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VAPOORIZING APPARATUS FOR INTERNAL COMBUSTION ENGINES

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The invention is an improvement in the fuel charge forming, vaporizing and preheating apparatus of internal combustion engines using relatively non-volatile fuel, and particularly automobile engines, and consists in an organization of the charge mixture proportioner or fuel delivery device and the preheating burner in a special relation to the elements in which the fuel is normally vaporized, and in the use of a single constant-level, fuel supply receptacle serving both the said device and the preheating burner, and in various other appurtenant, incidental and independent features whereby superior operation and economy are obtained and whereby minimum burner operation and quick starting are assured, all as hereinafter made apparent to those skilled in this subject.

In the accompanying drawings:
Fig. 1 shows an automobile engine in side elevation with the improved fuel vaporizing apparatus of this invention in longitudinal vertical section;
Fig. 2 is an end elevation of the principal parts shown in Fig. 1, looking forward; and including a plan view of the operating set for the burner on a slightly reduced scale; and
Fig. 3 is a top plan of the engine and vaporizing elements.

The particular apparatus taken for illustration is designed for supplying correct charge mixtures of gasoline and air to an automobile engine and consists in general of a vaporizer for such mixture constructed according to the principles set forth and claimed in my pending application Serial No. 101,888, to which reference may be had for a complete explanation, but such apparatus is taken for illustration only in the present case and it will therefore be understood that the invention may be used for or adapted to any kind of fuel, referring of course to those which are so difficultly vaporized as to require preliminary heat for starting, or those which not only require starting heat but also a continued application of heat from the combustion in the engine or elsewhere to continue the vaporization during normal engine operation. In this illustrated apparatus the engine is conventionally shown as a multi-cylinder engine having its exhaust port 1 and intake port 2 on the same side of the row of cylinders. The charge proportioner 3 may be assumed to be any ordinary type of so-called carburetor, connected to the suction intake and operated by the engine suction to deliver a spray mixture of the liquid fuel and air in explosive or any desired proportions. The type indicated in the drawing has an air entrance 4, a throttle 5 and a spray nozzle shown in dotted line, and is supplied with fuel from a float bowl 6 forming part thereof. The float is indicated in dotted line and will be recognized as occupying the usual position with reference to the spray nozzle. Liquid fuel is brought to this constant-level chamber through a supply pipe 7 from any suitable storage tank, the constant level being maintained by the action of the float as will be understood. The spray mixture from the charge-forming device passes first, and under the control of the throttle, through an elbow 8 into the vaporizing tube 9, which in the present case, consists of a thin-walled, relatively long Venturi tube surrounded by the engine exhaust gas. From the elbow of the tube the mixture flows into the inlet header 10 and thence directly to the intake port 2. The charge proportioner 3, elbow 8, vaporizing tube 9, and inlet header 10 will be observed together to constitute the intake passage of the engine, the engine charge mixture flowing first forwardly from the proportioner and then reversely to the vaporizing tube and again forwardly to the inlet ports. It will also be observed that the vaporizing tube intervenes between the throttle and the intake ports, which is not necessary but desirable, and also that the elbow 8 is enclosed in the off-take box marked 12, through which the exhaust gas in the header escapes to the exhaust pipe 13.

The section of the suction passage, beyond the exhaust header, and comprising the second bend and the inlet header 10, is encased in a tube or passage 14, forming a protective jacket around it. During the normal running operation of the engine, the exhaust gas in the space within the header 11 heats the exterior of the Venturi tube vaporizing the charge mixture flowing therein and the jacket 14 around the header serves to protect the vaporized mixture against loss of its heat or condensation while in transit to the engine, this protection being due to the air or gas layer between the intake header and the jacket or tube 14. For starting the
engine and at such other times as it may be needed, the tube 14 serves as a flame conducting passage, to conduct a forced draft flame from the burner head 15 around and into heat transferring relation to the said inlet header, and discharges its heated products of combustion through a tube 16 into an open exhaust hood 17, mounted on or adjacent to the air inlet 4 of the charge forming device. The burner head as will be noted, is attached to and carried by the end of the flame tube 14 which is curved downwardly from the inlet header 10 toward the charge-forming device 3 so that the latter and the burner head may occupy positions adjacent each other and at the side of the engine cylinders and at substantially the same level.

