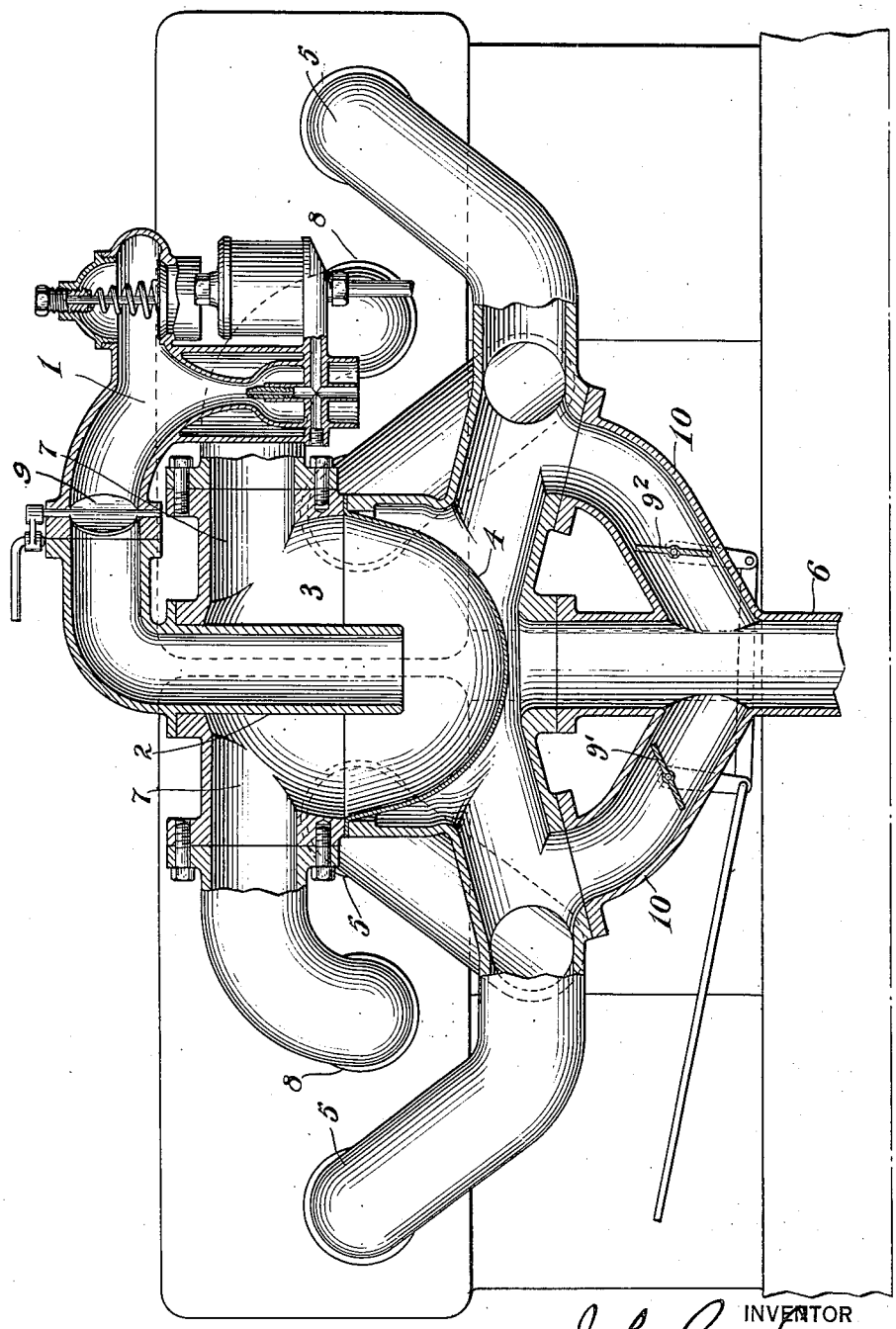
Jan. 1, 1924 1,479,381

J. GOOD

LIQUID FUEL VAPORIZER

Original Filed May 1, 1918



INVENTOR

BY

ATTORNEY

Patented Jan. 1, 1924. 1,479,381

UNITED STATES PATENT OFFICE.

JOHN GOOD, OF GARDEN CITY, NEW YORK, ASSIGNOR TO GOOD INVENTIONS CO., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

LIQUID-FUEL VAPORIZER.

Application filed May 1, 1918, Serial No. 231,808. Renewed June 8, 1923.

To all whom it may concern:

Be it known that I, JOHN GOOD, United States citizen, residing in Garden City, Long Island, New York, have invented the following described Improvements in Liquid-Fuel Vaporizers.

