April 22 , 1924. 1,490,921

E. R. GODWARD

VAPORIZER

Filed May 3, 1923 3 Sheets-Sheet 1

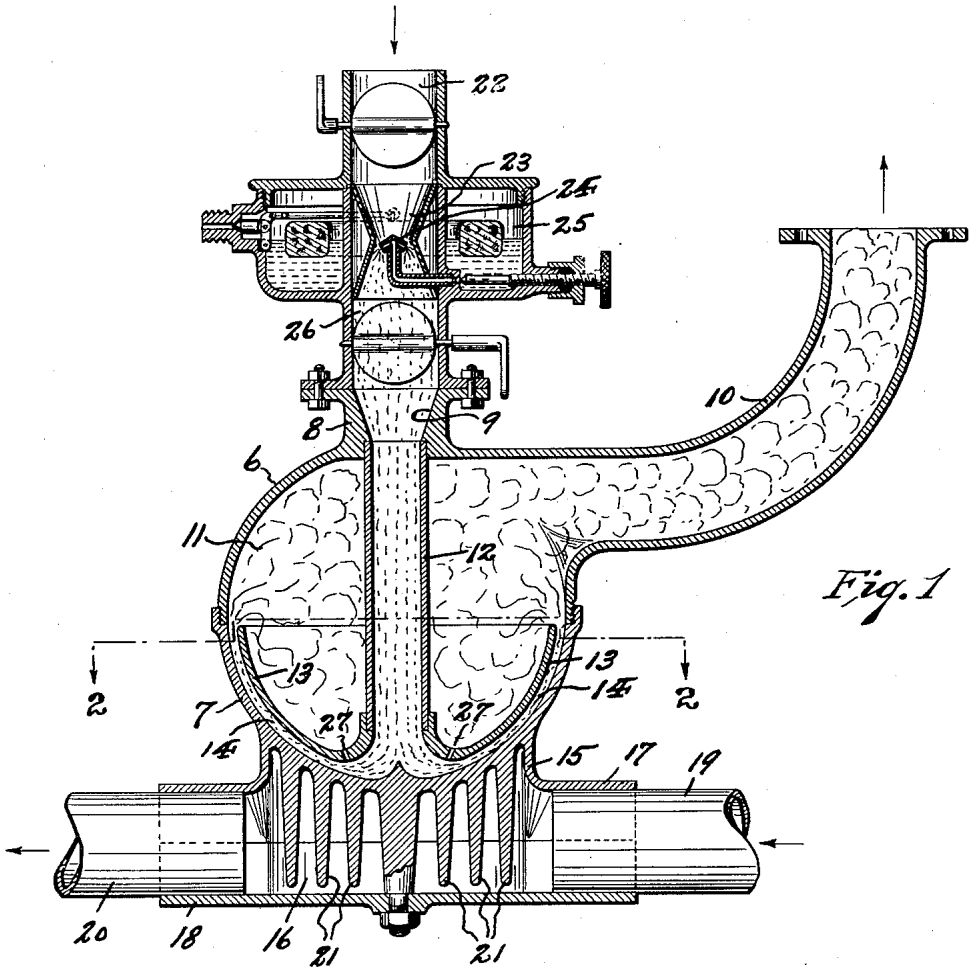

Fig. 1

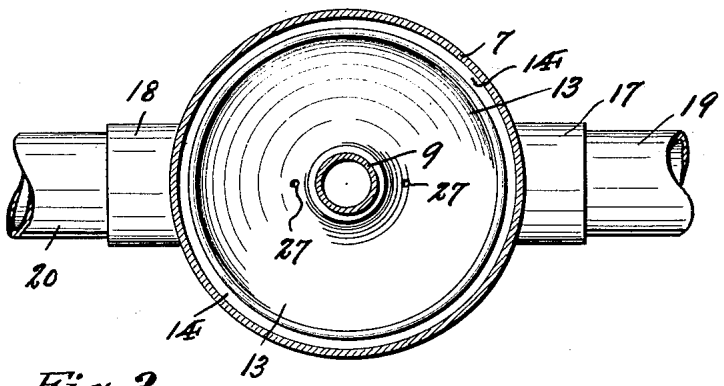

