

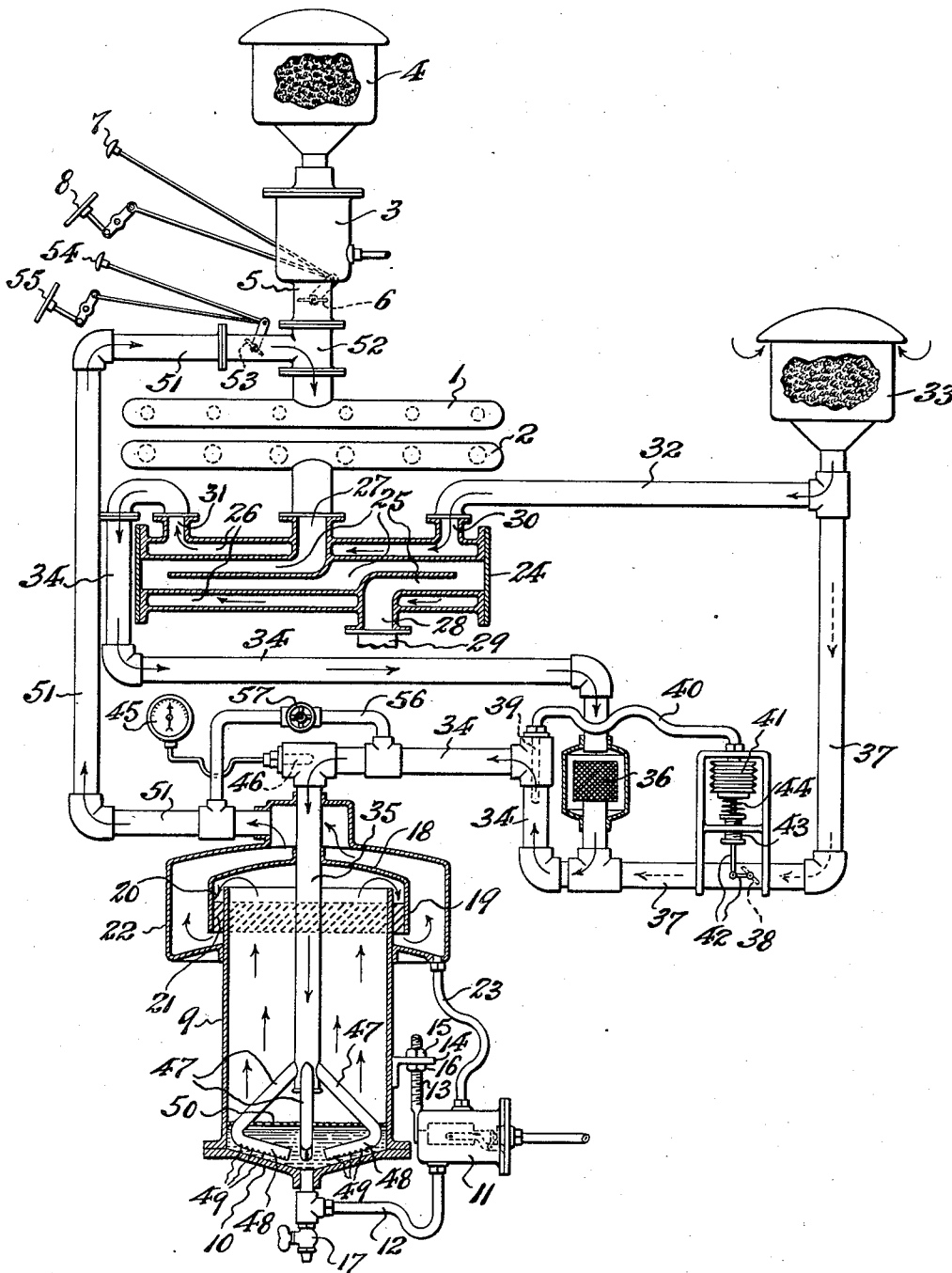
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FUEL CARBURATION SYSTEM

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FUEL CARBURATION SYSTEM

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1 Claim. (Cl. 261-14)

This invention relates to a novel fuel carburation system; and, the invention has reference, more particularly, to a novel multi-fuel carburation system for internal combustion engines.