The invention is an improved vaporizer for internal combustion engines and other apparatus using fuel liquids which require heat for proper combustion as for instance kerosene, alcohol, low grade gasolines, etc. The object of the invention is to produce of such fuels and air a dry and relatively cool vaporous mixture, that is to say a mixture containing substantially no liquid fuel particles and having a low temperature as it enters the intake ports of the engine. The means hereinafter disclosed attain this object in a high degree and are capable of operation with perfect satisfaction and excellent general efficiency on automobile and other engines which work under wide variations of load and speed. The invention consists essentially in a special and critical relation which I have ascertained to exist between an externally heated vaporizing chamber and its entrance and exit passages and which operates in such manner that the liquid component of the charge mixture is deposited as a film upon the heated internal vaporizer surface and subject to complete vaporization by the frictional or scrubbing action of the air component of the mixture moving thereover, and gives the said results under all the varying conditions of engine operation, that is to say, for all velocities of mixture flow through the chamber as for example when the engine is running slowly, under load or idling, as well as when it is running at full speed or load. This effect is accomplished without involving any moving part or adjustment, automatic or otherwise.

The preferred means of accomplishing the said result and the principle of action thereof are illustrated in the accompanying drawings which shows a vertical section of the essential parts as applied to an ordinary four-cylinder automobile engine.

The engine charge mixture is produced by a carburetor 1 which may be of any of the usual types, containing a spray nozzle, and passes therefrom under the effect of the engine suction to a delivery spout 2 of about the same diameter as the outlet from the carburetor. This spout is mounted centrally in the upper wall of a vaporizing chamber 3 and directed towards the centre of the opposite end wall or floor 4 of said chamber, which floor is externally heated by contact on its lower face with the engine exhaust gas flowing from the exhaust ports 5 to the exhaust pipe 6. The wall 4 is relatively thin and preferably semi-spherical as indicated, being conveniently formed with a peripheral flange whereby it is clamped between the upper and lower castings of the structure. From the chamber 3 the vaporized mixture is drawn through the exit connection 7 to the engine intake ports 8 which in the present case are symmetrically related to the chamber, one connection being on each side thereof. A single connection however would be equally efficient, but it should in any case be connected to a plurality of engine ports, as in a multi-cylinder engine, because it is necessary that the flow through the chamber shall be fairly uniform in velocity. The charge mixture from the carburetor consists of air with a proper amount of fuel liquid, more or less suspended in it in the form of spray particles or even in larger masses. Substantially all forms of carburetor produce this kind of mingled fuel liquid and air. If the discharge end of the entrance spout 2 is mounted at a distance above the end or bottom wall 4 in line with it, somewhat in excess of the length of its own internal diameter and at about the same or a greater distance from the surrounding side wall of the chamber, such a mixture of air and liquid will discharge against the end wall 4 in such manner as to produce a desired film-forming effect and substantially none of the liquid particles will remain suspended in the current to be carried thereby into the exit connection 7. If the heat externally applied to the wall 4 be of the appropriate temperature—such as is obtained by using the exhaust gas from the engine— the liquid film will become rapidly vaporized and impregnated into the liquid-free air in the chamber without greatly raising the temperature of the latter and the result is that the issuing mixture is relatively cool and dry. Being cool, and containing substantially the whole air component of the charge, this mixture is the least likely to condense on the internal cylinder surfaces and is for the same reason correspondingly

high in contained heat units. Using kerosene as fuel, the foregoing arrangement will regularly and reliably deliver dry mixture at a temperature as low as 200° F. measured at the intake ports and it is obtained without any restriction whatever to the normal intake flow since the action does not depend upon reduction of pressure. The throttle 9 however is desirably located between the chamber and the carburetor so that the vacuum effect existing between it and the engine cylinders may be available for whatever benefit it may confer.

It will be noted that the vaporizing chamber is substantially spherical and that the exit therefrom is as remote as possible from the discharge end of the spout. This arrangement is desirable though not strictly necessary. It may be stated in general that the necessary relation between the dimensions of the spout and chamber is such that the annular cross sectional area of the chamber at the end of the spout is made as large as possible to still provide an extended film spread out to a substantially uniform thickness on the heated end wall 4, (as distinguished from a pool of liquid thereon) and is not so small as to create such an upward velocity of air around the end of the spout as will carry off suspended particles intended to form the film. These medium conditions are obtained in apparatus of about the proportions indicated in the drawing but can be accurately obtained in any given case by substituting a glass bowl for the floor 4 and visually observing the film-forming action of different dimensions of the spout and the effect of different separations of the same from the floor. It will be found that the condition which produces the film without carrying over of suspended liquid for one particular rate of mixture flow will also serve equally well for considerable variations on each side of that rate so that when the vaporizer is installed in an engine intake passage it will operate uniformly for all normal speed variations of the engine. I am aware that the general structure of a vaporizing chamber containing a delivery spout opening near its heated bottom is old in the art of engine vaporizers and my invention makes use of such structure but differs therefrom in principle by reason of the relation of the passages as above described and which maintains the film for all rates of mixture flows and without transfer of suspended liquid particles from the spout to the engine ports.

The heat applied to the end wall 4 is adjustable or subject to regulation by an appropriate manipulation of the linked dampers 9^1 and 9^2 in the by-pass passages 10, it being apparent that when these passages are closed the entire engine exhaust will be forced to pass in contact with the center of the heated wall 4. By reason of the fact that the fuel liquid is vaporized as a film and without imparting heat to the air component of the mixture, it is possible to apply such a temperature to the wall 4 that the vapor from the liquid film will be converted into a fine fog as it impregnates the cooler air giving a smoky appearance to the resulting entering mixture but not making it wet in the sense that it produces serious or objectionable wetness of the walls of the intake passages or the interior surfaces of the cylinders. Under some conditions of operation and maintaining the intake manifold relatively cool, I have succeeded in producing such substantially dry mixtures of kerosene and air at the remarkably low temperature of 160° F., with correspondingly high thermal and general engine efficiency.

