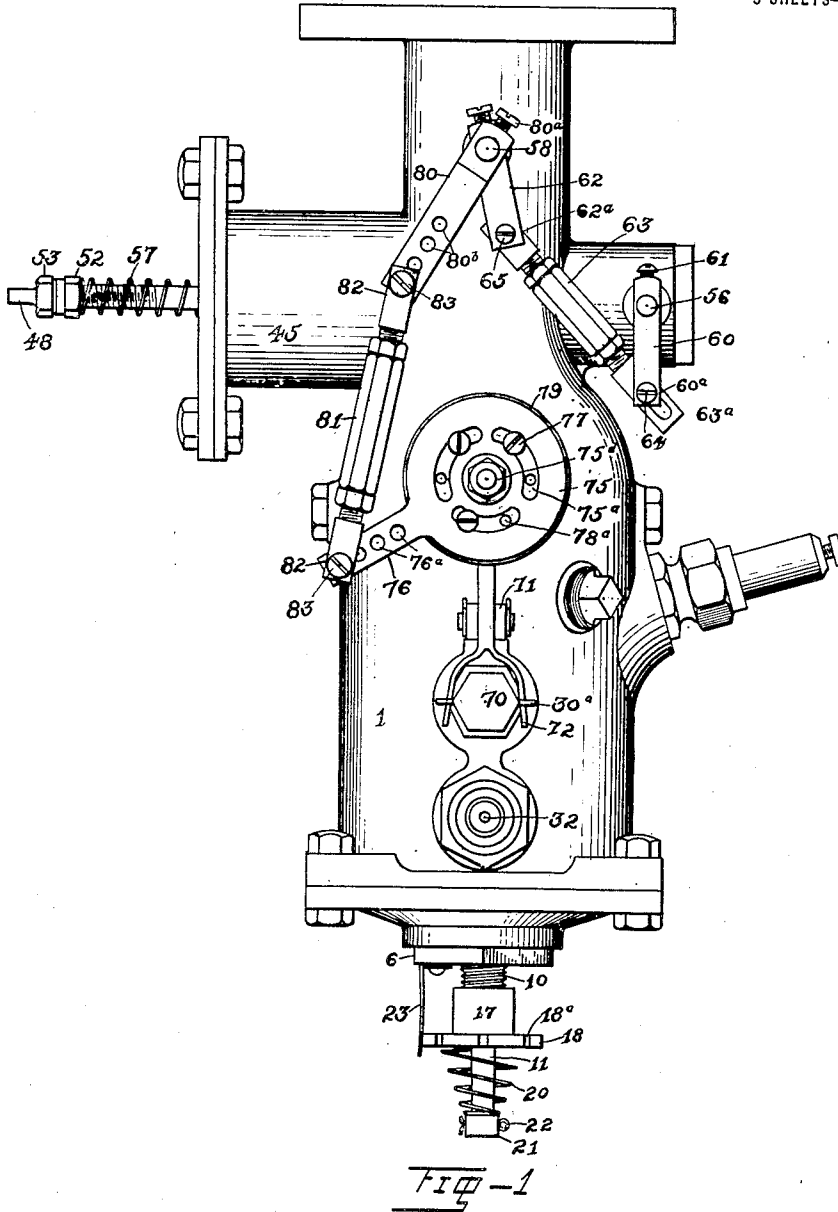


E. A. WEST AND E. E. PARSONS.
OIL GAS PRODUCER.
APPLICATION FILED JUNE 5, 1918.

1,386,038.

Patented Aug. 2, 1921.