This invention has for an object to provide in association with the ordinary gasoline carbureter means, for serving a fuel mixture to an internal combustion engine, additional means for vaporizing heavier fuels, such as kerosene and heavier grades of fuel oil, to provide a fuel mixture adapted to be substituted for the gasoline mixture under engine running conditions.

The invention has for another object to provide a fuel carburation system including a novel heavy fuel vaporizer wherein hot air is passed through a body of heavy fuel liquid with vaporizing effect thereupon, means being provided to automatically regulate and control the air temperature to maintain the same at a predetermined required degree, and means being further provided to regulate the volume or head of the heavy fuel liquid, whereby to predetermine the time of contact of the hot air and liquid fuel, to the end that a uniformly stable and correctly proportioned air and fuel vapor mixture is produced and served to the engine cylinders, adequate for efficient operation of the engine at all speeds and loads.

The invention has for another object to provide a heavy fuel vaporizer as above characterized, the construction of which provides novel means for distributively discharging hot air into and for passage through the heavy fuel liquid, and which further provides a novel means for thoroughly mixing and drying the air-vapor mixture prior to delivery thereof to the engine cylinders.

And still further objects of the invention are to provide means for utilizing the waste heat of the engine exhaust gases for heating the air served to the heavy fuel vaporizer, and to provide means for manually controlling the system for shifting from service of an initial gasoline fuel mixture to that of the heavy fuel vapor mixture.

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

The accompanying drawing provides a schematic view of the novel multi-fuel carburation system of this invention, certain parts being shown in section.

In the drawing, the reference character 1 indicates a fuel mixture intake manifold of an internal combustion engine, and 2 indicates the exhaust manifold of said engine.

Connected for communication with said intake manifold 1 is an ordinary carbureter 3 for producing a gasoline fuel mixture; the air intake of said carbureter 3 being equipped with a suitable air cleansing filter 4, in the well known manner.

Mounted within the fuel mixture discharge portion 5 of the carbureter 3 is the usual throttle valve 6, which is subject to optional manipulation by either the hand control 7 or the foot control 8.

The heavy fuel vaporizer of the system comprises a vaporizing chamber 9, preferably provided with a dish-shaped bottom end wall 10, and having an upwardly open top end. The selected relatively heavy liquid fuel is delivered into the bottom end of said vaporizing chamber 9 through a float chamber 11, which is connected with a source of liquid fuel supply (not shown), so as to receive the same therefrom. The liquid fuel is delivered from said float chamber 11 to said vaporizing chamber 9 through an intercommunicating flexible conduit 12. The float chamber operates to automatically maintain the liquid fuel within the vaporizing chamber at a predetermined level. The float chamber 11 is so arranged and mounted relative to the vaporizing chamber that it may be adjustably raised or lowered to vary the level of liquid fuel within the latter, whereby to regulatably increase or decrease the volume or head of liquid fuel therein, for the purposes and with the advantages herein-after more particularly explained; and to this end, said float chamber 11 is carried on a vertically adjustable support, comprising e. g. a screw-threaded suspension rod 13 which extends through an external supporting bracket 14 affixed to said vaporizing chamber, and said rod having upper and lower adjusting nuts 15 and 16, manipulation of which permits vertical adjustment of said float chamber for disposition thereof relative to the vaporizing chamber in a selected liquid fuel level determining position. The connection for coupling said conduit 12 to the bottom of the vaporizing chamber preferably includes a normally closed drain means 17.