Fig. 2

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VAPORIZER

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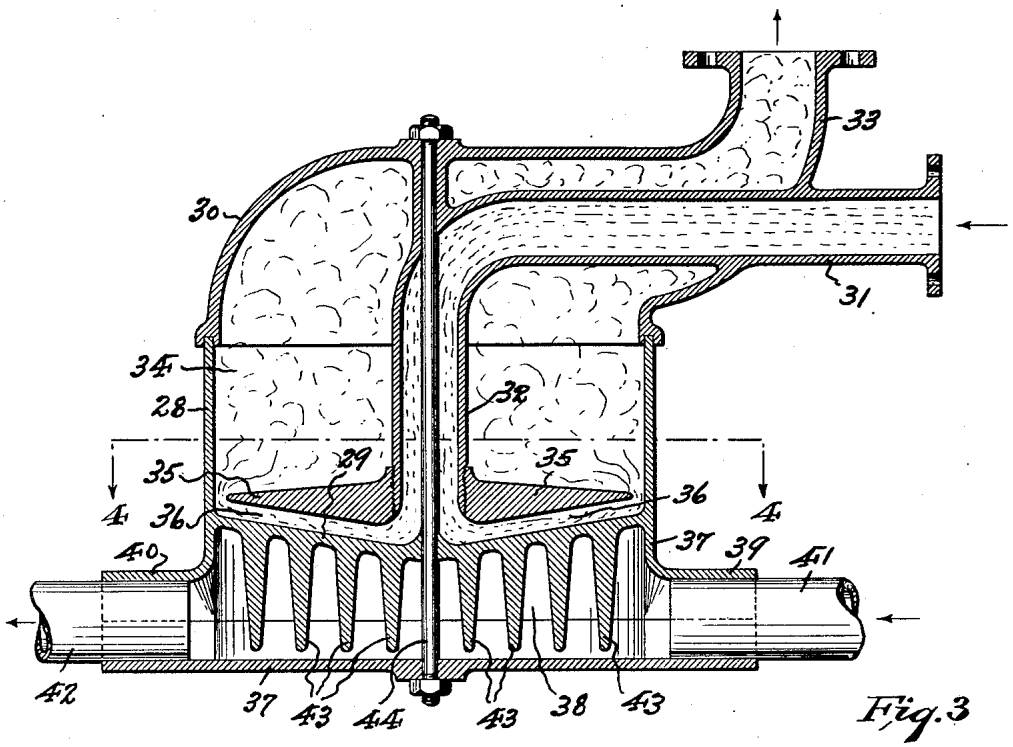