3 SHEETS—SHEET 1.



Inventors
Edward A. West and
Edward E. Parsons,
By Hull, Smith, Brock West,
Attys

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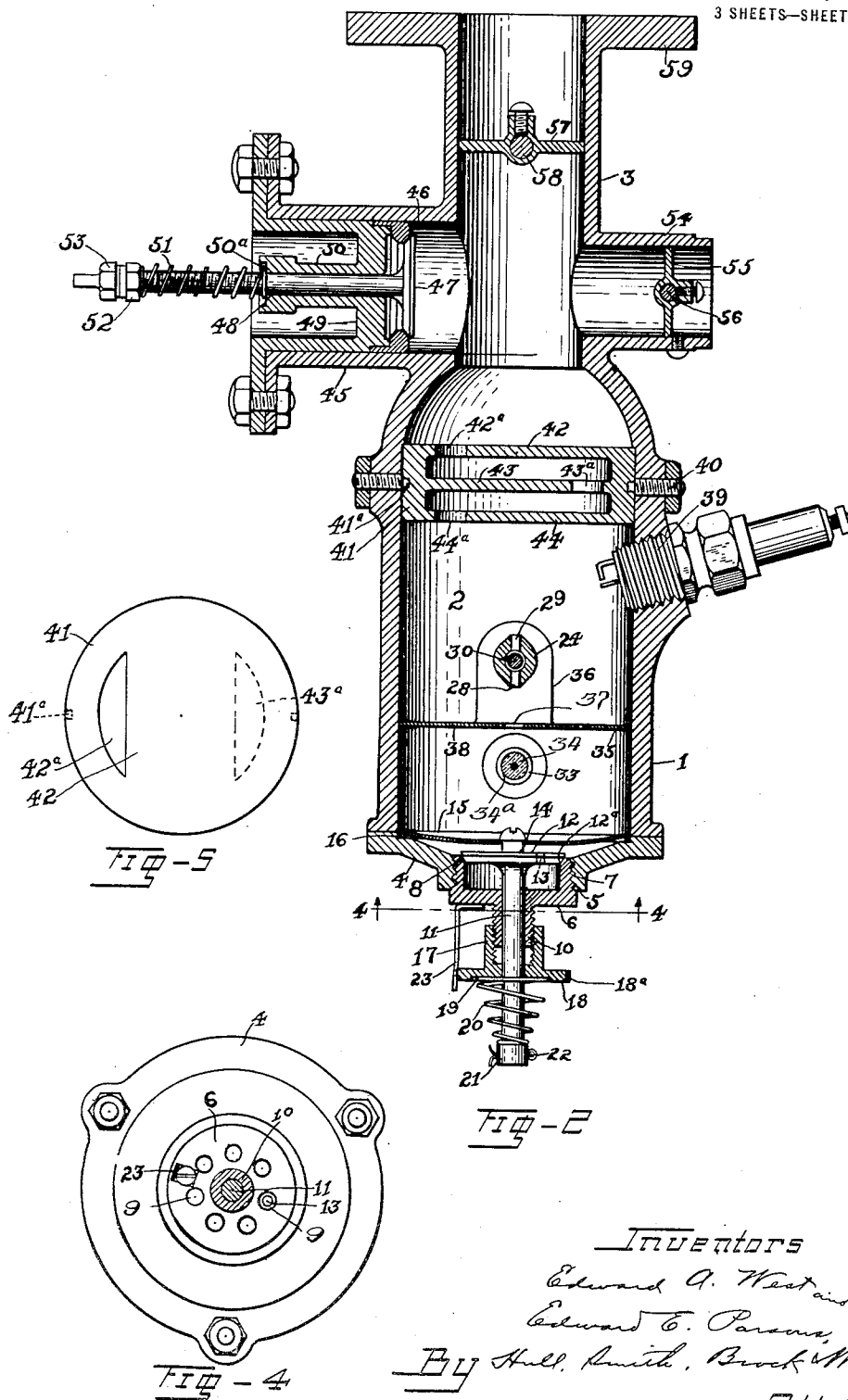
