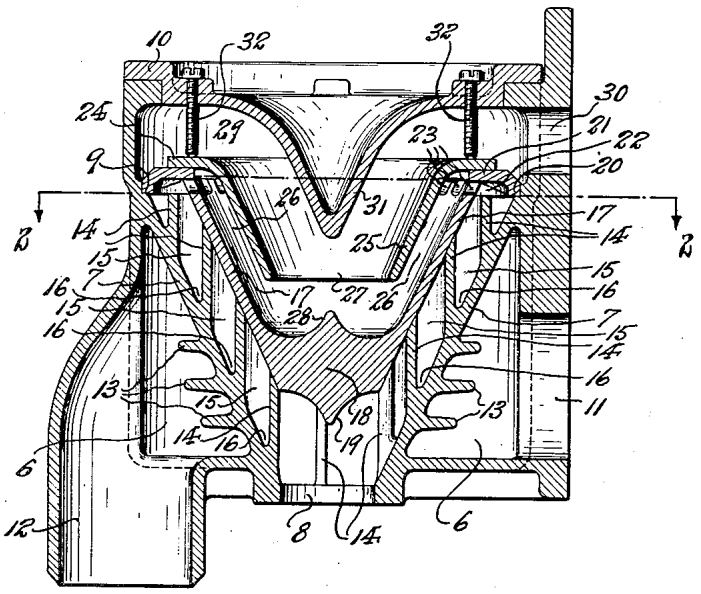
Aug. 14, 1934. E. R. GODWARD 1,970,169

LIQUID FUEL MIXTURE VAPORIZER

Filed Oct. 4, 1932

Fig. 1



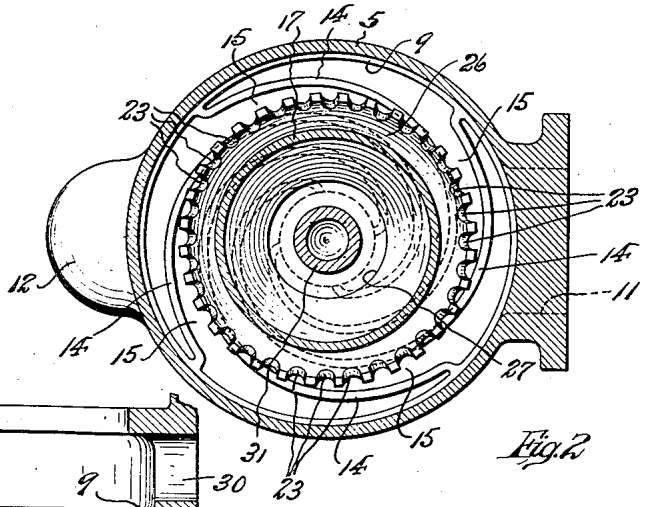
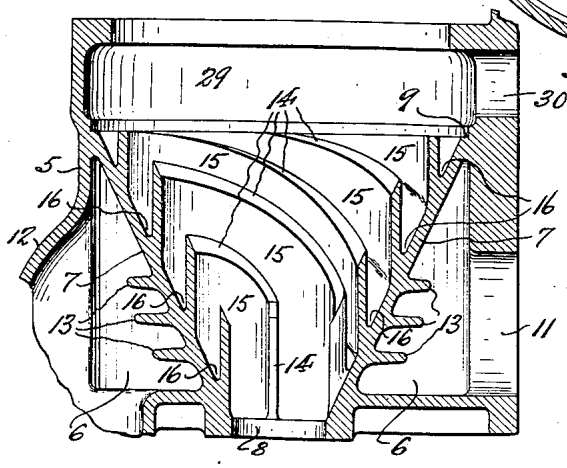


Fig. 2

Fig. 3



INVENTOR
Ernest R. Godward,
BY
George S. Richards
ATTORNEY

Patented Aug. 14, 1934 1,970,169

# UNITED STATES PATENT OFFICE

1,970,169

## LIQUID FUEL MIXTURE VAPORIZER

Ernest R. Godward, New York, N. Y.

Application October 4, 1932, Serial No. 636,119

3 Claims. (Cl. 261—12)

This invention relates to improvements in apparatus for vaporizing fuel mixtures, such e. g. as are supplied to internal combustion engines; and the invention has reference, more particularly, to a novel vaporizer apparatus adapted to submit fuel mixtures to the effects of expansion and gyratory movement tending to separate therefrom unvaporized wet fuel particles, and thereupon subject the same to heat by the deposit thereof upon hot supporting surfaces to thus assure vaporization thereof for return to the fuel mixture stream.

