No. 750,451. PATENTED JAN. 26, 1904.

W. W. GRANT.

VAPORIZER FOR GAS ENGINES.

APPLICATION FILED FEB. 13, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

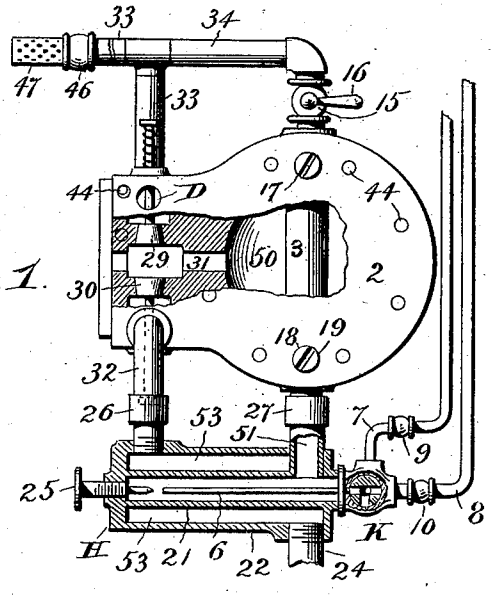
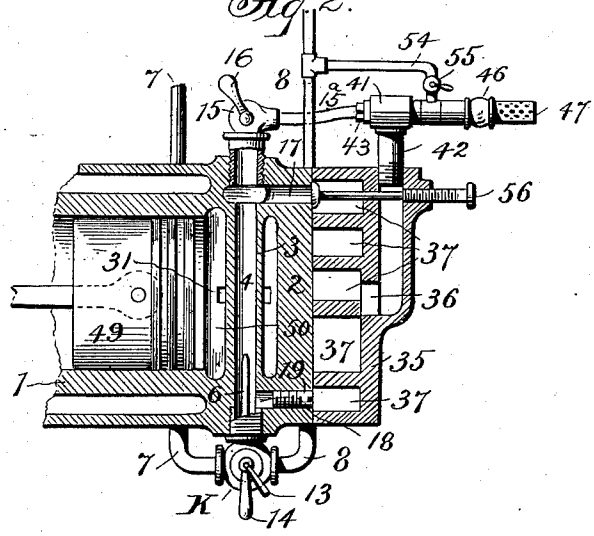


Fig. 2.



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Fig. 3.

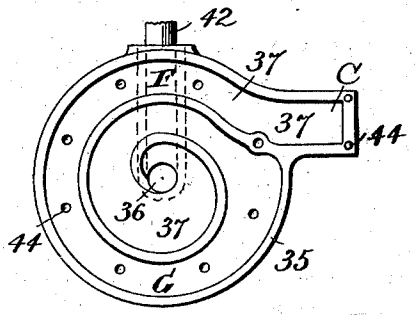


Fig. 4.

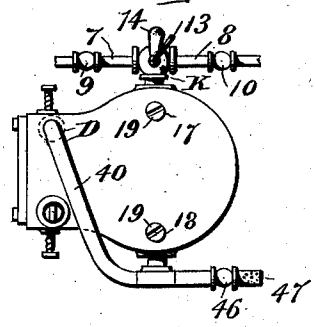


Fig. 5.

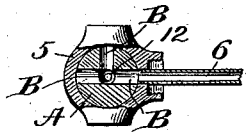


Fig. 6.

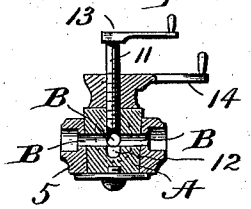


Fig. 7.

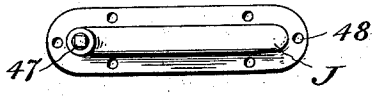
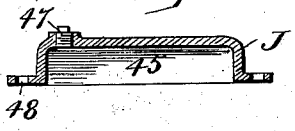


Fig. 8.



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No. 750,451. Patented January 26, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM WALLACE GRANT, OF BROOKLYN, NEW YORK.

VAPORIZER FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 750,451, dated January 26, 1904.

Application filed February 13, 1902. Serial No. 93,824. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM WALLACE GRANT, a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Vaporizers for Gas-Engines; 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.

