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CARBURATION SYSTEM

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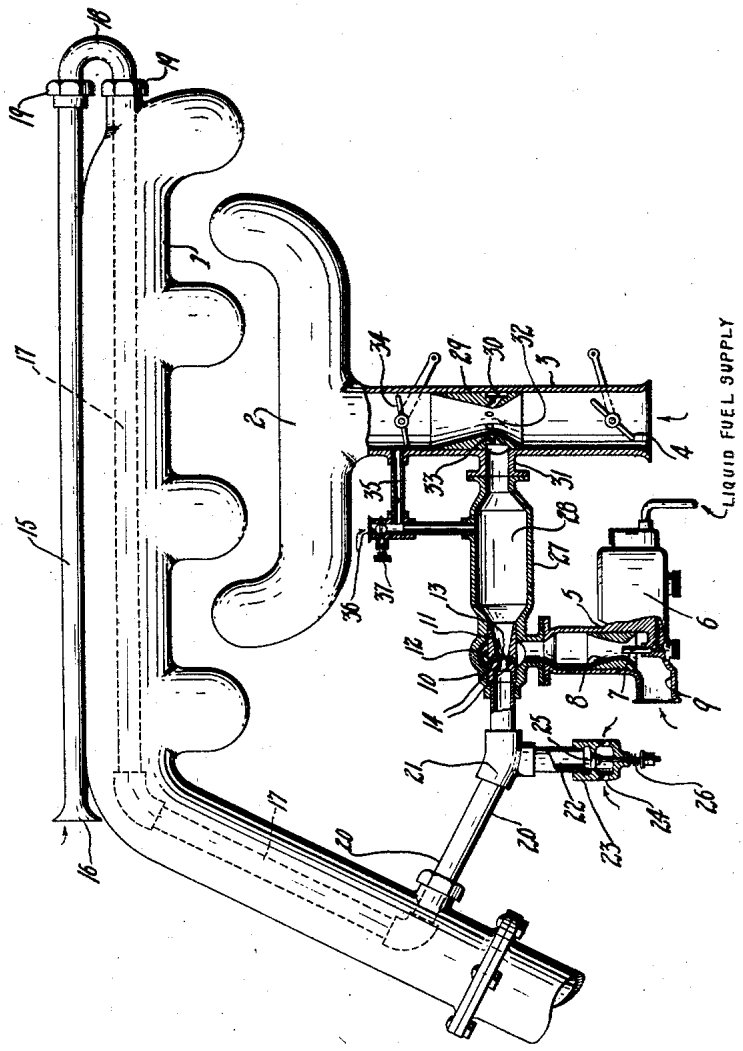

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CARBURATION SYSTEM

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This invention relates, generally, to improvements in carburation systems for internal combustion engine fuel; and the invention has reference, more particularly, to a novel carburation system adapted to treat liquid fuels of the heavy oil type.

This invention has for its principal object to provide a novel carburation system whereby an initial mixture of atomized liquid fuel and air is submitted to the vaporizing effects of superheated air before admission to the intake manifold of an internal combustion engine, and whereby on admission to said intake manifold a quantity of cool air is intermingled with the vaporized fuel mixture prior to delivery to the engine cylinders, so that the air content of the mixture is increased and the temperature of the delivered fuel mixture is lowered, thereby increasing the density of the mixture and increasing its efficiency.

This invention has for a further object to provide in a carburation system of the kind above characterized, an adjustable cool air admission means for regulating the temperature of the supplied superheated air, prior to admixture with the initial atomized fuel, whereby at the time of admixture the temperature of said superheated air is approximately at or slightly above the boiling point of the heavier or less volatile constituents of the liquid fuel employed.

Other objects of this invention, not at this time more particularly enumerated, will be clearly understood from the following detailed description of the same.

An illustrative embodiment of an arrangement of apparatus according to this invention is shown in the accompanying drawing in part side elevation and in part section.

Referring to the drawing, the reference character 1 indicates the exhaust manifold of an internal combustion engine and 2 indicates the intake manifold of the same. Said intake manifold 2 is provided with an inlet branch 3 open at its free extremity to the atmosphere and within its open end is arranged an adjustable strangler or choke valve means 4 of any suitable kind which may be partially or wholly closed during the starting of the engine, so as to obtain a richer mixture for the engine.