Fig. 3

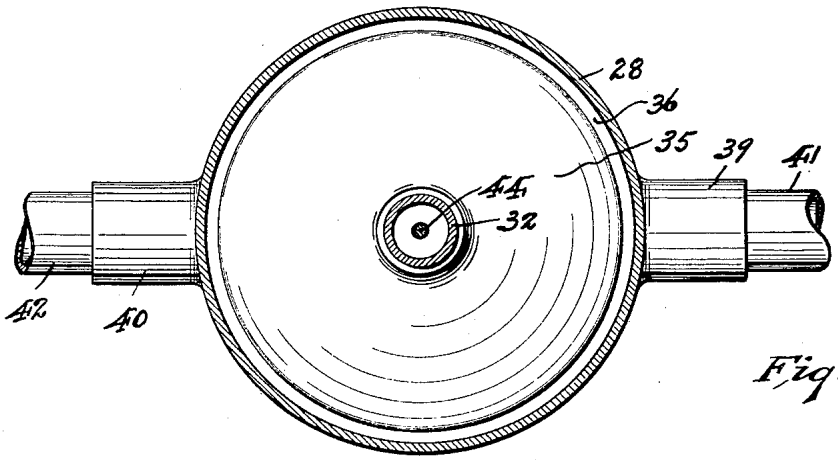

Fig. 4

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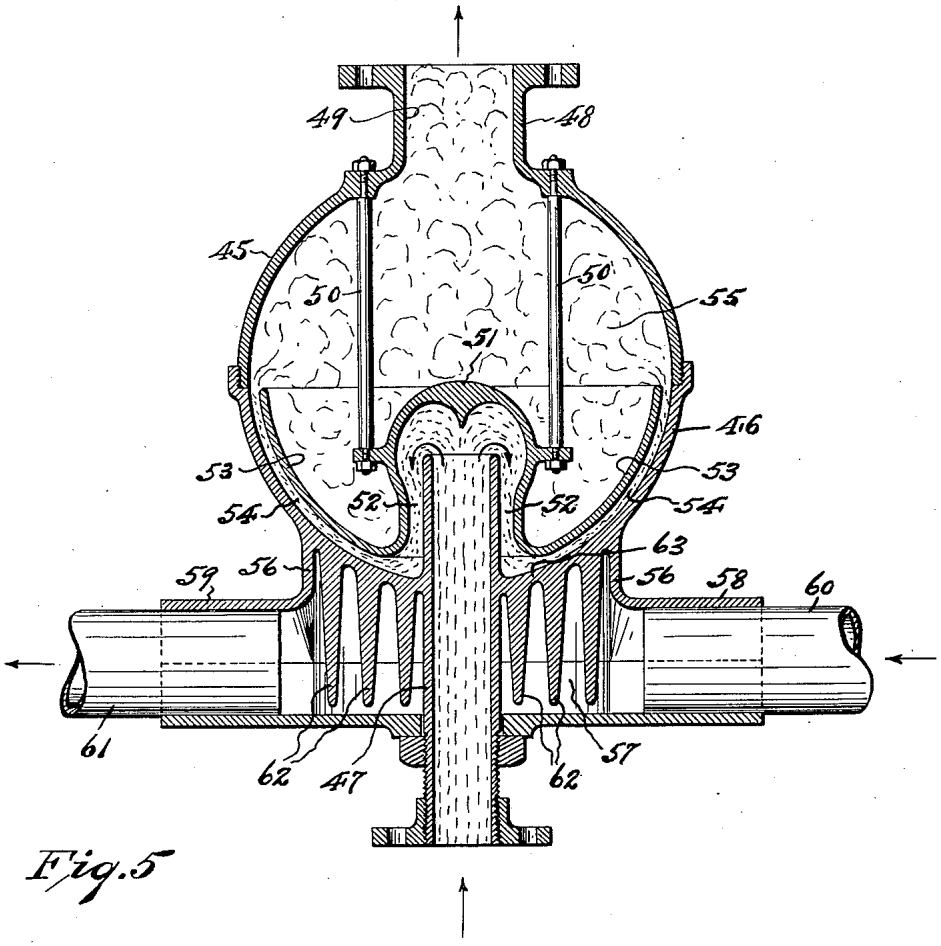

Fig. 5

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Patented Apr. 22, 1924. 1,490,921

UNITED STATES PATENT OFFICE.

ERNEST R. GODWARD, OF NEW YORK, N. Y.

VAPORIZER.

Application filed May 3, 1923. Serial No. 636,340.

To all whom it may concern:

Be it known that I, ERNEST R. GODWARD, a subject of the King of Great Britain, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Vaporizers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to characters of reference marked thereon, which form a part of this specification.

This invention relates, generally, to improvements in fuel vaporizers for use in connection with internal combustion engines, and for other uses; and, the invention has reference, more particularly, to a device adapted to deal with carburetted air or the ordinary fuel mixture which is produced and delivered by any well known type of carbureter or mixing device, to the end that the liquid fuel element of the mixture may be subjected to substantially complete vaporization and gasification before being finally delivered to the point of use, as e. g. the cylinders of an internal combustion engine.