My invention relates to improvements in vaporizers for gas-engines and embraces a system whereby to cause liquid fuel (or liquid to be used as fuel for operating or driving gas-engines) to absorb or become impregnated with heat, that through the agency of such heat said liquid fuel (or liquid to be used as fuel) may be converted into gas, an object of the invention being the expeditious formation of gas from liquid substance and to derive therefrom (through its combustion) energy for operating gas-engines.

A further object is the effecting combination of the gas thus formed with atmospheric air or other gaseous body for production of an energy or working charge with which to afford and promote operation of internal combustion for explosive and other types of gas-engines.

A liquid the vapor whereof when combined with atmospheric air or other gas forms an explosive or combustible compound of a character adapted to furnish an energy or working charge for effecting working operation of what is generally designated as a "gas-engine" of the internal-combustion, explosive, and kindred type of engine or motor is the character of liquid referred to when the term "liquid" is named or referred to in the specification and claims of this application.

To effect vaporization of liquid of the character hereinbefore named, I cause said liquid to charge or feed into a strongly-heated receptacle in the interior of the explosion or combustion chamber of the engine or into a receptacle strongly heated through contact with the hot exhaust-gases of the engine, or both these receptacles in combination, the liquid being first charged into one receptacle and then passing (or the vapor thereof passing) into the other receptacle and thereafter this product to be combined with the air or other gas for completing the quality of the working charge hereinbefore referred to for operating the engine.

In the accompanying drawings, Figure 1 is a view, partly in section, illustrating one form of my improvements. Fig. 2 is a view in section slightly modified. Fig. 3 is a detail view of sheath 35. Fig. 4 is a view illustrating other modifications. Figs. 5 and 6 are enlarged detail views of a modified form of three-way valve for use on the vaporizer, and Figs. 7 and 8 are enlarged views of a modified form of attachment to constitute a vapor-passage.

Referring now to Fig. 1 of the drawings, the device H thereon will be seen to consist of an outer shell or sheath 22, inclosing a vaporizer 21, the intervening space 53 being traversed by the hot exhaust-gases of the engine-cylinder 1, which pass out through exhaust-pipe 24. The vaporizer 21 becomes very strongly heated thereby, and the heat radiating upon the interior of the vaporizer will heat or convert into vapor liquid fed thereinto through the tube 6, connected with the three-way valve K, Figs. 1, 2, and 5. Upon the plug or rotary part of said valve K is carried a needle-valve 11 for controlling feed or liquid into the vaporizer 21 or into the vaporizer 3 when thereunto attached, as in Figs. 2 and 4. To this three-way valve K are attached two pipes 7 and 8, which convey, respectively, liquids of a density differing the one from the other. These pipes 7 and 8 are intersected by check-valves 9 and 10, Figs. 1 and 4, which valves, however, may be omitted when expedient, as shown in Fig. 2. It will be noted that this device H, Fig. 1, is connected with exhaust-pipe 32 and that the vaporizer 21 is connected with the bottom of vaporizer 3 by the couplings 26 and 27, which latter may of course be unions when preferred. By this arrangement, as will be seen, a double heating of the liquid or vapor may be effected first by heat from exhaust-gases from the engine about the vaporizer 21 and thereafter (when the vapor passes from 21 through the passage 51 on and into vaporizer

3) by the inflamed gases or strongly-heated gases in the combustion-chamber 50, and from whence the vapor passes to meet and combine with atmospheric air or other gas for or charging into the engine-cylinder, as will be later referred to and described. Obviously by disconnecting the device H from the vaporizer 3 by unscrewing the coupling 27 and then capping or plugging the disconnected end of vaporizer 3 and making a pipe connection upon outlet 51 of vaporizer 21 and the tapped opening D, leading into inlet-chamber of valve-chest, vaporization would transpire through the agency of the device H, while vaporizer 3 would be out of commission; but, again, where it is desired to cut H out and use only the vaporizer 3 instead then by disconnecting couplings 26 and 27 and disconnecting H from the three-way valve K and its appendages and making connection of the said valve and appendages upon vaporizer 3 at the point where the coupling 27 is now shown vaporization would transpire through vaporizer 3 to the exclusion of vaporizer 21, as in Fig. 2. Of course the pipe 6 may be of any required length or omitted, as may prove desirable.

To obviate encumbering the drawings, &c., I have only shown thereon so much of the gas-engine as would make clear the relative positions of the vaporizers for the vaporization of liquid and means or manner of causing the gas formed to combine with air and the conduct of the compound into the combustion-chamber of the engine.