The reference character 5 indicates any suitable form of liquid fuel atomizer device or primary carburetor, the same having a liquid fuel reservoir 6 connected with a source of liquid fuel supply, the admission of which is controlled in the usual manner by a float controlled valve (not shown). Connected in communication with said reservoir 6 is a jet 7, the discharge end of which is positioned in the throat of a Venturi passage 8 provided in the discharge end of said atomizer device or primary carburetor 5. Communicating with the intake end of said Venturi passage 8 is an intake passage 9. Venturi passage 8 is sized, approximately, to admit just about the quantity of initial air from the atmosphere which is sufficient to lift and atomize the liquid fuel supplied by the jet 7.

Connected with the discharge end of said atomizer device or primary carburetor 5 is a superheated air mixing device 10, the same having a Venturi member 11 around which is an annular passage 12 which is in communication with the outlet of said atomizer device or primary carburetor. Extending through the walls of said Venturi member 11, from said annular passage 12 to the restricted interior 13 of said Venturi member, are fuel mixture supply ports 14.

Means to provide superheated air to said mixing device 10 is coupled therewith in communication with the intake end of its Venturi member 11. Said means is illustrated as comprising an air heater conduit having an external portion 15 extending upon and along the exhaust manifold 1, and provided at one end with an air intake 16 open to the atmosphere, and an internal portion 17 which extends axially through the interior of said exhaust manifold 1; said external portion 15 and internal portion 17 being connected in communicating relation through an elbow fitting 18 or the like, by means of suitable unions 19, or other suitable forms of coupling devices. The relative great length of the air superheater 15—17 is necessary in order to produce truly superheated air.

This heater means is not to be confused with the ordinary hot stove, which in common practice is built for introducing hot air into the carburetor intake. Air is a poor conductor and therefore to produce truly superheated air, it is necessary to allow a relatively long time element between the air and the heating means in order to adequately heat the air for the purposes of this invention. This long time element is obtained by passing the air through the long passage 15—17, the latter portion 17 of which is entirely surrounded by the exhaust gases being discharged from the engine, so that the air temperature at the time it leaves portion 17 is substantially at the temperature of the exhaust gases. It is to be understood that in some instances in order to adequately superheat the air, the portion 17 may consist of a plurality of convolutions extending back and forth within the exhaust manifold 1, so that the air will absorb all the heat units possible from the exhaust gases. It will be understood that the passage 15—17 may be cast integral with the exhaust manifold 1, if desired.

Said internal portion 17 of the air heater conduit is turned laterally, through suitable connections to emerge exteriorly from the exhaust manifold adjacent the device 10, and is thereupon coupled to the intake side of said superheated air mixing device 10 by a delivery extension 20. Coupled in communication with said delivery extension 20, through a T fitting 21, or other suitable fitting, preferably at a point closely adjacent to the mixing device 10, is a regulatable cool air intake member 22, having at its intake end a valve housing 23 provided with air intake ports 24 open to the atmosphere. Arranged in said valve housing 23 is an adjustable air admission valve 25, preferably of the poppet type, although it may be of any other suitable form. The spring 26 for closing said valve 25 may be tensionally adjusted to control the degree of air admission opening thereof according to the amount of cool air desired to be intermixed with the superheated air in order to determine the temperature of the latter at approximately the boiling point of the heavier constituents of liquid fuel contained in the fuel mixture to be treated by said superheated air.

Said mixing device 10 is preferably provided at its discharge side or end with an enlarged portion 27 to provide a mixing expansion chamber 28. Arranged in the inlet branch 3 of the intake manifold 2 is an auxiliary air mixing Venturi member 29 having an external annular passage 30 which is connected, by an intake neck 31 formed on said intake manifold branch 3, in communication with the expansion chamber 28 of said mixing device 10. The throat diameter of Venturi member 29 is made such as to admit a predetermined percentage of cool air through inlet branch 3 into the intake manifold 2. Extending through the walls of said Venturi member 29, from said annular passage 30 to the restricted interior 32 of said Venturi member, are vaporized fuel mixture supply ports 33.

Mounted within said manifold intake branch 3 above said Venturi member 29 is a pivoted throttle valve 34. Connected in communication between said expansion chamber 28 and the interior of said manifold branch 3 above the throttle valve 34 is a by-pass conduit 35 of relatively small capacity. Said by-pass conduit 35 is provided in the line thereof, and in communication therewith, with an air intake 36 having an adjustable intake valve 37 for regulating and controlling a flow of auxiliary air into said by-pass conduit for mixture with vaporized fuel passing therethrough to the intake manifold 2. The said by-pass conduit 35 is operative, on closing of throttle valve 34, to admit a limited amount of fuel mixture to the intake manifold and thence to the engine cylinders for slow running or idling of the engine under closed throttle conditions.