This invention has for its principal object to provide a simple and efficient vaporizer apparatus in which an atomized mixture of liquid fuel and air is caused to travel with gyratory movement through a plurality of ascending spiral passages or paths of increasing orbit and contiguous, on one side, to heated outer wall surfaces and, on the other side, contiguous to relatively cooler inner wall surfaces, whereby the mixture is subjected to expansion and centrifugal action so as to separate therefrom relatively heavy wet fuel particles and deposit the same upon the hot outer walls subject to the vaporizing effect of heat application thereto; while the lighter air and volatilized fuel of the mixture is prevented from overheating by contact with the relatively cool inner walls of the passages, thus maintaining a maximum cooling effect upon the air constituent of the mixture, and a maximum heating effect upon the wet unvaporized fuel particles.

Another object of this invention is to provide means beyond the spiral vaporizing passages of the apparatus for guiding the stream of vaporized fuel mixture discharged therefrom in flowing contact with the inner walls of said passage for cooling effect thereupon; means being provided for thereafter guiding the vaporized fuel mixture to and discharging the same from the outlet of the apparatus for delivery through suitable manifold leads to the internal combustion engine served by the apparatus.

Another object of this invention is to provide a novel construction of vaporizer apparatus characterized as above indicated, which is of exceedingly simple mechanical construction, involving the use and assembly of a minimum number of parts, which may be produced by simple casting operations, all to the end that the apparatus may be economically produced and rapidly and easily assembled with a minimum expenditure of time and labor.

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

An illustrative embodiment of this invention is shown in the accompanying drawing, in which:—

Fig. 1 is a vertical longitudinal sectional view of a vaporizer apparatus according to this invention; Fig. 2 is a horizontal section of the same, taken on line 2—2 in Fig. 1; and Fig. 3 is a vertical section similar to that of Fig. 1, but with certain internal parts of the apparatus removed to disclose the means providing the plurality of spirally ascending vaporizing passages thereof.

Similar characters of reference are employed in the said views, to indicate corresponding parts.

Referring to the drawing, the reference character 5 indicates the main casing or pot. Said casing or pot is preferably formed by casting, in which case its lower portion is cored to provide an annular heating chamber 6 bounded on its inner side by an inverted conical wall 7 which converges upon an intake opening 8 at the bottom of the casing or pot, to which intake opening may be suitably connected any desired form of liquid fuel atomizing carburetor (not shown) for delivering an initial fuel mixture to the vaporizing apparatus. The upper end of said inverted conical wall 7 converges upon and joins the side walls of said casing or pot 5, an internal annular seating shoulder 9 being provided at the juncture of these walls. The upper end of the casing or pot 5 is open, the opening thus provided being closed by a removable cover plate 10. Formed in connection with the wall of the casing or pot 5, at one side thereof, is an inlet opening 11, to which may be suitably connected a conduit (not shown) for delivering a heating medium into said heating chamber 6, which heating medium may comprise the hot exhaust gases from the internal combustion engine which is served by the vaporizing apparatus. Formed in connection with the wall of the casing or pot 5, at the opposite side thereof, is an outlet means 12 for discharging the heating medium from said heating chamber 6. Formed in connection with the outer or heating chamber side of said inverted conical wall 7 are a plurality of vertically spaced annular fins 13 which project into said heating chamber 6, and which provide said wall 7 with an increased area of surface for contact with the heating medium

circulated through said heating chamber, so as to thereby increase the heat absorption capacity and heat conduction efficiency of said wall 7.