This invention has for its principal object to provide a simple apparatus, for connection between a carbureter or fuel and air mixing device and the apparatus to which the combustible fuel is to be ultimately delivered, whereby the fuel mixture is subjected to the influences of heat applied thereto in an especial manner to aid in the complete vaporization of the liquid fuel element, and also to the effects of expansion whereby the air element and the vaporized fuel element are caused to more intimately unite and homogenize to the end that a resultant gaseous fuel is obtained which is readily and substantially completely combusted in use, all as will be more fully set forth in the following specification.

The invention is clearly illustrated in the accompanying drawings, in which:—

Figure 1 is a vertical longitudinal section of an apparatus made according to and embodying the principles of the present invention, a carbureter element being shown in connection therewith; Figure 2 is a horizontal section through the same, taken on line 2—2 in said Figure 1.

Figure 3 is a vertical longitudinal section of a somewhat modified form of apparatus, which still embodies, however, the general principles of my present invention; and Figure 4 is a horizontal section through the same, taken on line 4—4 in said Figure 3.

Figure 5 is another vertical longitudinal section of a third form of my apparatus made according to the present invention.

Similar characters of reference are employed in all of the hereinabove described views, to indicate corresponding parts.

Referring now to said drawings, I have shown in Figures 1 and 2 thereof one form of vaporizer embodying the principles of my present invention, the same comprising a casing or shell, preferably of spherical shape. The said casing or shell is preferably made in two parts consisting of an upper casing member 6 and a lower casing member 7 which are suitably connected together. Formed in connection with the upper end of said upper casing 6 is a flanged neck 8 providing an intake opening 9, and also connected with the upper casing 6 is a suitable discharge member or outlet conduit 10 which communicates with the interior expansion chamber 11 provided by the enclosed space within the casing or shell. Connected with the inner end of the intake opening 9 is an intake pipe or conduit 12 which extends vertically downward through the interior of said casing or shell. Connected with the lower end of said intake pipe or conduit 12 is a semi-spherical plate or spreader flange 13 which substantially conforms to the contour of the lower casing member 7, but which is spaced from the inner wall surfaces thereof to provide an annular passage 14 communicating with the lower discharge end of said intake pipe or conduit 12 and leading into the expansion chamber 11. Due to its increasing diameter and spread this annular passage 14 gradually increases in area and cubic capacity from the intake pipe or conduit 12 toward its point of discharge into the expansion chamber 11.

Connected with the under side of said lower casing member 7 is a hot-box 15 providing a heat transfer chamber 16, having in communication therewith an intake mem-

ber 17 and an outlet member 18, to which may be connected suitable conduits 19 and 20 for respectively passing into and discharging from said heat transfer chamber 16 a suitable heating medium, such e. g. as the exhaust gases from an internal combustion engine. That portion of the under side of said lower casing member 7, which is disposed at the upper end of said heat transfer chamber 16, is provided with a plurality of depending heat conducting fingers or projections 21, which receiving the heat from the medium circulated in said heat transfer chamber, aid in conducting the same to the bottom of said lower casing member 7 to thus permit the latter to function as a hot plate which bounds the under side of said annular passage 14.

Connected with said flanged neck 8 of said upper casing member 6 is a carbureter mechanism having an air intake 22, a Venturi mixing passage 23 in which is located a suitable fuel jet 24, a float-controlled fuel reservoir 25 for supplying said jet 24, and a discharge passage 26 which communicates with the intake opening 9 and the intake pipe or conduit 12 of the vaporizer. It will be understood, however, that I do not limit myself to the use of a carbureter mechanism of any specific detail construction, since the carbureter element may comprise any desired specific form of mechanism which functions to produce and deliver to the vaporizer a mechanical mixture of air and liquid fuel.