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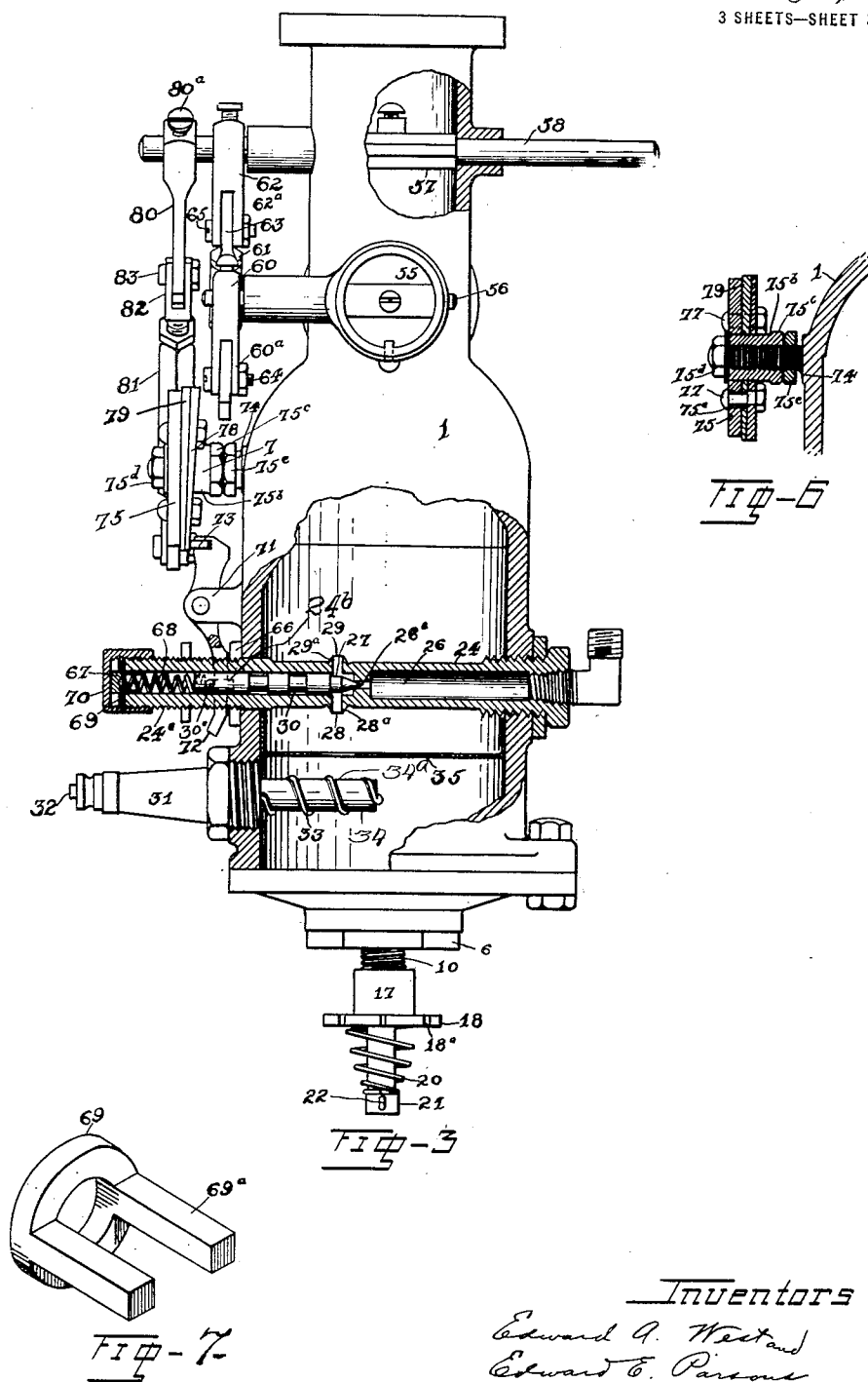
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OIL GAS PRODUCER.

