

Oct. 9, 1928.

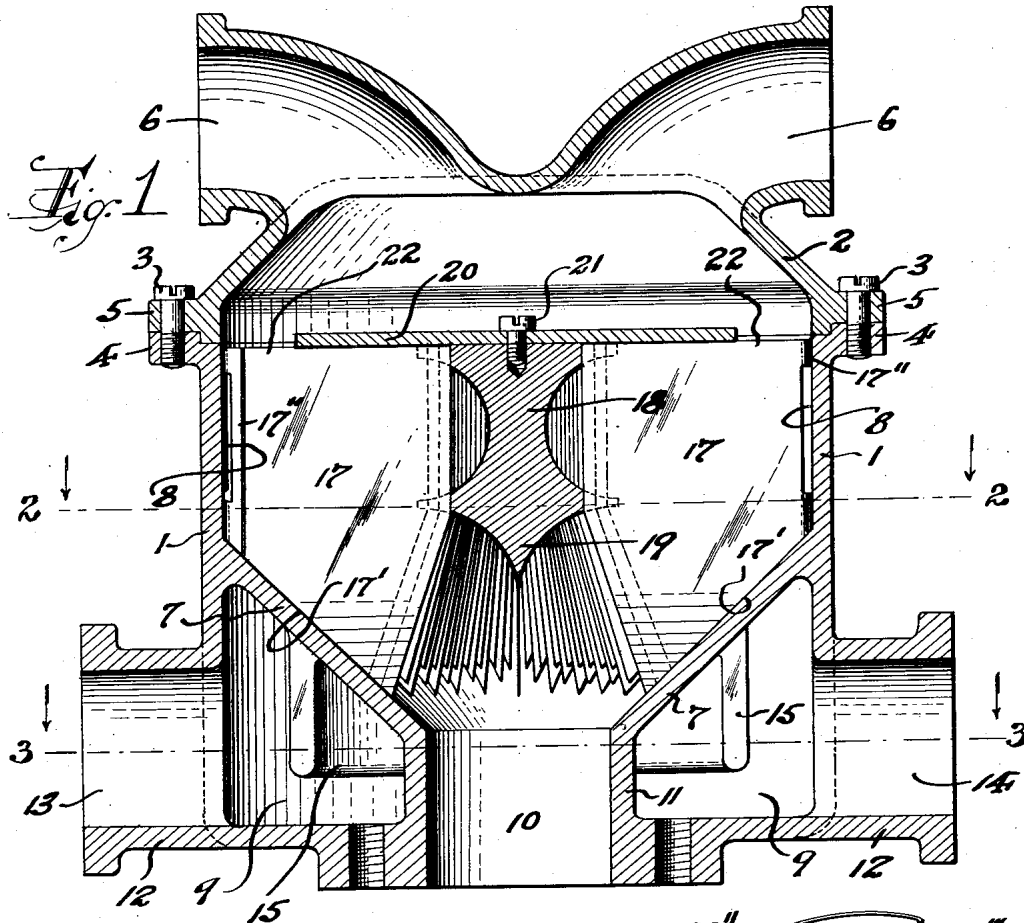
1,686,609

E. R. GODWARD

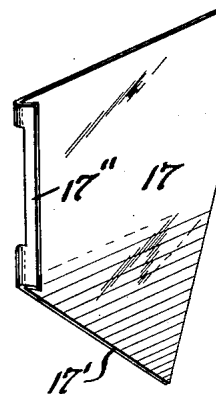
VAPORIZER

Filed Oct. 22, 1926

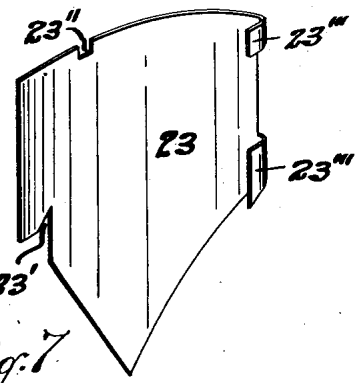
3 Sheets-Sheet 1



*Fig. 4*



*Fig. 7*



INVENTOR.  
*Ernest R. Godward*  
BY *Frautzel and Richards*  
ATTORNEYS.

Oct. 9, 1928.