The operation of the vaporizer embodying the principles of construction above set forth, is as follows:—

For the sake of illustration it may be assumed that the discharge member or outlet conduit 10 of the vaporizer is connected with the intake manifold of an internal combustion engine, so that the suction effects of the engine pistons will depress atmospheric pressure within the vaporizer and the carbureter mechanism connected with the latter, to produce the popularly termed suction whereby the initial fuel charge is formed at the carbureter and caused to move through the vaporizer and finally into the engine cylinders. In this manner a mixture of liquid hydrocarbon or distillate fuel and air produced by ordinary carburation methods is discharged into the intake opening 9 and intake pipe or conduit 12 of the vaporizer apparatus, so that the same descends the latter and enters the annular passage 14. The fuel mixture is drawn radially outward through the annular passage 14, from the centrally located discharge end of said intake pipe or conduit 12. Since the capacity of said annular passage 14 gradually increases toward the discharge mouth thereof, it will follow that the speed of travel of the charge in passing therethrough is reduced or slowed down, to an extent sufficient to permit gravity to act upon the heavier liquid particles of fuel contained in the charge, thus causing the latter to fall upon the hot-plate formed by the heated wall of said lower casing member 7, and since the walls of said casing member 7 are bowl shaped or inclined inwardly and downwardly, the heavy particles of liquid fuel will tend by their weight to creep downward thereon toward the zones of most intense heat over the hot-box 15, thus quickly finding a degree of heat adequate to vaporize the same and thus return the vaporized fuel into the fuel mixture stream as it proceeds toward the expansion chamber 11. On the other hand the liquid particles of fuel deposited on the inclined hot-plate are also subjected to the friction of the onward and outwardly moving stream of air and fuel, so that as this friction tends to balance the weight of the fuel particles against the downward pull of gravity, the deposited fuel particles are then caused to spread out and creep upwardly on the surface of the hot-plate, which surface provides a constantly increasing area, being thereby spread or thinned out on said surface and consequently filmed and expanded, and thus more quickly volatilized and returned as vapor to the onward moving stream of the air and fuel mixture. These effects are also considerably aided by the fact that the whole of the interior of the vaporizer is under a partial vacuum, and since this vacuum is not confined to a restricted tube but is effective in a gradually enlarging passage and finally in a comparatively large expansion space in which the passage terminates, the fuel mixture is continuously undergoing a progressive expansion which allows ample time for the precipitated heavier liquid fuel particles to be easily vaporized and thereupon again taken up and absorbed into the moving fuel and air mixture stream.

The mixture of vaporized fuel and air which finally escapes from the annular passage 14 is discharged into the comparatively large expansion chamber 11, wherein is permitted a further and comparatively greater expansion thereof under a partial vacuum, to the end that the movement of the fuel mixture is further slowed down, thus providing both time and space for a further and more intimate homogenizing union of the elements making up the fuel charge. This homogenizing effect is obtained under the circumstances because particles of different weight or density become nearer to each other in weight and density according to the amount of vaccum produced, and tend under natural laws of diffusion to commingle. For example, the fluids which form in combination a hydro-

carbon gaseous fuel, being of different densities, become if slowed up under a partial vacuum nearer to each other in density, and if given time under such conditions are enabled to diffuse themselves and more intimately intermingle or unite to readily form a substantially definite gaseous fuel.

Since the discharge conduit 10 is smaller than the expansion chamber 11, the latter will act as a reservoir to hold a reserve volume of gaseous fuel mixture once the apparatus is initally operated.

Owing to the substantially definite character of the gaseous fuel mixture, which results from a substantially complete vaporization of the liquid fuel particles initally contained therein, it is practically impossible for wet fuel to pass into the engine cylinders, and consequently in internal combustion engine practice, many troubles due to carbon deposits and the presence of partially combusted fuel are avoided.

In some cases I find it desirable to provide the plate or spreader flange 13 with one or more perforations 27 in the bottom thereof which lead from the expansion chamber 11 into the annular passage 14. In the event of any condensation or precipitation of the liquid fuel particles taking place within the expansion chamber 11 when the engine is idle, the same are deposited in the depression of the plate or spreader flange 13 and are permitted to flow back into the annular passage 14 through said perforations 27.