Referring now to Fig. 2, it will be noted the engine-cylinder 1 has its end 2 cast integral with the cylinder and that the vaporizer 3 is likewise cast integral with the cylinder. Of course it is not necessary that the cylinder end and vaporizer 3 should be cast integral with the cylinder 1, but is the form of construction I prefer when other conditions warrant it. The vaporizer 3, it will be observed, is provided with a passage 4. Between this passage 4 and the exterior of cylinder end 2 communication is established by passages 17 and 18, the latter of which being shown as closed by a screw 19, while the passage 17 is tapped to be likewise closed when so desired. Both these passages are shown as being so closed upon Fig. 4. About the top of passage 4, Fig. 2, is a valve 15, provided with a prolonged screw-threaded neck, whereby this valve may be made operative as a needle-valve, for by screwing it down into passage 4 the passage 17 may have the size, or rather its opening, reduced and flow of vapor therethrough reduced or controlled. About the lower end of this passage 4 is secured the three-way valve K for feeding liquid into the vaporizer 3 direct, and, as further seen, this vaporizer 3 is located in the combustion-chamber 50, which in this construction is shown as between the piston 49 and cylinder end 2. A detachable sheath 35, having formed upon its interior a spiral-shaped passage 37, Figs. 2 and 3, is shown in Fig. 2 as fitted upon the outer face of cylinder end 2 and as being provided with a passage 36, leading into the spiral passage 37. The passage 36 is surmounted by a pipe 42, fitted with a T 41, having one end plugged by 43, its other end connected with a check-valve 46 and an air-screen 47. The valve 15, while disposed to operate as a needle-valve, is also provided to effect or cut off communication with passage 4 by removing plug 43 and making pipe 15^a long enough to connect valve 15 and T 41, and thereupon by a proper turn of the valve-lever 16 vapor from 3 may flow by this valve. Passage 17 may be stopped out, if desired, and necessarily so if it be required that vapor from 4 meet and join with air in 41 to traverse the length of the spiral passage 36 together. The check-valve 46 serves the double purpose of aiding induction of vapor from the vaporizer when the action of the piston is inducting air past this valve by the vacuum set up by suction of the piston required to lift valve 46 from its seat and to prevent escape of vapor before being utilized in the combustion-chamber into the atmosphere. Bolt-holes 44 are provided upon the sheath and are tapped upon cylinder end 2, Figs. 1 and 3, for bolting the sheath to cylinder when it is preferred to use the sheath. The elongated part C of the sheath is for cover of that part of the valve-chest which embraces the port D, Fig. 1, leading to the inlet-valve 29, and this port D will about register with that part of the sheath marked C when the sheath is turned over upon and bolted to cylinder end 2. Passage 17 will about register with the point F and passage 18 with the point G of spiral passage 37. This sheath may or may not be employed, accordingly as requirements may demand. Its purpose is to partly warm a current of air drawn by suction of piston upon its outstroke through screen 47, past valve 46, pipe 42, and passage 36 into and through passage 37, where it meets the vapor or heated product emerging from passage 17 to combine therewith and pass to the vicinity of C upon the spiral passage 37, from which they enter the valve-chamber through the port D, thence past the valve 29, and through port 31 into the combustion-chamber 50. (See Figs. 1, 2, and 3.) When in the combustion-chamber, the charge is compressed and ignited by the usual means employed therefor, but not shown, (excepting piston,) as embracing means well understood and in common practice and not a part of this invention. It will be noted in the just-described combining of vapor with air that the combination takes place in proximity to the port D of valve-chest; but should it be preferred that the vapor join with the air for the fuller course traveled by the air as it passes valve 46 then by connecting 41

to 15 and plugging passage 17, Fig. 2, and opening valve 15 the desired result may be obtained, as already related; but when, to the contrary, it is not desired that the air be warmed and that the vapor hold most nearly to its higher temperature until it reaches the valve-chamber then the shield 35 is to be omitted and other means employed for conduct of the vapor to the valve-chest. To this end the attachment J, Figs. 7 and 8, preferably a casting having a flange with bolt-holes 48 therein, a scooped-out interior 45, and a boss thereon tapped, (provided for any desired connection thereon—as, for instance, valve 46 and air-screen 47 and plug 47^a,) may be brought into use and is designed to be brought over the openings 17 and D, Fig. 1, and embrace these two ports upon the passage-way 45 thus formed between them. Bolt-holes are to be tapped into cylinder end 2 to register with those, 48, upon the flange of attachment J, Figs. 7, 8, and bolts applied to hold J firmly and tightly in position. Vapor emerging at 17 will be conducted by passage 45 to port D, where it will enter the valve-chamber and meet air being drawn thereinto through 47 46 33, Fig 1.