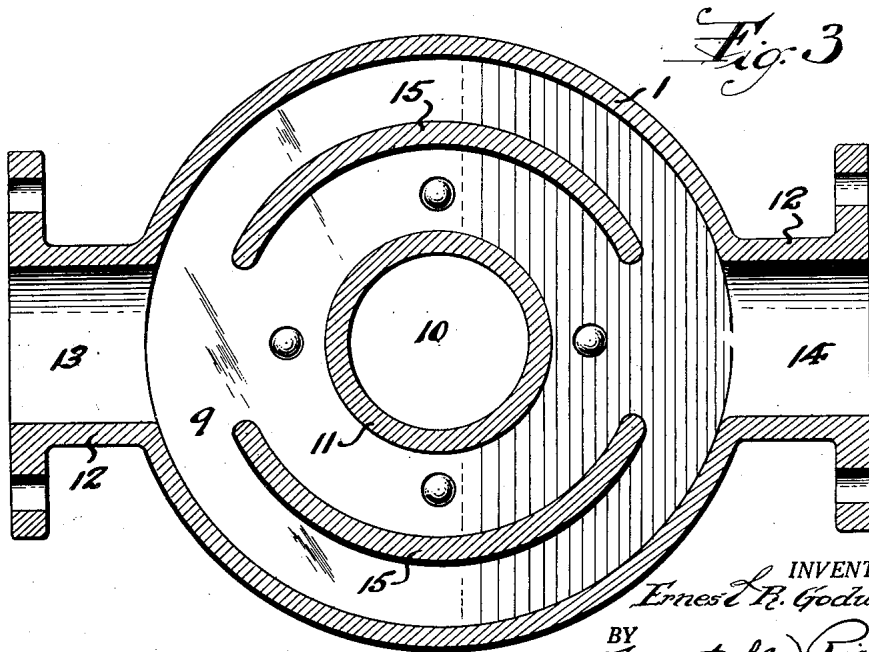
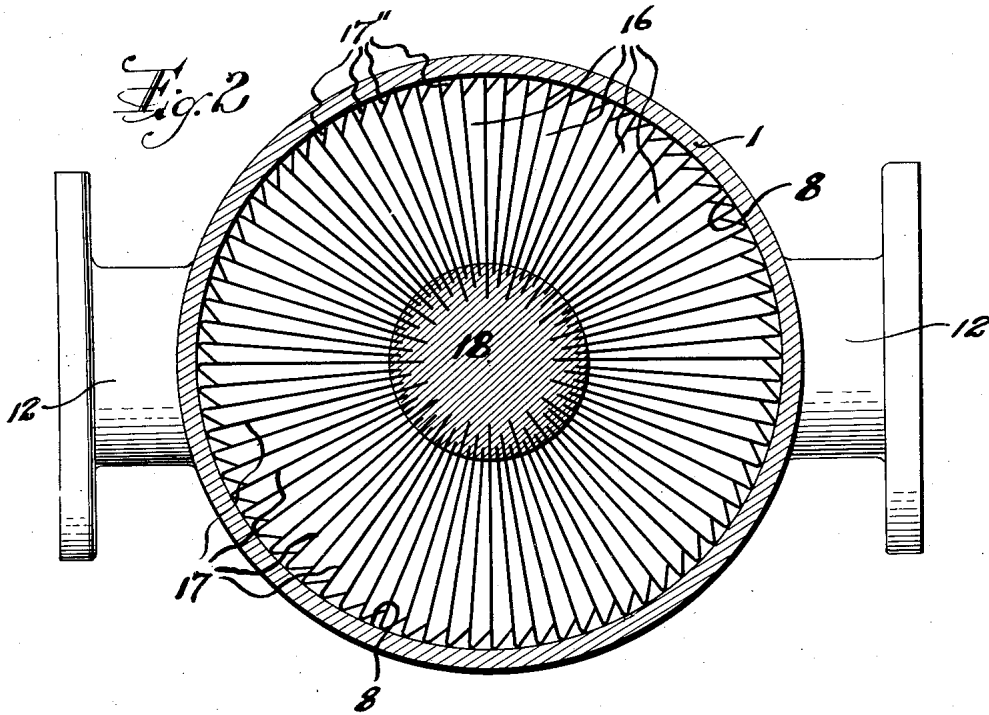
1,686,609

E. R. GODWARD

VAPORIZER

Filed Oct. 22, 1926

3 Sheets-Sheet 2



INVENTOR.  
*Ernest R. Godward*  
BY  
*Frautzel and Richards*  
ATTORNEYS.

Oct. 9, 1928.