Extending over the upper open end of said vaporizing chamber 9 is a diametrically enlarged hood 18, the dependent skirt flange 19 of which overlaps the upper end portion of said vaporizing chamber in concentrically spaced relation thereto, thus providing an annular vapor discharge passage 20. Intersecting said vapor discharge passage 20 are a series of circumferentially spaced oblique vanes 21, which impart a swirling movement to the air and vapor mixture discharging from the vaporizing chamber, whereby to effect turbulence thereof operative to thoroughly mix the air and vapor constituents of the mixture. Surrounding the thus hooded end of the vaporizing chamber is a closed diametrically enlarged fuel mixture collecting and drying chamber 22. In order to balance the pressure within the float chamber 11 with that within the vaporizer, a flexible conduit 23 is communicatively connected between the interior of said collecting and drying

chamber 22 and the interior of said float chamber 11. Said conduit 23 also serves to drain back to the float chamber any vapor condensation which may possibly form and accumulate within said collecting and drying chamber.

The means for delivering hot air to the vaporizing chamber 9, in a preferred arrangement thereof, comprises an air heater 24, the interior of which is suitably partitioned to provide an exhaust gas chamber or compartment 25 and a fresh air chamber or compartment 26. Said heater is provided with an exhaust gas intake 27 adapted to be communicatingly connected with the exhaust manifold 2 of an internal combustion engine, to deliver hot exhaust gases into said exhaust gas chamber or compartment 25, and an exhaust gas outlet 28 to discharge exhaust gases from the latter to the atmosphere through an exhaust pipe 29. Said heater is further provided with an air intake 30 leading into the air chamber or compartment 26, and an air outlet 31 discharging from the latter. Fresh atmospheric air is delivered to the air chamber or compartment 26 of the heater 24 through a cold air delivery conduit 32, which preferably communicates with the atmosphere through an attached air cleansing filter 33. Cold air delivered into the heater 24 is heated, and the resultant hot air is discharged through a hot air delivery conduit 34, which extends to and is coupled with a hot air discharge manifold 35 entered in the vaporizing chamber 9. As a safety factor, the line of said hot air delivery conduit 34 may include, if desired, a spark arrester means 36 of suitable construction.

Means is provided for both modifying the temperature of the hot air delivered into the vaporizer and automatically maintaining the same at a selected temperature suitable for vaporization of a given grade of liquid fuel desired to be vaporized within the vaporizer. To this end a cold air by-pass conduit 37 extends from the main cold air delivery conduit 32 to communicate with the hot air conduit 34, in advance of the point of connection of the latter with the vaporizer hot air discharge manifold 35. Included in the line of said cold air by-pass conduit 37 is a temperature control valve 38 adapted to be actuated by means which is responsive to the temperature of the hot air flowing to the vaporizer through said hot air conduit 34, as e. g. by a trapped expansible gas confined in a gas bulb 39 which is exposed to contact by the hot air traversing said hot air conduit 34. Said bulb is connected, through pipe 40, in communication with an adjustable spring contracted bellows 41, expansion of which opens the valve 38, and contraction of which closes said valve, through interconnecting linkage 42. An adjustable thrust nut 43, or other suitable means, is provided for regulating the tension of the bellows contracting spring 44, whereby to adjust the temperature control valve mechanism, so as to obtain operative response thereof to a desired selected temperature, as will be hereinafter explained. In order to visibly indicate the temperature of the hot air which is delivered to the vaporizer chamber 9 through the manifold 35, a thermometer 45 may be provided, the same being operatively connected to a thermometer bulb 46 which is exposed to contact by the hot air entering said manifold 35.

The hot air discharge manifold 35, which serves the vaporizer, extends axially downward through the collecting and drying chamber 22,

hood 18, and into the interior of the vaporizer chamber 9. At its lower end said manifold 35 is provided with a plurality of radial discharge arms 47, the lower ends of which terminate in inwardly directed nozzle members 48, which are closely spaced in substantially parallel relation to the bottom end wall 10 of the vaporizer chamber 9. These nozzle members 48 are provided, on their underside and along the lengths thereof, with a multiplicity of small discharge outlets 49. Said nozzle members 48 being submerged in and at the bottom of the body of liquid fuel supplied to the vaporizer chamber 9, function to distributively discharge hot air into said fuel body, so that the hot air will divide into a multiplicity of small streams adapted to bubble upwardly through said liquid fuel with vaporizing effect thereupon. Arranged within the vaporizing chamber 9, above the level of the liquid fuel body contained therein, is a transverse perforate anti-splash plate 50, or equivalent pervious body, which not only arrests undue splashing or violent movement of the liquid fuel (especially when the system is used in connection with the internal combustion engine of an automotive vehicle), but also serves to further break up or more finely subdivide the air and vapor bubbles discharged into and through the upper regions of the vaporizing chamber 9.