Formed in connection with the inner side of said inverted conical wall 7 are a plurality of upright partition flanges 14 of ascending spiral form which define ascending spiral passages 15 leading upwardly from said intake opening 8 and contiguous to said inverted conical wall 7. Owing to the inverted conical shape of said wall 7, the passages 15 thus formed are of increasing orbit as they ascend whereby the fuel mixture stream directed therethrough is both subjected to expansion, as the capacity of the passages progressively increases, as well as to a gyratory movement imparting a centrifugal effect upon the relatively heavy unvaporized wet fuel particles carried by said fuel mixture stream. The said partition flanges 14, as illustrated in the accompanying drawing, are shown to be four in number having their terminals spaced ninety degrees apart around the interior of said inverted conical wall 7, thus providing four parallel spirally ascending passages 15. It will be obvious that the number of said partition flanges 14, and consequently the number of passages 15 defined thereby, may be increased or decreased, although four thereof is believed to be the most satisfactory number, since such number most satisfactorily divides the fuel mixture stream into controlled moving volumes each adequately gyrated to induce the desired centrifugal action, and each subjected to an adequate area of surface at maximum heat provided by the hot inverted conical wall 7, while at the same time the undue restriction of fuel mixture stream movement is avoided. Said partition flanges 14 provide vertical bounding walls along the passages 15, and since said partition flanges 14 have their lower margins integrally connected with the heated inverted conical wall 7, heat from the latter is transferred by conduction upwardly through said partition flanges 14 which are therefore subjected to a graduated heat, being hottest at their junctures with said conical wall 7 and of diminishing temperature toward their upper margins. This arrangement permits of gravitation of wet fuel particles deposited upon the surfaces of said partition flanges toward zones of increasing heat, whereby the degree of heat best suited to vaporize given wet fuel particles is met with by the latter during descent thereof. Owing to the acute angular relation of said partition flanges 14 to said inverted conical wall 7, troughs or channels 16 are formed at the junctures of these parts, which catch the heavy or less volatile ends of the liquid fuel so as to subject the same to the maximum heat of the inverted conical wall 7, such liquid fuel being permitted to slowly descend these troughs or channels 16 toward the intake opening 8, so that in the event they are not vaporized before reaching the latter point, the same may flow back into contact with the inrushing initial fuel mixture stream so as to be resubmitted to the indicated vaporizing processes until finally returned to the mixture in vaporized form.

To close the inner sides and thus complete the vaporizing passages 15 an internal inverted conical wall member 17 is provided for insertion within the casing or pot 5 to engage or abut the upper margins of said partition flanges 14. At its lower end, said wall member 17 terminates in an end closure 18 having an external deflector portion 19 spaced above and opposed to said intake opening 8, and functioning to deflect the in-rushing stream of fuel mixture into the lower or receiving ends of said vaporizing passages 15.

Seated upon the seating shoulder 9 is the skirt 20 of a closure ring 21, the inner marginal portion of which abuts the upper end of said internal inverted conical wall member 17, thus defining an annular discharge passage 22 with which the upper ends of the vaporizing passages 15 severally communicate. The upper marginal portion of said internal inverted conical wall member 17 is provided with a multiplicity of indented openings or ports 23 through which the vaporized fuel mixture discharged from the vaporizing passages 15 and discharge passage 22 escapes.

Supported by its suspension flange 24 upon the inner marginal portions of said closure ring 21 is an annular guide member 25 of inverted conical form, which enters the upper open end of said inverted conical wall member 17 so as to be concentric thereto and spaced therefrom to provide a descending guide passage 26 contiguous to said inverted conical wall member 17, but terminating short of the end closure 18 thereof, to which latter part the opening 27 at the lower end of said guide member 25 is opposed. Said end closure 18, where opposed to said opening 27, is preferably formed to provide a conical deflector boss 28 to direct the vaporized fuel mixture stream emerging from said guide passage 26 upwardly through said opening 27 and into the discharge chamber 29 provided within the upper end of the casing or pot 5, and from which discharge chamber leads the vaporizer outlet opening 30, which is connected in communication with the intake manifold (not shown) of the internal combustion engine served by the vaporizer. If desired, the cover plate 10 of the casing or pot 5 may be provided with inverted deflector cone 31.

After the internal inverted conical wall member 17, the closure ring 21 (which may be in two or more sections) and guide member 25 have been inserted within the casing or pot 5, in their cooperative assembled relations with the latter and each other, and the cover plate 10 is applied and secured to the casing or pot, retaining screws 32 are screwed through said cover plate 10 into holding relation to the inserted structures to thereby retain the same in their above-described operative assembled relations.

In the operation of the apparatus, as the initial fuel mixture is delivered through the intake opening 8 it is deflected into the lower ends of the vaporizing passages 15 through which the fuel mixture ascends. Due to the increasing capicity of the passages 15, the fuel mixture is permitted to expand, and due to the spiral path of the passages the fuel mixture is also gyrated with centrifugal effect upon the relatively heavy unvaporized wet fuel particles suspended therein. The centrifugal action tends to throw such wet fuel particles against the upstanding surfaces of the partition flanges 14 for deposit thereon. These partition flanges 14, being heated by conduction from the hot wall 7, subject the deposited wet fuel particles to heat, and as these wet particles descend, under gravity, the surfaces of said partition flanges they will be sooner or later brought into contact with that amount of heat which is requisite for vaporization thereof; the last volatile portions of