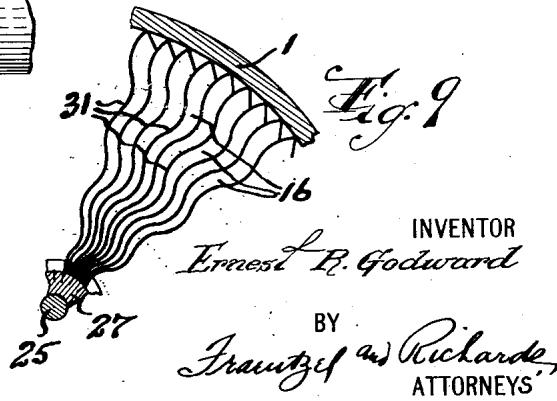
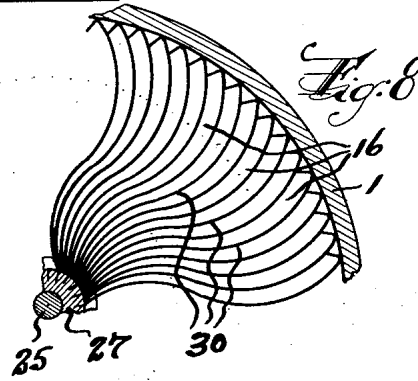
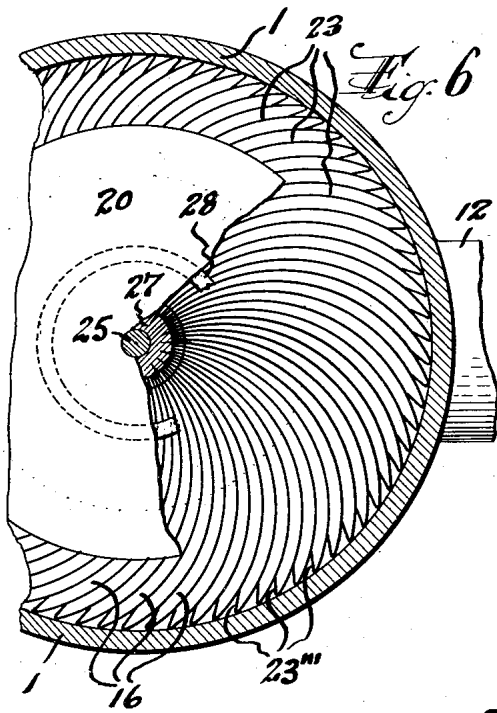
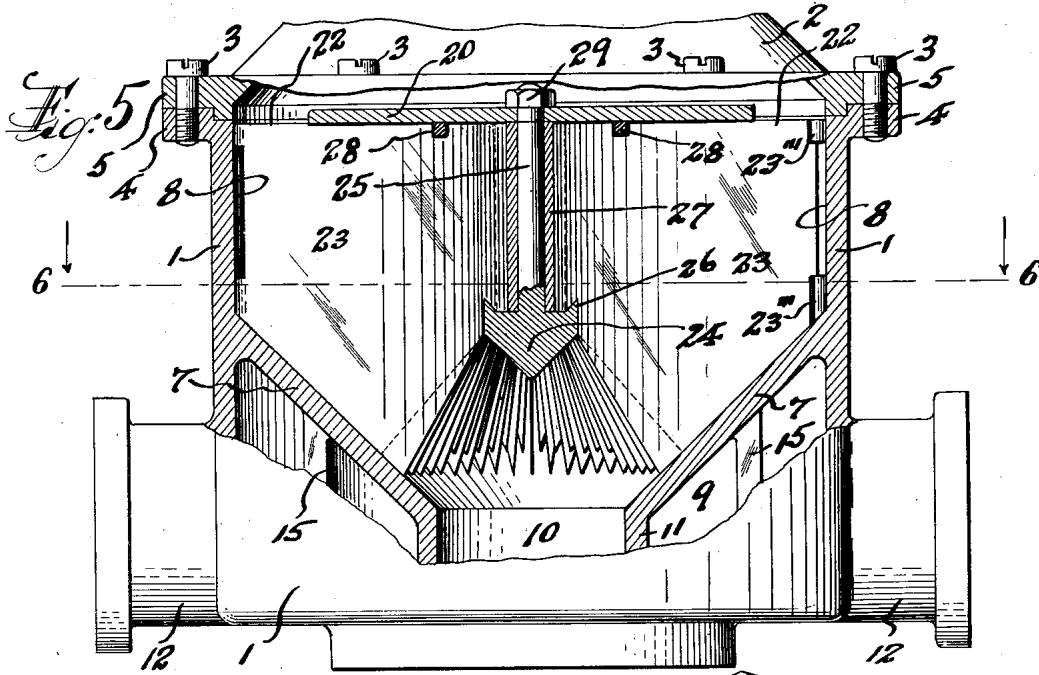
1,686,609

E. R. GODWARD

VAPORIZER

Filed Oct. 22, 1926

3 Sheets-Sheet 3



INVENTOR

Ernest P. Godward

BY

Frankel and Richards,  
ATTORNEYS

# UNITED STATES PATENT OFFICE.

ERNEST ROBERT GODWARD, OF NEW YORK, N. Y., ASSIGNOR TO THE ECLIPSE PETROL ECONOMISER SYSTEM COMPANY, LIMITED, OF CHRISTCHURCH, NEW ZEALAND, A CORPORATION OF NEW ZEALAND.