In the operation of the carburation system provided by the apparatus above described, under the suction of the engine, under open throttle running conditions, approximately only the quantity of air sufficient to lift and atomize the liquid fuel delivered by the jet is entered through the air intake 9 of the liquid fuel atomizer or primary carburetor device 5; usually such amount of air approximates about 5 per cent of the total air content ultimately contained in the fuel mixture delivered through the intake manifold 2 to the engine cylinders. Simultaneously with the movement of air through the atomizer device or primary carburetor, 5, the engine suction also pulls into and through the air heater conduit 15—17 a quantity of air to be first raised to a high temperature and thereafter mixed with the atomized fuel; the capacity of said air heater conduit 15—17 is selectively sized to assure the desired quantity of air to be superheated. Ordinarily, this quantity may range in amount from approximately twenty to forty per cent of the total air content ultimately contained in the fuel mixture delivered to the engine. According to the boiling point temperature of the heavy ends of the particular fuel oil in use, it may be desired to decrease the temperature of the superheated air to a point where the same approximates a given boiling point temperature. Owing to the novel external and internal relation of the air heater conduit 15—17 to the exhaust manifold, and the maximum lineal extent thereof which its novel external-internal arrangement permits of, there is time for a maximum transfer of heat from the exhaust gases, passing through

the manifold 1, to the air moving through the conduit 15—17, and consequently the temperature of said air may be raised to a very high degree or to substantially that of the exhaust before it reaches its point of contact with the atomized fuel mixture to be treated. For example, superheated air at temperatures ranging from 400 degrees F. to 1500 degrees F. are easily obtained. If it is desired to downwardly modify the maximum temperature of the superheated air discharged by the heater conduit, to bring the same to a point approximating a lower boiling point possessed by the heavy ends of a particular liquid fuel being used, then cooling air may be added to the superheated air in desired amount through the cool air intake member 22, according to the adjustment of the regulating valve 25. This cooling air may range in amount from approximately zero to twenty per cent of the total air content ultimately contained in the fuel mixture delivered to the engine.

As the superheated air, at desired temperature, is drawn, through the Venturi passage 13 of the mixing device 10, the primary atomized liquid fuel mixture from the atomizer device or primary carburetor 5 is drawn through the annular passage 12 and ports 14 thereinto so as to mingle with said superheated air, thereupon flowing through the mixing and expansion chamber 28. The finely atomized fuel delivered from the primary carburetor 5 is thus treated with the superheated air immediately at the point of greatest atomization, so that the fine particles of atomized fuel are readily and immediately mixed with the air at the immediate point of delivery of the superheated air. The atomized liquid fuel is thus brought into intimate contact with superheated air at a temperature approximating the boiling points of the heavier constituents of said liquid fuel, and the heat thus supplied is transferred to the liquid fuel particles so as to quickly and efficiently vaporize the same to produce a rich gaseous fuel mixture.

The rich gaseous fuel mixture, produced in the manner above described, is drawn into the Venturi passage 32 of intake manifold branch 3 through the neck 31, annular passage 30 and ports 33, and is thoroughly mixed with additional cool air which enters through the intake end of said branch 3. Said additional cool air, except at times of starting the engine, ordinarily should approximate in amount above fifty-five per cent of the total air content ultimately contained in the fuel mixture delivered to the engine. The cool air thus added to the rich gaseous fuel mixture, prior to delivery thereof through the intake manifold 2 to the engine cylinders, not only cools down to the mixture to a desired lower intake temperature, but also by increasing the density thereof dilutes the mixture so as to assure more efficient combustion thereof.

While I have specified approximate relative proportions of primary liquid fuel atomizing air, superheated air, and additional diluting air, it will be obvious that modifications of these illustrative relative proportions may be made as desired, and according to the particular grade or kind of liquid fuel to be treated.

From the above description it will be apparent that the novel carburation system of this invention provides a very simple and yet effective means for preparing gaseous fuel mixtures for internal combustion engine operation, especially when the liquid fuel base employed for the mixture comprises a low grade or comparatively heavy oil.