The burner head contains a liquid fuel nozzle 18 connected by a pipe and regulating valve 19 to the float bowl 6 of the charge forming device and by virtue of the location of the burner head, as just explained, the orifice of the nozzle is disposed slightly above the constant level of the liquid in the bowl so that the liquid fuel may be discharged and atomized from the nozzle, 18 by the blast from the air nozzle 20 in aspirating relation thereto. The said air nozzle is mounted axially in the end of the burner head as shown, and projects the atomized liquid fuel past a pair of sparking terminals 21 and centrally through an air admission chamber 22 into the flame tube 14. The air nozzle 20 is connected by a flexible pipe 23 to a small gear type blower 24 in the operating set shown in Fig. 2. The electrodes of the spark plug 21 are set in the path of the spray from the atomizing nozzles and current is supplied to them through the cable 25 from any suitable source of sparking current, such as the magneto-generator 26. The air admission chamber 22 surrounds the spray just in advance of the igniting plugs 21 and contains a star shaped partition and distributing device 27, centralized to the spray, and air is supplied to this chamber by the flexible piping 28 from a fan blower 29 in the operating set, and when so supplied, enters the burner head without diluting the spray at the point of ignition and in quantities sufficient to establish complete combustion in the flame tube 14. The general construction of the burner head is not herein claimed, being the subject-matter of a prior application, Serial No. 135,751, and being also fully described and shown in my prior Patent No. 1,207,897.

The several members of the operating set are driven by a single shaft 30, that is to say all are directly secured to the single shaft and are each of such relative size and construction that each is thereby driven in proper mutual relation to produce and ignite the fuel spray in the burner head and maintain continuous combustion therein for as long as the said shaft is rotated. A small motor 31, controlled by the closing of switch 32 is shown as the means for driving the operating set and it will be understood that in the case of automobiles, this switch may be organized in the regular starting mechanism which cranks the engine and the batteries shown may be the starting and lighting batteries of the vehicle, and of course the sparking current may if desired be derived from the ignition system of the vehicle. By virtue of the flexible connection to the burner head, the operating set may be disposed at any convenient place in the automobile, either on the engine frame or on the vehicle frame, or may be mounted on the dash where it will be available for operation by a crank by hand instead of a motor. The flame projected into the closed passage 14 will quickly heat the same and the inlet header 10 as hot as may be required so that the first charge mixture from the charge proportioner 3 will be adequately vaporized to enable the engine to start its normal operation, after which continued vaporization may be accomplished by the exhaust gas in the header 11 or otherwise. The elbow at the right or rear end of the manifold 10 produces an abrupt change in direction of the mixture flow and it is at this point where the heat from the burner is first and principally applied, which arrangement results in economy of heat and burner fuel. The burner may be continued in operation, overlapping the initial period of engine operation for as long as required, but in order to shorten this period of overlap and enable the engine to pick up more quickly, the otherwise, the products of combustion from the burner are arranged to be discharged through the exhaust hood 17 where some of the heated gas will be drawn into the air inlet 4 to take the chill from the air component of the charge mixture.