## VAPORIZER.

Application filed October 22, 1926. Serial No. 143,332.

This invention relates to vaporizers, for treating mechanical mixtures of liquid fuels (such as hydrocarbons or other volatile combustible liquids) and air, of the general type disclosed in my prior United States Letters Patent #1,490,919, dated April 22nd, 1924, and in my co-pending application for method patent Serial No. 64,476/25 filed October 23rd, 1925.

The present invention has for its principal objects to provide an improved construction of vaporizer adapted to, first, increase the general efficiency thereof in operation, and, second, to provide a construction which readily lends itself to economical production. With these objects in view, the present invention provides a novel construction of vaporizer adapted to furnish an increased contact surface area in the form of relative short plates either straight, arcuate or of corrugated or reverse curve formation; to furnish a conical or downwardly and inwardly sloping heated bottom plate, to both increase the efficiency thereof in transmitting heat to contact surface area, as well as to back drain unvaporized liquid fuel to the incoming stream of fuel mixture for redistribution to said contact surface area; to furnish a center core structure adapted to facilitate the assembling and positioning of the radial surface providing plates, said center core also including, at its lower end in alignment with the fuel mixture intake, a depending inverted cone adapted to accentuate the centrifugal movement of the ingoing fuel mixture, as well as to direct or deflect the same to the contact surface area; and to furnish other detail improvements, not at this plate more particularly enumerated, but which will be readily understood from the following detailed description of the same.

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

Figure 1 is a vertical longitudinal section showing one form of vaporizer embodying the improvements made in accordance with the principles of the present invention; Figure 2 is a horizontal section through the same, taken on line 2—2 in Figure 1; Figure 3 is another horizontal section through the same, taken on line 3—3 in Figure 1; and Figure 4 is a perspective view of one form of radial plate used to produce the contact surface area of the device.

Figure 5 is a fragmentary side elevation

and part vertical section of the improved vaporizer, showing another form of radial plate structure adapted to provide the contact surface area of the device; Figure 6 is a fragmentary horizontal section through the same, taken on line 6—6 in said Figure 5; and Figure 7 is a perspective view of one of the radial plates thereof.

Figure 8 is a fragmentary horizontal section, showing another modified form of radial plate structure; and Figure 9 is a similar view, showing still another modified form of said radial plate structure.

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

Referring now to said drawings, the reference character 1 indicates a casing or pot having an open upper end normally closed by a cover member 2, which may be secured thereto in any suitable manner, as e. g. by bolts or screws 3 serving to join peripheral flanges 4 and 5 with which the casing or pot and said cover member are respectively provided. Said cover member 2 is provided with one or more outlet members 6, as shown in Figure 1.

The interior of the casing or pot 1 is subdivided by an inverted conical bottom plate or partition 7, to provide above the same an upper vaporizing chamber 8 and a lower heater chamber 9. The fuel mixture intake 10, which leads centrally into the lower end of the vaporizing chamber 8, is formed by a centrally located throat member 11 which rises through the interior of the heater chamber 9 to extend intermediate the outer bottom wall of said casing or pot to the interior bottom plate or partition 7.

The casing or pot 1 is provided at opposite sides with laterally extending necks 12, respectively providing inlet and outlet passages 13 and 14 leading into and out of the heater chamber 9. and through which, in connection with suitable delivering and discharging conduits (not shown) a heating medium (such e. g. as the exhaust gases from an internal combustion engine) may be introduced into and circulated through the heater chamber 9. so as to transfer heat to the bottom wall of said vaporizing chamber 8, which is provided by the conical bottom plate or partition 7. To increase the amount of surface in contact with the heating medium, and consequently the heat absorption

capacity and conduction efficiency of said conical bottom plate or partition 7, the latter is provided with curved fins 15 depending therefrom into the interior of said heater chamber between the inlet and outlet of the latter, and intermediate opposite sides of the throat member 11 and the outer walls of the casing or pot 1. The heating medium introduced into and through said heater chamber 9 will flow around and in contact with said fins and with the underside of the bottom plate or partition 7. This arrangement of depending curved fins, lying in the path of movement of the heating medium through the heater chamber, is an improvement over the plurality of tits or fingers shown in my earlier forms of vaporizer, not alone by reason of the greater contact surface afforded thereby, but also because such fins, due to their stream-like contour, produce less turbulence in the flowing heating medium, and consequently a freer and quicker movement thereof with less tendency to the creation of back-pressure.