Claims:

1. A method of operating engines on low grade liquid fuels which consists in producing, in a carburetor connected to the engine intake ports, a mixture of air and liquid fuel in engine-operating proportions, the liquid fuel being suspended in or carried along by the air, delivering said mixture through a spout against an exhaust-heated wall of a vaporizing chamber which forms part of the suction intake, with an entering velocity adapted to cause the suspended liquid therein to separate from the gaseous flow and adhere to said heated wall, simultaneously causing the gaseous part of said mixture to flow reversely around the exterior of the spout and along and over said heated wall with a reduced velocity adapted to spread and maintain the so-deposited liquid in the form of a film thereon without permitting said liquid to become resuspended in said gaseous part whereby the heat is directly applied to the liquid part and only indirectly and slightly transmitted to said gaseous part, and conducting the resulting gaseous mixture from the chamber and delivering it in a relatively cool and dry state to the engine.

2. A method of operating multi-cylinder engines on low grade liquid fuels which consists in causing the engine to produce a flowing mixture of air and liquid fuel in engine-operating proportions, the liquid fuel being suspended or carried along in or by the air, delivering said mixture through a spout entrance against the curved, heated bottom wall of a bowl-shaped vaporizing chamber which forms part of the suction intake passage of the engine, with an entering velocity adapted to cause the suspended liquid therein to separate from the gaseous flow and impinge upon and adhere to said heated wall, simultaneously causing the gaseous part of said mixture to flow reversely in the space around the exterior of the spout

and along and over said curved wall with a reduced velocity adapted to spread and maintain the so-deposited liquid in the form of a film thereon without picking up unvaporized liquid, whereby the said film is directly heated and continuously vaporized in the presence of substantially the whole of the air component of the engine mixture, without directly heating said air component, and conducting the resulting mixture in a relatively cool and dry state from said chamber to the engine without applying further heat thereto.

3. A method of operating multi-cylinder engines on low grade liquid fuels which consists in causing the engine to produce a mixture of air and liquid fuel in engine-operating proportions, the liquid fuel being suspended and carried along in or by the air, directing said mixture against an exhaust heated wall of a vaporizing chamber which forms part of the engine intake and thereby abruptly and simultaneously changing the direction and velocity of said mixture so as to collect the suspended liquid therein as an extended film on said heated wall and cause the gaseous part of the mixture to flow under its reduced velocity along and over said film, the flow at said reduced velocity being incapable of picking up liquid from the film and adapted to absorb and remove the vapor thereof as generated, and conducting the resulting medium to the engine.

4. In an apparatus of the kind described, an engine intake passage connected to a plurality of engine ports and provided with means for producing a mixture of liquid fuel and air in engine-operating proportions and including a vaporizing chamber comprising a heated wall, an entrance for said mixture disposed in such relation to said wall as to deposit the suspended liquid on said wall and spread the same out thereon in the form of a thin liquid film, the capacity and dimensions of said chamber being adapted to cause the gaseous part of the mixture to flow with reduced velocity away from the point of such deposit in contact with said film without picking up liquid therefrom, and an exit from said chamber adjacent the entrance thereto.

5. In an apparatus of the kind described, the combination with means for producing a mixture of liquid fuel and air in engine-operating proportions, of a bowl-shaped vaporizing chamber, a spout entrance thereto connected with said means, a heated wall opposite the spout and an exit from the chamber removed from the heated wall, the end of said spout being spaced from the heated wall by a distance suited to cause suspended liquid therein to be deposited and spread out as a thin film on said wall and being spaced from the side walls of the chamber by a distance suited to maintain a sufficiently low velocity of the gaseous part of the mixture to avoid picking up of the film liquid.

6. In an apparatus of the kind described, a bowl-shaped chamber adapted for connection in the intake of an engine, means for heating the bottom of the chamber, an entrance spout extending into the chamber to a point spaced from said heated bottom by a distance substantially equal to the diameter of the spout, said spout being spaced from the side walls of the chamber by a like distance and an exit from the chamber above the spout.

7. In apparatus of the kind described, an engine intake passage connected to a plurality of engine ports and provided with means for producing a mixture of liquid fuel and air in engine operating proportions and including a throttle and a vaporizing chamber on the engine side of the throttle, said chamber comprising a heated wall, an entrance for said mixture disposed in such relation to said wall as to deposit the suspended liquid on said wall and spread the same out thereon in the form of a thin liquid film, the capacity and dimensions of said chamber being adapted to cause the gaseous part of the mixture to flow with reduced velocity away from the point of said deposit in contact with said film without picking up liquid therefrom, and an exit from said chamber adjacent the entrance thereto.

In testimony whereof, I have signed this specification.

JOHN GOOD.