1,386,038.

3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

EDWARD A. WEST, OF WEST PARK, AND EDWARD E. PARSONS, OF CLEVELAND, OHIO,
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OIL-GAS PRODUCER.

1,386,038.

Specification of Letters Patent.

Patented Aug. 2, 1921.

Application filed June 5, 1918. Serial No. 238,251.

To all whom it may concern:

Be it known that we, (1) EDWARD A. WEST and (2) EDWARD E. PARSONS, citizens of the United States, residing at (1) West Park,
5 (2) Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Oil-Gas Producers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to devices or apparatus for gasifying liquid fuels and, in the embodiment disclosed herein, is particularly applicable for use in conjunction
15 with internal combustion engines as a substitute for the carbureters ordinarily employed therewith.

It is the general purpose and object of this invention to provide a device of this character which will enable such engines to be started and operated continuously with fuel oils, as distinguished from gasoline and other lighter distillates; to provide a device which is capable of being operated,
25 not only with various grades of such oils, but which will be capable of operating with complete gasification of the liquid fuel and which will be efficient and reliable in operation and capable of withstanding all of the ordinary incidents of use. We accomplish the foregoing object and other objects which will appear hereinafter in and through the construction embodied in the drawings forming part hereof wherein Figure 1 represents a side elevation of a gasifying device constructed in accordance with our invention. Fig. 2 a central vertical sectional view through such device, Fig. 3, a view, similar to Fig. 1, with parts broken
40 away, the view being taken at about 90 degrees from Fig. 1, Fig. 4 a sectional view corresponding to the line 4-4 of Fig. 2; Fig. 5 a detail in plan of the extinguishing device; Fig. 6, a detail in section of the
45 cam for operating the liquid fuel supply valve, the cam disks being in different relative positions than in Fig. 3; and Fig. 7 a detail in perspective of the washer which assists in supporting the spring and cup of
50 the liquid fuel supply valve.

The invention illustrated, described, and claimed herein is in some respects a continuation of our application #186,606, filed August 16, 1917.

Referring to the drawings, 1 denotes generally the casing of our gas producing device, said casing comprising an elongated cylindrical chamber 2, the upper end whereof is rounded and with which there communicates a cylindrical outlet connection in the form of a neck 3.

Secured to the bottom of the casing 1 and constituting a bottom closure for the chamber 2 is a plate 4, said plate having an internally threaded opening 5 located centrally thereof into which there is threaded a valve seat member comprising a plate 6 having an externally threaded flange 7 provided with a beveled valve seat 8. The plate 6 is provided with a circular series of perforations 9 therethrough; also with a depending externally threaded boss 10, the said boss and the plate 6 being apertured for the reception of the stem 11 of a valve 12, said valve having a beveled seat-engaging portion 12^a and being provided with an aperture 13 through which a fixed amount of air may at all times enter the chamber 2. Mounted on a stud 14, projecting upwardly from the central portion of the valve 12 is a diffusing plate 15, said plate being preferably curved upwardly at the peripheral portion thereof and providing at all times a passageway 16 beneath and around the peripheral portion thereof and the adjacent surfaces of the plate 4 and the chamber 2. Threaded upon the boss 10 is a sleeve 17 having a disk 18 at its lower end, said disk being provided with an annular seat 19 for one end of a spiral spring 20, the opposite end of which engages a collar 21 secured to the lower end of the valve stem 11, as by means of a cotter pin 22. The outer edge of the disk 18 is notched, as indicated at 18^a, the notches cooperating with the arm 23 of a locking spring secured to and projecting from the plate 6.