The inverted conical bottom plate or partition 7 slopes downwardly and inwardly toward the fuel mixture intake 10, preferably at an angle of 30 to 45 degrees. Arranged within the vaporizing chamber 8 so as to be fitted to and so as to rest in engagement with said inwardly sloping bottom plate or partition 7 is a nest of radially disposed plates, so spaced apart as to provide a multiplicity of radial and laterally extending passages 16 extending laterally and upwardly from the fuel mixture intake 10. As shown in Figures 1 to 4 inclusive, the nest of plates may comprise a plurality of straight radial plates 17, the upper inner marginal portions of which are dove-tailed into corresponding radial slits or grooves with which a central supporting core 18 is provided; such arrangement not only securing the inner ends of said plates in supported relation to said core 18, but also serving to space such inner ends apart one from another. The lower margins 17' of said plates 17 are inclined at an angle corresponding to the angle of slope of said bottom plate or partition 7 so as to properly contact with the latter. Said center core 18 is engaged only with the upper portions of the plates, and is of a length substantially less than the total height of said plates at their inner ends, thus providing, at the lower inner end portions of the spaced plates, entrances to the intermediate passages 16 with which the fuel mixture intake 10 communicates. The lower end of the core 18, which is in alignment with the fuel mixture intake 10, is provided with an inverted conical portion 19, which acts as a deflector to the incoming charges of fuel mixture, not only serving to direct and distribute the latter into the passages 16 intermediate the plates 17, but also accentuating centrifugal action of the fuel

mixture in contact with the plate walls which bound said passages. Forms of deflector other than a cone may be used if desired. The outer marginal portions of the plates are provided with laterally bent portions 17'', which serve as spacing means for disposing the outer ends of the plates in mutually spaced apart relations; the outer marginal portions of the plates are preferably arranged to fit against the wall of the vaporizing chamber, as shown, although, if desired, they may be spaced somewhat from such wall to provide the annular collecting space for gas, as shown in my earlier application and patent. Extending over the upper end of the nest of plates, so as to close the major portion of the upper ends of the passages 16 therebetween, is a top-plate 20, preferably secured to the upper end of the center core 18 by a suitable fastening means, such, for example, as the screw 21. Said top-plate is of less diameter than the inside diameter of the vaporizing chamber 8, thus leaving the outer portions of the upper ends of the passages 16 open, and thereby providing discharge mouths or exits 22, which communicate through the interior of the cover-member with the outlet members 6.

Referring now to Figures 5, 6 and 7 of the drawings I have illustrated therein a somewhat modified form of radial plate structure, as well as a modified construction of center supporting core; these modifications embodying what I believe to be the preferred form and arrangement of these features. In this modified form the radial passages 16 are bounded by radial plates 23 of laterally arcuate shape, thus also producing a lateral curvature of the passages 16 from their inner toward their outer ends. The center core structure comprises a lower inverted conical deflector member 24 having an upward extending axially disposed shank 25. The upper periphery of said conical deflector member 24 is provided with an annular upstanding shoulder 26, the rear side of which is preferably downwardly and inwardly inclined, as shown in Figure 5. Telescopically fitted over the shank 25 is a hub-sleeve 27, provided in its exterior portion with radial slits to receive the upper inner marginal portions of certain of said plates 23. Between the plates thus connected with the hub-sleeve 27 are disposed intermediate plates of slightly less length, so that their upper inner marginal portions are registered against the exterior surface of said hub-sleeve. Said plates 23 are provided with properly disposed notches 23' (see Figure 7) shaped to engage over the shoulder 26 of the conical deflector member 24, thus locking said plates in assembled relation to the hub-sleeve 27. As a further aid in retaining the plates in position, the upper ends of the same may be provided with notches 23'' (also see Figure 7)