In Fig. 4 the three-way valve K, with its connecting pipes, is shown as connected with vaporizer about the top thereof in a position like that of valve 15, Fig. 2. The passages 17 18 are shown as closed by screws 19. A T connects bottom of vaporizer in a position like that of the three-way valve K, as shown in Fig. 2. Between this T and the port D (shown on Fig. 1) communication is established by the pipe 40. Upon the opposite end of the T check-valve 46 and air-screen 47 are connected. In this arrangement when it is desired to start engine it is only necessary to open valve to allow a sufficiency of liquid to pass, which will fall through the vaporizer 3 into the current of air being drawn from 47 through the T, assuming, of course, that the piston is moving out upon the suction-stroke. This current will be relied upon to vaporize the liquid coming into it until the igniting and explosions thereof heat the vaporizer sufficiently to provide the hot or more completely vaporized liquid. To facilitate vaporization, gauze or other medium may be interposed in whole or in part upon one or the other or both the vaporizers 3 21, accordingly as the density of the liquid used or other condition may make such introduction advisable. A needle-valve 25 may be provided to coöperate with the needle-valve 11 upon the valve K when such additional control may prove necessary in operating the construction or device H, Fig. 1. So likewise in Fig. 2 the sheath 35 may have thereon a valve 56 to coöperate in control of port 17 and may be omitted when necessary, as it is on Fig. 3.

In Figs. 5 and 6 the three-way valve is shown to consist of an outer case or seat 5, provided with passages and tapped bosses. A rotary valve-plug A, having a vertical passage 12 thereon tapped part way of its length and having therein secured a needle-valve 11, is provided also with a lever 13. A little above the bottom of the passage 12 and radiating therefrom are three other passages, B, adapted to register with those about the bosses after a manner required of them and accordingly as the one or the other of the respective liquids in the pipes 7 or 8 may require to be fed to the vaporizer, Figs. 1, 2. The needle-valve by being passed down into the passage 12 may cause such restriction of flow of liquid through the passages B as may be required, cutting off all flow when passed entirely down to the bottom of its seat. Flow of liquid may of course be also cut off upon turning the valve-plug A so that none of the outer passages are in alinement with the inner passages. A lever 14 is provided for operating the plug A. This plug A has the usual taper and is secured upon its seat in the usual way. Of course the tapped bosses, Figs. 5, 6, are for reception of the pipes 7, 8 and engagement upon the vaporizer 21 or 3. The pipes 7 and 8 communicate with whatever source of liquid-supply, (not shown;) but such source of supply of the containing vessel should be at a point preferably above the point that liquid is discharged into the vaporizer, so that the flow of liquid may transpire, preferably, through gravity.

When construction of the character shown in Figs. 1 and 2 is preferred, gasolene or some such liquid should be injected or brought upon or about the air-passage in proximity to the valve 46 and the screen 47 for purposes of effecting initial charges for starting the engine and heating the vaporizer. To accomplish this, I have shown upon Fig. 2 a pipe 54, intersected by a valve 55, for establishing communication between pipe 8 and air-passage about valve 46. Manipulation of this valve will permit liquid to discharge upon the current of air to start engine and heat vaporizer and thereupon to be cut off. Assuming now that some proper liquid in requisite proportion is being fed upon or about the inlet-passage for air and that the engine-piston is being operated to induct a charge of air into the air-inlet passage, an explosive mixture will be drawn into the chamber 50, which being ignited at a proper time upon the engine's cycle by means provided therefor (not shown for reasons already stated) the vaporizing mechanism will heat. The valves controlling supply being properly adjusted, a supply of vapor will promptly set up as liquid feeds to the vaporizer and dispense with further need of temporary feed of liquid about screen required for starting. Referring now to Fig. 1 and assuming the engine to be operating, suction of the piston inducts air past check-valve 46,