the deposited wet fuel finally reaching the hot wall 7 to be there subjected to maximum heat and vaporized. The air constituent and the volatilized fuel constituent of the mixture, being lightest in weight, will be least affected by centrifugal force and will tend to flow contiguous to the inner walls of the passages 15 provided by the inverted conical wall member 17. This latter wall is comparatively cool, and consequently will tend to prevent excess heating of the air constituent of the mixture, which is a very desirable thing. In order to assure the maintenance of said wall member 17 at a comparatively low temperature, the vaporized fuel mixture stream is caused, after discharge from the vaporizing passages 15, to pass through the descending guide passage 26 in flowing contact with said wall 17 before being finally diverted for discharge from the vaporizer. It will thus be apparent that a very efficient vaporizing function is attained in the use of the novel vaporizer apparatus of this invention, in connection with which all the factors making for rapid and complete vaporizing of the wet fuel content of an initial mixture are availed of: viz. expansion of the initial fuel mixture; centrifugal effect upon the mixture to separate unvaporized wet fuel therefrom; application of graduated heat to separated wet fuel under gravitational conditions permitting the latter to seek that degree of heat best suited to its vaporization; a time factor, whereby the length of the spiral fuel passages allow sufficient time for effective centrifugal separation with resultant heat vaporization; and finally the provision of means whereby differential temperature conditions may be made to prevail at the inner and outer sides of the vaporizing passages, to the end that maximum cooling effect upon the air constituent of the mixture and maximum heat effect upon the heavy fuel constituents is attained. In addition to these factors another is availed of, to wit, the vaporizing effect of the friction of the moving mixture stream upon separated wet fuel as deposited and supported in the presence of the mixture stream.

All the above advantageous functionings are attained in the instant apparatus by an exceedingly simple mechanical structure comprising but few non-moving parts and those capable of exceedingly easy and rapid assembly.

I am aware that some changes could be made in the apparatus as above described and as illustrated in the accompanying drawing, as well as in the details of its parts, without departing from the scope of this invention; it is therefore 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. A fuel mixture vaporizer apparatus, comprising concentrically spaced inverted conical wall members, upstanding spiral partitions extending between said wall members to form a plurality of spirally ascending vaporizing passages therebetween, the lower ends of said partitions being conductively connected with the outer conical wall member and the upper ends of said partitions being in contact with said inner conical wall member, means to heat the outer conical wall member, means to conduct vaporized fuel mixture when discharged from said passages in flowing contact with the inner conical wall member with cooling effect thereupon, and means to thereafter receive said vaporized fuel mixture for final discharge from the apparatus.

2. A fuel mixture vaporizing apparatus, comprising a casing having internally thereof a main inverted conical wall member so related thereto as to provide a heating chamber externally surrounding said wall member, a second inverted conical wall member inwardly and concentrically spaced relative to said main wall member, upstanding spirally disposed partitions extending between said main and second wall members to form a plurality of spirally ascending vaporizing passages therebetween, said casing having a fuel mixture intake opening communicating with the lower ends of said vaporizing passages, means to provide an annular discharge passage communicating with the upper ends of said vaporizing passages, said second wall member having outlet ports communicating with said annular discharge passage, means to conduct vaporized fuel mixture when discharged from said annular discharge passage in flowing contact with said second wall member with cooling effect thereupon, and said casing having at its upper end means to collect and discharge vaporized fuel mixture from the apparatus.

3. A fuel mixture vaporizing apparatus, comprising a casing having internally thereof a main inverted conical wall member so related thereto as to provide a heating chamber externally surrounding said wall member, a second inverted conical wall member inwardly and concentrically spaced relative to said main wall member, upstanding spirally disposed partitions extending between said main and second wall members to form a plurality of spirally ascending vaporizing passages therebetween, said casing having a fuel mixture intake opening communicating with the lower ends of said vaporizing passages, means to provide an annular discharge passage communicating with the upper ends of said vaporizing passages, said second wall member having outlet ports communicating with said annular discharge passage, an inverted conical guide ring inwardly and concentrically spaced relative to said second wall member to cause vaporized fuel mixture discharged from said annular discharge passage to flow contiguous to said second wall member with cooling effect thereupon, means to deflect said vaporized fuel mixture upwardly through said guide ring, and said casing having at its upper end means to collect and discharge the vaporized fuel mixture from the apparatus.

ERNEST R. GODWARD.