which, when the plates are operatively assembled, will be annularly aligned so as to receive a lock-ring 28. After the plates are thus assembled with the center core structure, the top-plate 20 is engaged over the same, with the upper end of the shank 25 (which is screw threaded) extending upwardly there-through to receive a fastening nut 29. The outer ends of the plates 23 are provided with laterally bent portions 23'', which serve as spacing means for disposing the outer ends of said plates in mutually spaced-apart relations. The lower margins of the plates 28 are inclined at an angle corresponding to the angle of slope of said bottom plate or partition 7, so as to rest upon and in contact therewith. The above described structure is very easily assembled, and provides a structure which may be rapidly and economically produced with a minimum of labor, and so that, when completed, it is merely required to drop the same into position within the vaporizing chamber, whereupon the cover-member 2 is secured in place in connection with the pot or casing 1 so that the vaporizer is complete and ready for use. While as above intimated the plates may be made straight, as the plates 17, or arcuate, as the plates 23, it may be here pointed out that other formations of said plates may be employed, as, for example, the reverse curve plates 30 shown in Figure 8, or the corrugated plates 31 shown in Figure 9.

The novel construction and arrangement comprising the nest of plates is such, that I am enabled to utilize a very large number of plates to thereby obtain a maximum area of contact surface. As shown in the drawings in the instant case I provide eighty plates, which by reason of their comparatively short length, provide an equally large number of intermediate passages 16, which may be narrower near the center and may gradually increase in width toward their outer ends, thereby providing room for expansion of each individual stream of fuel mixture as it progresses through the vaporizer. The relatively short radial plates and corresponding passages, the length of which approximates about one-fifth the circumference of the vaporizing chamber, provides a distinct advantage over comparatively long plates and passages which form one or more complete convolutions, for the reason that the long curved passages of the latter form produce too great restriction of the moving fuel mixture streams, especially at high speeds, to assure production of adequate power. In my instant form, the comparatively short radial plates, employed in relatively large numbers, provides a maximum of contact surface area, while the comparatively short radial passages reduce restriction to a minimum.

In operation, the vaporizer, constructed in accordance with the teaching of the instant

invention, functions according to the method of procedure fully set forth in my co-pending application for process of producing dry gaseous fuel, Serial No. 64,476/25, filed October 23, 1925, with certain advantages due to the improved apparatus form above described. In the instant form of apparatus having eighty plates, the combined contact surface area of the plates, together with the walls and bottom of the vaporizing chamber, should bear a ratio to the cross sectional area of the fuel intake passage in excess of two hundred to one, and in fact should preferably possess a ratio of from four to seven hundred to one, or even more; and the total cubic content of the passages 16 between the plates should bear a ratio to the cubic content of the fuel intake passage in excess of four to one, and in fact should preferably possess a ratio of eight to ten to one, or even more. For example, assuming the internal diameter of the vaporizing chamber to be 5 and  $\frac{5}{8}$  inches, with a fuel intake passage of approximately 2 square inches cross-sectional area, the nest of eighty plates may be made to provide, with the sides and bottom of the vaporizing chamber, a total contact surface area of from 800 to 1400 square inches.

A very considerable improvement in the functioning of the instant apparatus is due to the provision of the conical downwardly sloping hot bottom plate 7 of the vaporizing chamber. This form of bottom plate affords the following advantages: First, it enables the unvaporized heavy ends of the fuel mixture to drain back into the throat or fuel intake passage 10, to be thus returned to the incoming stream of fuel mixture, reatomized and then redistributed through the passages 16 and in contact with the plate contact surface bounding the latter; second, the angular disposition of the bottom plate 7 increases the area of such bottom plate in contact with the heating medium, and in fact provides approximately about forty per cent more very hot bottom plate heating surface, than does the flat bottom plate of my earlier structures; and, third, the angular arrangement of the bottom plate permits the heating medium circulated through the underlying heating chamber to be carried up about half the height of the outer wall of the vaporizer pot, thereby giving a better heating to such outer wall and eliminating relatively cold surfaces adjacent to the path of flow of the produced gas. With the flat bottom plate of my earlier structures, it has been found that when employed for automotive purposes, the engine ran under full load and wide open throttle at low speeds, as e. g. on steep hills, all the gasoline or volatile liquid fuel failed to completely vaporize, and a "loading up" of the engine resulted. With the angular or sloping bottom plate of the instant invention, with its increased heating surface, the gasoline fuel constituent discharged to the engine is all vaporized, and no

"loading" is experienced. These advantages are very important in trucking and other "heavy duty" service, especially in winter.

Another advantage of the instant form of vaporizer in operation is that the depending deflector cone 19 of the center plate-supporting core 18 both accentuates centrifugal movement of and easily and quickly deflects the incoming stream of fuel mixture to cause the heavier portions of the same to be quickly brought into contact with the hotter portions of the plates and ultimately upon the bottom plate.