The air-vapor mixture generated within the vaporizer is discharged therefrom through a fuel mixture delivery conduit 51, which leads out of the top of the collecting and drying chamber 22, and extends to a coupling connection 52 which communicates with the engine intake manifold 1, at a point between the latter and the discharge portion 5 of the gasoline carburetor 3. Mounted within said coupling connection 52 is a second throttle valve 53, which is subject to optional manipulation by either the hand control 54 or the foot control 55.

Means is provided for testing the heavy fuel air-vapor mixture, the same comprising a shunt conduit 56 connected in communication between the hot air delivery conduit 34 and the fuel mixture delivery conduit 51, so as to by-pass the vaporizer. Arranged in the line of said shunt conduit 56 is a manually actuatable normally closed valve 57. The manner of using this testing means will be subsequently explained.

In order to prevent loss of heat by radiation from the vaporizer, it is desirable to cover the collecting and mixing chamber 22 and the vaporizing chamber 9 thereof with an insulating jacket (not shown), such e. g. as an asbestos jacket or other suitable insulating material. The heater 24 and any other parts of the system desired to be protected from heat losses by radiation may be likewise insulated.

In the use and operation of the system, when starting, from cold condition, an internal combustion engine served thereby, the throttle valve 53 is closed, and the throttle valve 6 is opened to admit a gasoline fuel mixture to the engine intake manifold 1, whereby to start and warm up the engine with such readily volatile fuel. After an initial period of engine operation under such conditions, sufficiently long to produce effective operation of the heater 24 by engine exhaust gases, the throttle 53 is partly opened, thereby admitting excess air to the gasoline mixture, to induce circulation of air through the vaporizer, whereupon cold air is delivered through the cold air delivery conduit 32 to said heater 24. As the cold air passes through the heater 24, its tem-

perature is considerably elevated, and it flows onward, as a hot air stream, from the heater through the hot air delivery conduit 34 to the vaporizer manifold 35 to issue from the nozzle members 48 thereof, so as to bubble upwardly through the liquid fuel content of the vaporizing chamber 9 with vaporizing effect thereupon, whereby to generate a combustible or explosive air-vapor mixture for delivery through the fuel mixture delivery conduit 51 and intake manifold 1 to the engine cylinders.

As soon as the vaporizing equipment is warmed up, and properly proportioned air-vapor mixture obtained, the engine will increase in speed, whereupon the throttle valve 6 is fully closed to shut off the gasoline fuel mixture, and thereafter the throttle valve 53 may be manipulated so as to controllably operate the engine solely by the delivered air-vapor mixture produced in and supplied from the vaporizing chamber 9.

A mixture of just the right amount of air and fuel vapor is obtained, according to the grade of liquid fuel used, by adjusting the level or head of liquid fuel in the vaporizing chamber 9, and by regulating and maintaining the temperature of the hot air delivered to and through said liquid fuel at a predetermined degree best adapted for vaporization of the selected grade of the latter. For instance, when dealing with kerosene as the selected liquid fuel, as compared with heavier grades of fuel, such e. g. as light fuel oils, the head of liquid fuel in the vaporizing chamber 9 may be lowered, and the temperature of the hot air reduced, since less time of contact of the air with such liquid fuel and a lower temperature would be adequate to produce the required operative air-vapor mixture. With grades of fuel oil heavier than kerosene, the level or head of liquid fuel in the vaporizing chamber should be raised to give longer contact of hot air with said liquid fuel as it bubbles therethrough, and at the same time the temperature of the hot air should be adjusted and maintained at a selected higher degree best adapted to vaporize such heavier fuel liquid. For example, the temperature of the hot air for vaporizing kerosene should approximate 300 degrees F., while for vaporizing light fuel oil should be raised to 390 to 400 degrees F.