I am aware that many changes could be made in the above described mechanism as well as in the details of the construction thereof, without departing from the scope of this invention, and therefore it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim:—

1. In a carburation system for internal combustion engines having an exhaust manifold and an intake manifold, the combination of an air heater conduit having an intake open to the atmosphere and the body of which is in part externally arranged contiguous to said exhaust manifold and in part internally extending through the same, means to initially atomize liquid fuel, a mixing device in mutual communication with said atomizing means and air heater conduit to receive and mix atomized liquid fuel and superheated air to form a rich vaporized fuel mixture, means connected with said intake manifold to receive said rich fuel mixture and mix added cool air therewith to form the ultimate fuel mixture delivered to the engine through said intake manifold, and means in communication with the discharge portion of said air heater conduit for admitting regulated amounts of cool air to modify the temperature of superheated air discharged from said heater conduit to said mixing device.

2. In a carburation system for internal combustion engines, means to initially atomize liquid fuel, a mixing device having a Venturi passage, means to supply superheated air to said mixing device through said Venturi passage, means to couple said atomizing means with said Venturi passage whereby atomized liquid fuel is drawn into and mixed with said superheated air, and means connected with superheated air supply means for admitting regulated amounts of cool air thereinto to modify the temperature of superheated air discharged to said mixing device.

3. In a carburation system for internal

combustion engines having an exhaust manifold and an intake manifold, the combination of an air heater conduit of relatively great length having an intake open to the atmosphere and the body of which is in part externally arranged contiguous to said exhaust manifold and in part internally extending within the same, means to initially atomize liquid fuel, a primary mixing device in mutual communication with said atomizing means and air heater conduit, an air intake branch connected with said engine intake manifold, a secondary mixing means in receiving communication with said air intake branch and said primary mixing device and in discharging communication with said engine intake manifold, a throttle valve at the engine intake manifold side of said secondary mixing means, and an air admission regulator at the air intake side of said secondary mixing means.

4. In a carburation system for internal combustion engines having an exhaust manifold and an intake manifold, the combination of an air heater conduit having an intake open to the atmosphere and the body of which is in part externally arranged contiguous to said exhaust manifold and in part internally extending within the same, means to initially atomize liquid fuel, a mixing device in mutual communication with said atomizing means and air heater conduit, means connected with said intake manifold to receive fuel mixture from said mixing device and to supply additional air thereto, a throttle valve in said intake manifold above said receiving means, and a fuel mixture by-pass between said mixing device and said intake manifold, said by-pass being connected with the intake manifold on the engine side of said throttle valve.

5. A carburation system for internal combustion engines as defined in claim 4, including means in communication with the discharge portion of said air heater conduit for admitting regulated amounts of cool air to modify the temperature of superheated air discharged from said heater conduit to said mixing device.

6. In a carburation system for internal combustion engines having an exhaust manifold and an intake manifold, the combination of an air heater condit having an intake open to the atmosphere and the body of which is in part externally arranged contiguous to said exhaust manifold and in part internally extending within the same, means to initially atomize liquid fuel, a primary mixing device in mutual communication with said atomizing means and air heater conduit, an air intake branch connected with said engine intake manifold, means for choking the quantity of air admitted to said branch, a secondary mixing means in receiving communication with said air intake branch and said primary mixing device and in discharging communication with said engine intake manifold, a throttle valve in said intake manifold on the engine side of said secondary mixing means, and a fuel mixture by-pass between said mixing device and said intake manifold, said by-pass being connected with the intake manifold on the engine side of said throttle valve.

7. A carburation system for internal combustion engines as defined in claim 6, including means in communication with the discharge portion of said air heater conduit for admitting regulated amounts of cool air to modify the temperature of superheated air discharged from said heater conduit to said primary mixing device.

8. In a carburation system for internal combustion engines having an exhaust manifold and an intake manifold, the combination of an air heater conduit having an intake open to the atmosphere and the body of which is in part externally arranged contiguous to said exhaust manifold and in part internally extending within the same, means to initially atomize liquid fuel, a primary mixing device in mutual communication with said atomizing means and air heater conduit, an air intake branch connected with said engine intake manifold, a secondary mixing means in receiving communication with said air intake branch and said primary mixing device and in discharging communication with said engine intake manifold, and means in communication with the discharge portion of said air heater conduit for admitting regulated amounts of cool air to modify the temperature of superheated air discharged from said heater conduit to said primary mixing device.

In testimony that I claim the invention set forth above I have hereunto set my hand this 21st day of August, 1930.

ERNEST R. GODWARD.