through passage 33, to inlet-chamber or valve-chest. Supposing that ports 17 and D are plugged like 18 and the valve mechanism permitting liquid to flow to be vaporized in vaporizers 21 and 3, the valve 15, adjusted to permit the vapor to pass through it and into pipe 34, will meet incoming charge of air entering through passage 33 and the air and vapor will come together into explosion-chamber 50. Again, a removal of plugs from the ports 17 and D and effecting a covered passage between them by the attachment K, Figs. 7, 8, and closing the valve 15 air will be drawn through the passage 33 and will meet the vapor from the vaporizers in the valve-chest, where they will pass together into the chamber 50 through port 31. Again, with the piece J removed and the sheath 35 substituted, Fig. 3, air-induction will transpire through passage 36 into and through spiral passage 37, meeting vapor emanating through port 17 and with it pass into port D and thence through to chamber 50. Again, with the plug 43, Fig. 2, removed and connection made between valve 15 and T 41 and passage 17 plugged like passage 18 and valve 15 opened air inducted past check-valve 46 will meet vapor in the T 41 and will therewith traverse the various passages, until they enter finally chamber 50 through port 31.

Obviously the valve K could be provided to attach at the position on H, Fig. 1, shown as occupied by valve 25, and vice versa, whereupon the pipe 6 could be omitted. These and other arrangements which may be read upon the drawings afford a multiplicity of ways for causing liquid after it has been strongly heated or vaporized issuing forth to meet and combine with air, warm or cold, and for a long or short travel together, according to the nature or quality of charge required or the character of the liquid to be vaporized. Obviously a light or more readily vaporizable liquid could be used for starting the engine up readily and strongly heating the vaporizing devices or device, and thereupon a turn of the three-way valve could be caused to bring a denser liquid to furnish required vapor. Hence a great many changes and alterations might be resorted to in the general form and arrangement of the several parts described without departing from my invention, and hence I would have it understood that I do not limit myself to the precise details set forth, but consider myself at liberty to make such slight changes and alterations as fairly fall within the spirit and scope of my invention.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a gas-engine, the combination with a combustion-chamber, of a vaporizer, an air-supply passage to said combustion-chamber and a plurality of ducts connecting said vaporizer and air-passage and means for closing any or all of said ducts.

2. In a gas-engine, a vaporizer mechanism secured about the engine, and adapted and provided, to become heated by hot gases evolved within the engine, whereby to heat liquid fed thereinto as a preparatory step for obtainment of a heated product from liquid, which is to be later incorporated with some gaseous body—such as atmospheric air—to effect thereby a combustible compound to effect operation of the engine; inlet and outlet passages upon the vaporizer mechanism, separate pipes conducting separate liquids of differing densities, valve mechanism for effecting control of liquid-discharge from any of said pipes into the vaporizer mechanism; adjustable valves upon and about vaporizing mechanism for controlling discharge into and from the vaporizing mechanism; air-inlet passage communicating with combustion-chamber and with outlet from vaporizer mechanism; extra passages for air, and for vapor of liquid, transmission; plugs for estopping such passages as require to be closed against discharge.

3. In a gas-engine, a vaporizer located in the combustion-chamber of the engine, for rarefying and vaporizing liquid discharged into the vaporizer; such rarefying and vaporizing of liquid transpiring in consequence of heat evolved within the combustion-chamber of the engine; and the liquid thus rarefied, to be thereafter admixed with atmospheric air; inlet and outlet passages upon the vaporizer; liquid-supply pipes; connection made upon the supply-pipes and upon the vaporizer for passage therethrough of liquid from the required supply-pipe and for effecting control of the supply of liquid to discharge into the vaporizer; a passage establishing communication between the interior of the vaporizer and interior of valve-chest; an opening upon this passage having thereon a removable plug; a passage for conveying air into the valve-chest; an inlet-valve disposed upon this air-passage; the air-passage and the passage from the vaporizer disposing to discharge in proximity to the inlet-valve seated in the valve-chest, whereby the air and the heated products of liquid mingle and passing by the valve enter the cylinder, through communicating port, to the combustion-chamber of the engine, to be there utilized for effecting operation of the engine.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WILLIAM WALLACE GRANT.

Witnesses:

WILLIAM FERRIS,

L. A. HOPKINS.