber.

4. A charge forming device for internal combustion engines comprising, in combination with an inlet mixture conduit provided with a throttle valve and an exhaust gas conduit, a vaporizing chamber, means for maintaining liquid fuel therein, means for delivering hot gases from the exhaust conduit to said chamber, means for metering the rate of supply of said delivery according to engine load including a fluid pressure responsive means in communication with the inlet conduit on the engine inlet side of the throttle valve, and means for delivering vaporized gases from the vaporizing chamber to the inlet conduit.

5. A charge forming device for internal combustion engines comprising, in combination with an inlet mixture manifold and an exhaust gas outlet manifold, a vaporizing chamber, means for maintaining liquid fuel in said chamber, means communicating with the exhaust manifold for delivering hot exhaust gases in contact with the liquid in the vaporizing chamber, a throttle valve in the exhaust manifold at the discharge side of the communication with the vaporizing chamber, a vaporized gas conduit leading from the vaporizing chamber to the inlet manifold, a throttle valve positioned in the inlet manifold, a pressure responsive device connected to the throttle valve in the exhaust conduit, and fluid pressure transmitting means connecting said device with the inlet manifold at the engine side of the throttle valve whereby the pressure in the inlet manifold regulates the throttle in the exhaust conduit thereby governing engine operation by back pressure on the exhaust conduit and regulating the rate of fuel supply according to engine load by regulating the amount of vaporizing gas supplied to the vaporizing chamber.

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