When the engine is to be started the first closing of the switch or push button 32, sets the burner head in operation, drawing fuel from the carburetor to supply the combustion. Coincidently with such combustion the operator may, if necessary, prime the engine, and this may be done by choking the air entrance to the carburetor in accordance with the customary practice, but it is accomplished according to this invention by opening the spring-pressed needle valve 34 in the special priming pipe 35. This pipe, as will be observed in the drawings, is merely a narrow tube connecting the float chamber 6 with a spray nozzle 35 at a point in the suction intake which is heated by the burner, so that when the valve 34 is opened, the throttle of course being closed, liquid fuel is sprayed directly into the hot part of the intake and is therefore immediately vaporized.
Such introduction of fuel around the vaporizer tube to a point more closely adjacent to the inlet header saves delay in starting, such as otherwise would be incurred if the rich priming mixture were made to traverse the entire preceding length of the suction intake. In the case of kerosene, one of the priming of the engine by direct injection of fuel into the pre-heated section also avoids the development of smoke when starting, due to the flooding of the vaporizer tube when it is cold. Of course the burner head may be unnecessary after the engine has started and taken up its normal function but with the more heavy fuels it is found advisable to allow the burner's period of operation to overlap the initial period of operation of the engine until the latter is sufficiently warmed to continue thereafter unaided. However, it will be apparent that the burner may be set in operation whenever desired, in cold weather or under abnormal fuel conditions to help the engine out either by heating the intake or the air which enters the carburetor.

With some fuels and in many types of engines and vaporizing systems supplemental heating is found necessary when the engine is idling, i.e., running with little or no load, and at those times this invention provides that the operator may close the starting switch of the independent combustion device whenever and for as long as he thinks necessary, the operation thereof being entirely independent of that of the engine and completely under his control as already made apparent.

It should be remarked also that the organization of the burner system whereby it draws its fuel from the constant level float receptacle of the carburetor, instead of having an individual receptacle of its own, not only saves the cost and complication of having such an extra receptacle, which is of course desirable and important, but also eliminates the extra contrivances and personal attention such extra receptacle requires to keep it from dripping when it is not in use but still subject to the vibration of the engine or the vehicle. The burner may be idle during long periods of vehicle operation during which the constant jiggling of its sensitive float valve, or whatever equivalent means is employed to maintain a constant level, causes the receptacle to fill up above its normal level overflowing through the burner spray nozzle or elsewhere thereby fouling the burner and the engine generally besides wasting fuel. The use for both purposes of the single float-controlled receptacle of the carburetor which is always in use when the engine or vehicle is running and hence cannot itself overflow, entirely obviates the need for a special shut-off valve or any attention thereto by the operator.

Claims:
1. In an internal combustion engine for automobiles and like uses, the combination of an intake passage including a carburetor having a constant level fuel mixture, a burner containing an igniting and means for producing an ignitable, steadily-burning mixture of fuel and air, said means deriving its fuel from said fuel chamber, and an outlet for the burner communicating with said intake, whereby burner products are admitted to the engine.
2. In an internal combustion engine, the combination of an intake passage including a carburetor having a constant level fuel supply chamber, a burner supplied with fuel from said chamber and a flame passage disposed in heat transferring relation to said intake with its outlet communicating with the air passage through the carburetor, whereby combustion products are admitted to the engine.
3. In an internal combustion engine, the combination with a charge-forming device and a liquid fuel burner, both supplied with liquid fuel from a common-constant-level fuel receptacle, a suction intake connecting said device to the engine intake ports, an engine exhaust gas passage in heating relation to one part of said intake, a passage conducting flame or hot combustion products from said burner into heating relation to another part of said intake and means for operating said burner to heat the latter part.
4. In an internal combustion engine, the combination with a passage normally heated by the engine combustion and a charge proportioning supplying fuel mixture to said passage, a burner head for heating said mixture, said proportioner and burner head being both mounted on the engine structure and served by a single float chamber, and means for operating said burner head comprising air compressing and electrical igniting apparatus having flexible connection to said burner head.
5. The combination in an engine having a suction intake including a carburetor, a burner for supplying heat to said intake, and means for admitting a priming charge of fuel into the heated part of said intake, said means being organized for operation by the suction effect in said intake and comprising a fuel supply tube and a controlling means therefor.
6. The combination in an internal combustion engine, of a suction intake including a carburetor, suction means independent of the carburetor action for admitting fuel into said intake for engine-starting purposes, and a liquid fuel combustion device for vaporizing said engine-starting fuel.
7. The combination in an internal combustion engine, of an exhaust heated suction intake including a carburetor, suction means
independent of the normal carburetor action for admitting fuel into said intake, and an electrically ignited, liquid-fuel burner arranged to vaporize said fuel.