Referring now to Figures 3 and 4 of the accompanying drawings, I have illustrated therein a slightly modified construction of my vaporizer, which embodies, however, the general principles of construction and operation involved in this invention. In this construction the vaporizer comprises a main body or casing 28, preferably of cylindrical shape and open at its upper end. The bottom wall inclines downwardly and inwardly toward the central portion thereof, and provides a hot-plate 29 as will subsequently be evident. Connected with the upper open end of said main body or casing 28 is a cover or top section 30. Leading into said cover or top section 30 is an intake conduit 31 which possesses a centrally disposed downwardly projecting portion 32 adapted to extend into said main body or casing 28 toward the hot-plate portion 29. Said cover or top section 30 is also provided with a suitable discharge member or outlet conduit 33 which communicates with the interior expansion chamber 34 provided by the space inclosed within the main body or casing 28 and the cover or top section 30. Connected with the lower inner end of said portion 32 of the intake conduit 31 is a spreader plate 35, the periphery of which is spaced inwardly from the side walls of said main body or casing 28. The under side of said spreader plate is inclined upwardly from its central portion toward its periphery so as to parallel the hot-plate 29, when spaced upwardly therefrom, thus providing an annular space or passage 36 communicating with the discharge end of said intake conduit 31 and leading into the expansion chamber 34. This passage 36, it will be observed, gradually increases in area and cubic capacity from the intake pipe or conduit 31 toward the point of discharge, intermediate the periphery of the spreader plate and the walls of the main body or casing, leading into said expansion chamber 34.

While I have shown in Figure 3 the wall 29 and spreader plate 35 inclined outwardly and upwardly from their central portions, thus providing the passage 36 with a corresponding inclination, it must be understood, that I do not intend to limit myself necessarily to any specific degree of inclination nor to a construction in which the passage 36 is so inclined, since it may even be level or horizontal if so desired.

Connected with the under side of said bottom member or hot-plate 29 of the main body or casing 28 is a hot-box 37 providing a heat transfer chamber 38, having in communication therewith an intake member 39 and an outlet member 40, to which may be connected suitable conduits 41 and 42 for respectively passing into and discharging from said heat transfer chamber 38 a suitable heating medium, such, e. g. as the exhaust gases from an internal combustion engine. That portion of the under side of said main body or casing 28 providing the hot-plate 29 which is disposed at the upper end of said heat transfer chamber 38, is provided with a plurality of depending heat conducting fingers or projections 43, which receiving the heat from the medium circulated in said heat transfer chamber, aid in conducting the same to the bottom or hot-plate 29 of said main body or casing 28, so that the lower side of the passage 36 is bounded by a heat transferring wall. The hot-box 37, main body or casing 28, and cover or top section 30 are all secured together, in assembled and mutually cooperative relation, by means of a tie-bolt 44, or in any other manner found expedient.

The operation and functioning of this modified form of my novel vaporizer is in principle the same as above set forth in connection with the first described construction. The discharge conduit 33 is connected in communication with the cylinders of an internal combustion engine, and a carbureter of desirable type is connected with the intake pipe or conduit 31 to deliver a mixture of liquid fuel and air into the latter under the suction of the engine. The fuel mixture is drawn into the annular passage

36 so as to spread radially therethrough while passing over the hot plate 29, being finally discharged into the expansion chamber 34, and thence through the discharge conduit 33 into the engine cylinders. The effects of slowing down the travel of the charge, the deposit of heavy particles of liquid fuel on the hot-plate, the expansion and vaporization of the charge under heat and direction, and the final expansion and intimate intermingling of the elements of the fuel mixture within the expansion chamber 34 prior to discharge therefrom to the engine cylinders all takes place in substantially the same manner as above described.