Having thus described my invention, I claim:—

1. In a vaporizing device a vaporizing chamber having a central carburetted fuel mixture inlet extending upwardly thereinto and a vaporized fuel mixture outlet at its upper end, and a centrally sloping bottom heating-plate heated by the exhaust gases of the engine, said bottom plate converging upon said fuel mixture inlet to drain unvaporized fuel back to the latter, a member comprising a multiplicity of spaced radially disposed vertical plates the lower edges of which are fitted to contact with said centrally sloping bottom heating-plate to receive heat by conduction from the latter, and means engaging the inner ends of said plates and means intermediate the outer ends of said plates to retain the same in spaced apart passage forming relation.

2. A vaporizing device, comprising a casing providing a vaporizing chamber having a central carburetted fuel mixture intake leading into the bottom and a vaporized fuel mixture outlet leading from the upper portion thereof; a multiplicity of radial vertically disposed plates engaged with the bottom of said chamber to provide a multiplicity of radial passages having their inner ends communicating with said intake and their outer ends in communication with said outlet; means engaged with portions of the converging inner ends of said plates to support the same in fixed spaced apart assembled relation; spacing means for retaining the outer ends of said plates in passages forming relation; a top-plate of less diameter than the internal diameter of said vaporizing chamber engaging the upper ends of said plates; and means for supplying heat to the bottom of said chamber for conduction to the lower ends of and upwardly through said plates.

3. A vaporizing device, comprising a casing providing a vaporizing chamber having a central carburetted fuel mixture intake leading into the bottom and a vaporized fuel mixture outlet leading from the upper portion thereof; a vaporizing member supported on the bottom of said vaporizing chamber having a multiplicity of relatively narrow radiating substantially vertical passages, the inner ends of which communicate with

said intake and the outer ends of which communicate with said outlet, said passages being bounded by metallic plates the aggregate surface area of which is in excess of two hundred times the cross-sectional area of said central intake; means at both the inner and outer ends of said plates to hold the same in passage forming relation; and means for supplying heat to the bottom of said chamber for conduction to the lower ends of and upwardly through said plates.

4. A vaporizing device, comprising a casing providing a vaporizing chamber having a central carburetted fuel mixture intake leading into the bottom and a vaporized fuel mixture outlet leading from the upper portion thereof; the bottom of said chamber comprising an inverted conical bottom plate converging on said central intake; a vaporizing member supported on said bottom plate within said member having a multiplicity of relatively narrow radiating substantially vertical passages, the inner ends of which communicate with said intake, said passages being bounded by radially disposed metallic plates, the lower ends of which are engaged on said bottom plate; means engaging the inner and outer end portions of said plates for spacing apart the same to form said passages, and means for supplying heat to said bottom plate for conduction to the lower ends of and upwardly through said radial plates.

5. A vaporizing device, comprising a casing providing a vaporizing chamber having a central carburetted fuel mixture intake leading into the bottom and a vaporized fuel mixture outlet leading from the upper portion thereof; the bottom of said chamber comprising an inverted conical bottom plate converging on said central intake; a vaporizing member supported on said bottom plate within said chamber, said member having a multiplicity of relatively narrow radiating substantially vertical passages, the inner ends of which communicate with said intake, said passages being bounded by radially disposed metallic plates, the lower ends of which are engaged on said bottom plate; means engaged with portions of the converging inner ends of said plates to support the same in spaced apart assembled relation, means intermediate the outer ends of said plates to retain the same in spaced apart relation; a top-plate of less diameter than the internal diameter of said vaporizing chamber engaging the upper ends of said plates; and means for supplying heat to said bottom plate for conduction to the lower ends of and upwardly through said radial plates.

6. A vaporizing device, comprising a casing providing a vaporizing chamber having a central carburetted fuel mixture intake leading into the bottom and a vaporized fuel mixture outlet leading from the upper por-

tion thereof; the bottom of said chamber comprising an inverted conical bottom plate converging on said central intake, a vaporizing member supported on said bottom plate within said chamber, said member having a multiplicity of relatively narrow radiating substantially vertical passages, the inner ends of which communicate with said intake, said passages being bounded by radially disposed metallic plates, the lower ends of which are engaged on said bottom plate; a center core element axially aligned with and spaced above said intake, said center core element having means to engage portions of the converging inner ends of said plates to retain the same in assembled relation, the lower end of said center core element having a deflector member opposed to said intake to turn the entering carburetted fuel mixture charges into the passages of said vaporizing member; a top-plate of less diameter than the internal diameter of said vaporizing chamber engaging the upper ends of said plates; and means for supplying heat to said bottom plate for conduction to the lower ends of and upwardly through said radial plates.