8. The combination in an internal combustion engine, of a suction intake including a carburetor, suction means independent of the normal carburetor action for admitting fuel into said intake, and a pressure operated liquid fuel burner adapted for operation at the will of the operator and arranged to heat the passage through which said fuel passes to the engine.

9. The combination in an internal combustion engine, of a suction intake including a carburetor adapted to supply the normal engine-operating charge mixture and having a throttle, suction-operated means connected to said intake on the engine side of the throttle and adapted to admit fuel to said intake and an electrically ignited burner arranged to supply heat to vaporize the fuel admitted by said means and the fuel admitted by said carburetor.

10. In an internal combustion engine, a suction intake normally heated from the combustion in the engine, means for independently heating a part of the same adjacent to the engine intake ports, a suction operated priming connection for admitting fuel directly to said independently heated part and a fuel receptacle for said priming connection below the level thereof.

11. In an internal combustion engine, a suction intake including a carburetor, and normally heated by the exhaust gas of the engine, means for independently heating the intake between the carburetor and the engine intake ports and means for delivering a priming fuel charge to said independently heated part.

12. In an internal combustion engine, the combination with a suction intake including a carburetor having a fuel receptacle means whereby the heat of the engine combustion is transmitted to the charge in said intake, means for independently heating the intake and a liquid priming connection from said receptacle to the independently-heated part of the intake.

13. In an internal combustion engine, a suction intake, part of which is normally heated by the heat developed internally in the engine and part of which is in heat transferring relation to an enclosed flame passage, a burner to supply flame to said passage, a constant level fuel receptacle to supply the burner and a priming connection from said receptacle to the burner-heated part of said intake.

14. In an internal combustion engine, the combination with a single constant-level fuel supply receptacle, a suction intake including a carburetor supplied from such receptacle, an enclosed flame combustion device in heat-transferring relation to said intake and including a liquid fuel nozzle also supplied from said receptacle, and a liquid priming connection between said receptacle and intake.

15. An automobile engine using the less volatile liquid fuels having a suction intake and provided with a part normally heated from the combustion occurring within the engine and a second part adapted to be heated by an independent combustion device, said device comprising a liquid fuel burner provided with a flame passage and operating means therefor all mutually correlated to permit the said second part to be independently heated at the option of the operator while the engine is in operation and to thereby supplement the heat generated by the combustion in the engine.

16. In an internal combustion engine, a charge mixture proportioning means, a suction intake having an elbow producing an abrupt change of direction of the mixture flow and a liquid fuel burner having a flame space arranged for heating the intake at the region of said change of direction.

17. In an internal combustion engine, a charge mixture proportioning means having a liquid receptacle, a suction intake having means producing an abrupt change of direction of mixture flow, a liquid fuel burner having an ignition and mixing space deriving fuel from said receptacle and adapted to heat the intake where the flow direction is changed.

In testimony whereof, I have signed this specification.

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independent of the normal carburetor action for admitting fuel into said intake, and an electrically ignited, liquid-fuel burner arranged to vaporize said fuel.

8. The combination in an internal combustion engine, of a suction intake including a carburetor, suction means independent of the normal carburetor action for admitting fuel into said intake, and a pressure operated liquid fuel burner adapted for operation at the will of the operator and arranged to heat the passage through which said fuel passes to the engine.

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Certificate of Correction.

Patent No. 1,625,312.

Granted April 19, 1927, to

JOHN GOOD.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, line 47, claim 12, before the word "heating" insert the word *externally*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 10th day of May, A. D. 1927.

[SEAL]

M. J. MOORE,

Acting Commissioner of Patents.
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