Referring now to Figure 5 of the drawings, I have shown another form of my novel vaporizer which also embodies the principles of construction and operation involved in this invention. In this modified form of vaporizer I provide a casing or shell preferably of spherical shape, consisting of an upper casing member 45 and a lower casing member 46, which are suitably connected together. Formed in connection with said lower casing member 46 is an intake pipe or conduit 47 which extends into the interior of said casing or shell. Formed in connection with said upper casing member 45 is a flanged neck 48 providing a discharge opening 49. Arranged within said casing, and secured and supported therein from the upper member 45 by the suspending rods or bolts 50 is a dome member 51 which is disposed over the discharge end of said intake pipe or conduit 47, but is so spaced therefrom as to provide a descending concentric passage 52 around said intake pipe or conduit 47. The lower end of said dome member 51 is provided with a semi-spherical plate or spreader flange 53, which substantially conforms to the contour of the lower casing member 46, but which is spaced from the inner wall surfaces thereof to provide an annular passage 54 inwardly communicating with the concentric passage 52, formed by the dome member 51 and intake pipe or conduit 47, and outwardly communicating with the main interior of the casing which forms an expansion chamber 55. This annular passage 54, as in the previously above-described constructions of my vaporizer, due to its increasing diameter and spread gradually increases in area and cubic capacity from the point of communication with the intake pipe or conduit toward the point of discharge at the periphery of the spreader plate.

Connected with the under side of said lower casing member 46 is a hot-box 56 providing a heat transfer chamber 57, having in communication therewith an intake member 58 and an outlet member 59, to which may be connected suitable conduits 60 and 61 for respectively passing into and discharging from said heat transfer chamber 57 a suitable heating medium, such e. g. as the exhaust gases from an internal combustion engine. That portion of the under side of said lower casing member 46, which is disposed at the upper end of said heat transfer chamber 57, is provided with a plurality of depending heat conducting fingers or projections 62, which receiving the heat from the heating medium circulated in said heat transfer chamber, aid in conducting the same to the bottom of said lower casing member, thus causing the same to function as a hot-plate 63 which bounds the under side of the annular passage 54.

In this construction, as in the previously described constructions, the operation and functioning thereof follows the principles and mode hereinbefore stated. The discharge opening 49 is connected in communication with the cylinders of an internal combustion engine, and a carbureter of desirable type is connected with the outer end of the intake pipe or conduit 47 to deliver a mixture of liquid fuel and air into the latter under the suction of the engine. The fuel mixture is drawn into the dome-member 51 so as to pass downwardly through the concentric passage 52 into the inner end of the annular passage 54, whence it spreads radially outward therethrough while passing over the hot-plate 63, being finally discharged into the expansion chamber 55, and thence through the discharge opening 49 to be conveyed to the engine cylinders. The effects of slowing down the travel of the charge, the deposit of heavy particles of liquid fuel on the hot-plate 63, the expansion and vaporization of the charge under heat and friction, and the final expansion and intimate intermingling of the elements of the fuel mixture within the expansion chamber 55 prior to discharge thereof to the engine cylinders all takes place in substantially the same manner as hereinbefore described.

Vaporizers made in accordance with this invention tend to produce a substantially dry gaseous fuel mixture, especially when the fuel base is a hydrocarbon, such for example as gasolene. It is well known that liquid gasolene contains, when atomized with air, numerous particles of differing degrees of volatility, and when fed from the carbureter into my vaporizer, the lighter or more readily volatilized hydrocarbon particles will immediately be absorbed into or united with the air accompanying the same. The effect of this absorption, however, is a tendency to lower the temperature of the charge, making it necessary to replace the loss of heat so that the heavier hydrocarbon particles can be volatilized and taken by the

air. In my vaporizer the heavier hydrocarbon particles drop or are thrown on to the hot-plate, while at the same time the passage contiguous to the hot-plate which is gradually enlarging toward an outlet tends to check the speed of flow of the charge, thus giving time for the vaporization of said heavy hydrocarbon particles by heat and the friction of the charge movement and a resultant return thereof in vaporized form into the carburetted air making up the charge, and finally the charge is passed into a comparatively large expansion chamber before delivery to the engine, so that time and opportunity is afforded for a final diffusion and intimate intermingling of the hydrocarbon vapor and air to the end that a very dry homogeneous gaseous fuel mixture is ultimately delivered into the engine cylinders.