7. A vaporizing device, comprising a casing providing a vaporizing chamber having a central carburetted fuel mixture intake leading into the bottom and a vaporized fuel mixture outlet leading from the upper portion thereof; a vaporizing member supported on the bottom of said chamber, said member having a multiplicity of relatively narrow radiating substantially vertical passages, said passages being bounded by radially disposed metallic plates, the lower ends of which are in contact with the bottom of said vaporizing chamber, means for spacing apart the outer ends of said plates, a center core device upon which the upper portions of the inner ends of said plates converge, said center core device having an enlarged lower end portion provided at its periphery with an up-standing annular shoulder, each plate having a notched portion engageable over said shoulder whereby said plates are retained against displacement from assembled relation; a top-plate of less diameter than the internal diameter of said vaporizing chamber engaging the upper ends of said plates; and means for supplying heat to said bottom plates for conduction to the lower ends of and upwardly through said radial plates.

8. A vaporizing device, comprising a casing providing a vaporizing chamber having a central carburetted fuel mixture intake leading into the bottom and a vaporized fuel mixture outlet leading from the upper portion thereof; a vaporizing member supported on the bottom of said chamber, said member having a multiplicity of relatively narrow radiating substantially vertical passages, said passages being bounded by radially disposed

metallic plates, the lower ends of which are in contact with the bottom of said vaporizing chamber, means for spacing apart the outer ends of said plates, a center core device upon which the upper portions of the inner ends of said plates converge, said center core device having an enlarged lower end portion provided at its periphery with an up-standing annular shoulder, each plate having a notched portion engageable over said shoulder whereby said plates are retained against displacement from assembled relation; a top-plate of less diameter than the internal diameter of said vaporizing chamber engaging the upper ends of said plates; the lower end of said center core device having a depending conical deflector member opposed to said intake to turn the entering carburetted fuel mixture charges into the passages of said vaporizing member; and means for supplying heat to said bottom plate for conduction to the lower ends of and upwardly through said radial plates.

9. A vaporizing device, comprising a casing providing a vaporizing chamber having a central carburetted fuel mixture intake leading into the bottom and a vaporized fuel mixture outlet leading from the upper portion thereof; the bottom of said chamber comprising an inverted conical bottom plate converging on said central intake; a vaporizing member within said chamber having a multiplicity of relatively narrow radiating substantially vertical passages, said passages being bounded by radially disposed curved metallic plates, the lower ends of which are engaged on said bottom plate, means for spacing apart the outer ends of said plates, means engaged by the upper portions of the converging inner ends of said plates to retain the same in assembled relation, the lower portions of said converging inner ends of said plates being spaced apart to bound the intake end of said passages whereby the latter communicate with said central intake; a top-plate engaged over the upper ends of said plates, said top-plate being of less diameter than the internal diameter of the vaporizing chamber whereby upwardly directed discharge mouths are provided in connection with said passages to communicate with said outlet; and means for supplying heat to said bottom plate for conduction to the lower ends of and upwardly through said radial plates.

10. A vaporizing device, comprising a casing providing a vaporizing chamber having a central carburetted fuel mixture intake leading into the bottom and a vaporized fuel mixture outlet leading from the upper portion thereof; the bottom of said chamber comprising an inverted conical bottom plate converging on said central intake; a vaporizing member within said chamber having a multiplicity of relatively narrow radiating sub-



stantially vertical passages, said passages being bounded by radially disposed curved metallic plates, the lower ends of which are engaged on said bottom plate, means for spacing apart the outer ends of said plates, means engaged by the upper portions of the converging inner ends of said plates to retain the same in assembled relation, the lower portions of said converging inner ends of said plates being spaced apart to bound the intake of said passages whereby the latter communicate with said central intake; a top-plate engaged over the upper ends of said plates, said top-plate being of less diameter than the internal diameter of the vaporizing chamber

whereby upwardly directed discharge mouths are provided in connection with said passages to communicate with said outlet; a depending conical deflector member opposed to said central intake to turn the entering carburetted fuel mixture charges into the passages of said vaporizing member; and means for supplying heat to said bottom plate for conduction to the lower ends of and upwardly through said radial plates.

In testimony, that I claim the invention set forth above I have hereunto set my hand this 20th day of October, 1926.

ERNEST ROBERT GODWARD.