Regulating or adjusting the level or head of liquid fuel within the vaporizing chamber 9 is accomplished by raising or lowering the float chamber 11 as required. Modification and control of the temperature of the hot air delivered to the vaporizing chamber is accomplished by admitting to the hot air stream, by operation of the temperature control valve 38, a controlled or measured amount of cold air sufficient to reduce the temperature of the air, ultimately delivered to the vaporizing chamber 9, to the desired degree. To thus modify and control the hot air temperature, the bellows contracting pressure of the spring 44 is adjusted so as to hold the bellows 41 against extension until expansion of the fluid in the communicating bulb 39 and bellows 41 by rise of temperature of the hot air in contact with the former, beyond a desired predetermined degree, overcomes the spring resistance, and thereby allows the bellows to extend and open the valve 38. Opening of the valve 38 admits sufficient cold air for admixture to the hot air stream as will drop and hold the temperature of the latter to the desired degree. It will be obvious that this operation, once the bellows spring adjustment is made, will be automatic. Inspec-

tion of the thermometer 45 will visibly advise as to the temperature of the hot air entering the vaporizing chamber 9. Proper adjustment of liquid fuel level or head and proper regulation of the temperature of the hot air delivered into the vaporizing chamber will assure a proper combustible or explosive air-vapor mixture for engine operation at all speeds, without necessity for supplying additional air to such produced fuel mixture.

Test of the efficiency of the air-vapor mixture delivered to the engine may be made by opening the manual valve 57 to allow heated air to be drawn into the air-vapor mixture. Assuming that the temperature of the hot air has been modified and held to a proper degree suitable to the particular grade of liquid fuel in use, if, upon admitting additional heated air into the air-vapor mixture, the engine speeds up, this indicates that the mixture is too rich, correction of which may be made by closing the valve 57 and then lowering the level or head of liquid fuel in the vaporizing chamber 9 so as to suitably lean the mixture.

Having now described my invention, I claim:

A liquid fuel vaporizer apparatus comprising a vaporizing chamber having a closed bottom and an open top and adapted to contain a volume of a selected volatilizable liquid fuel, means to deliver hot air for passage into and upwardly through the liquid fuel contained in said vaporizing chamber, a diametrically enlarged hood extending over the open top of said vaporizing chamber with dependent sides thereof overlapping the sides of the latter in concentrically spaced relation thereto whereby to provide a downwardly open gaseous mixture discharge passage leading out of said vaporizing chamber, oblique vanes intersecting said discharge passage operative to impart swirling movement to the gaseous mixture outgoing therethrough, a closed diametrically enlarged annular collection and drying chamber surrounding said hood and the upper end of said vaporizing chamber in concentrically spaced relation thereto adapted to receive the discharged gaseous mixture, a fuel mixture delivery conduit leading away from said collection and drying chamber, means to deliver liquid fuel to said vaporizing chamber including a float controlled valve chamber disposed exteriorly of the vaporizing chamber, a conduit in communication with and between the bottom interior of said drying and collection chamber and the interior of said float controlled valve chamber, whereby to balance the pressure within the latter chamber with that within the vaporizer chamber and to additionally serve to drain back to said float controlled valve chamber any liquid fuel condensation accumulating in said drying and collection chamber, means to control the temperature of hot air delivered through the liquid fuel within the vaporizing chamber and the time of contact of said air with said liquid fuel to that best adapted for vaporizing a selected given grade of liquid fuel, said means comprising means to automatically regulate the temperature of said hot air, and means to mount said float controlled valve chamber subject to substantial vertical adjustment whereby to selectively vary the level or head of liquid fuel within the vaporizing chamber and thus the time of contact therewith of the hot air discharged into said liquid fuel for passage therethrough.

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