While I have shown in connection with my above described vaporizers a heat transfer means adapted to utilize exhaust engine gases as the heating medium, it will be understood that this feature of my invention may be modified as may be desired for use with any other form of heating medium or method of heat generation.

Having thus described my invention, I claim:—

1. A vaporizer for volatile fuel mixtures comprising a casing, a centrally disposed intake conduit leading into said casing, a spreader plate associated with the discharge end of said intake conduit and spaced from the bottom of said casing to form an intermediate annular passage extending outwardly from said intake conduit to the periphery of said spreader plate to there communicate with the main interior of said casing which provides an expansion chamber, a discharge conduit leading out of said expansion chamber, and means for conducting heat to that portion of the bottom of said casing which is contiguous to said annular passage.

2. A vaporizer for volatile fuel mixtures comprising a casing having a bottom portion inclining downwardly and inwardly from its outer limits toward its central portion, a centrally disposed intake conduit leading into said casing and terminating adjacent to the bottom thereof, a spreader plate associated with the discharge end of said intake conduit, said spreader plate substantially conforming in shape to the shape of the bottom of said casing but being spaced therefrom to form an intermediate annular passage extending outwardly from said intake conduit to the periphery of said spreader plate to there communicate with the main interior of said casing which provides an expansion chamber, a discharge conduit leading out of said expansion chamber, and means for conducting heat to that portion of the bottom of said casing which is contiguous to said annular passage.

3. A vaporizer as characterized in claim 1 in which said heat-conducting means comprises a hot-box providing a chamber beneath the bottom of said casing, means for introducing a hot fluid into said chamber, and the under side of the bottom wall of said casing having a plurality of heat conductive projections extending into said chamber.

4. A vaporizer as characterized in claim 2 in which said heat conducting means comprises a hot-box providing a chamber beneath the bottom of said casing, means for introducing a hot fluid into said chamber, and the under side of the bottom wall of said casing having a plurality of heat conductive projections extending into said chamber.

5. A vaporizer for volatile fuel mixture comprising a casing the interior of which provides an expansion chamber, a discharge conduit of substantially reduced cross sectional area relative to said expansion chamber leading out of the latter, a centrally disposed intake conduit leading into said casing, a spreader plate associated with the discharge end of said intake conduit and spaced from the bottom of said casing to form an intermediate gradually enlarging annular passage extending outwardly from said intake conduit to the periphery of said spreader plate to there communicate with said expansion chamber, and means for conducting heat to that portion of the bottom of said casing which is contiguous to said annular passage.

6. A vaporizer as characterized in claim 5 in which said heat conducting means comprises a hot-box providing a chamber to receive a hot fluid beneath the bottom wall of said casing, and the under side of the bottom wall of said casing having a plurality of heat conductive projections extending into said chamber.

7. A vaporizer for volatile fuel mixtures comprising a casing having a substantially funnel-shaped bottom, a spreader plate arranged within said casing and substantially conforming in shape to the shape of said bottom but of slightly less diameter than the diameter of the casing interior, said spreader plate being spaced from said casing bottom to provide an intermediate passage communicating at its outer end with the main interior of said casing, means for introducing a fuel mixture to be vaporized into the central portion of said passage, a discharge conduit leading out of the main interior of said casing, and means for conducting heat to that portion of the casing bottom which is contiguous to said passage.

8. A vaporizer as characterized in claim 7 in which said heat conducting means comprises a hot-box providing a chamber to receive a hot fluid beneath the bottom of said casing, and the under side of the casing bottom having a plurality of heat conductive projections extending into said chamber.

In testimony that I claim the invention set forth above I have hereunto set my hand this 18th day of April, 1923.

ERNEST R. GODWARD.

Witnesses:
GEORGE D. RICHARDS,
MARION M. BANTA.