Extending into the chamber 2 is the delivery section, of the liquid fuel supply conduit. This delivery section, indicated at 24, 100

is extended entirely across and beyond the chamber, whereby the entering liquid fuel will be heated in one portion of such section while the other portion thereof provides a guide for a valve by which the supply of liquid fuel to the chamber 2 may be regulated. The section 24 is shown as threaded into the opposite sides of the chamber 2, being provided with a connection 25 from which a pipe (not shown) may in turn extend to the ordinary float feed chamber employed with carbureters and adapted to maintain a level slightly below the restricted port 26^a in the bore 26. At a point beyond the central portion of the chamber 2, the bore 26 communicates with a vertical port 27 extending through said section and having a downwardly directed discharge outlet 28 and an upwardly directed discharge outlet 29. Mounted in that portion of the bore of the section 24 which is opposite the passageway 26 is a reciprocating needle valve 30, said needle valve being operated through connections to be described hereinafter. Surrounding the discharge outlet 28 is an annular ledge or lip 28^a which prevents the liquid supplied through the orifice 28 from flowing along the body of the section 24 and thence accumulating upon the inner wall of the chamber 2. A similar lip or ledge 29^a surrounds the discharge orifice 29.

Immediately below the supply section 24 and extending beneath and beyond the outlet 28 is a heating element comprising a metallic body 31 through which there extends an electrode 32, insulated therefrom. Attached to the inner end of this electrode is a suitable resistance 33, which is wrapped about an insulating body 34, in which the electrode 32 is mounted said body being supported within the metallic casing 31. The opposite end of the resistance 33 may be grounded to the metallic body or to the casing. As shown, this resistance preferably is seated in a spiral groove formed in such insulating body. The resistance will be heated in any convenient manner for the starting operation, as by means of the circuit including the storage battery.

Interposed between the supply conduit section 24 and the heating element comprising the parts 31—34 is an air diffusing and distributing plate 35. This plate extends entirely across the chamber 2, with its peripheral portion fitting snugly against the inner wall of said chamber, and may be conveniently suspended from the conduit section 24 as by means of upwardly extending flanges 36 each having an aperture therethrough for the reception of said section. This plate is provided with a large aperture 37 located beneath and registering with the through port 27. In addition, it is provided with a number of small apertures 38 more or less uniformly distributed through-

out its extent and serving to diffuse the air entering through to the valve 12 into the portion of the chamber above said plate.

In order to ignite the mixture of air and liquid fuel within the chamber 2, a spark plug 39 is provided, said plug being screwed into a downwardly inclined opening in the wall of the chamber 2 above said plate and above the section 24. This spark plug may be operated by a vibrator independent of the ignition system for the motor, or in any other convenient manner. If operated continuously, it will serve the purpose of reigniting the mixture within the chamber 2 should the flame therein become extinguished. By inclining the plug downwardly any liquid fuel that might accumulate thereon will be delivered into the chamber in such manner as to insure its gasification.

Above the spark plug is a flame extinguisher which may be conveniently formed as a casting secured within the outlet portion of the chamber, as by means of screws 40 threaded into opposite sides of the wall of said chamber, their inner pointed ends entering corresponding recesses 41^a in the outer wall 41 of the extinguisher. The extinguisher comprises a series of parallel disks, three such disks being shown and indicated respectively at 42, 43, and 44, each connected to and preferably cast with the outer wall 41 and each having an aperture therethrough, indicated at 42^a, 43^a, and 44^a, respectively. The aperture 44^a is located adjacent to one side of the wall 41, the aperture 43^a adjacent to the opposite side of said wall, while the aperture 42^a is shown as directly above the aperture 44^a. This arrangement of the disks and apertures provides a tortuous passageway for the mixture of gas and flame which insures the extinguishing of the flame before it can reach the neck 3. The port 44^a, in the final disk 44 is in effect the outlet from chamber 2.

Projecting from the base of the neck 3 is a conduit 45 for auxiliary air. Within this casing is an annular valve seat 46 and cooperating with said seat is a valve 47, the stem 48 whereof is supported by a spider 49 having a central extension or hub 50 provided with an annular seat 50^a at the outer end thereof for the reception of a helical spring 51 which surrounds the valve stem, bearing at one end against said seat and at its opposite end against a nut 52 threaded on the stem. This nut affords a means for varying the tension of the spring and hence the degree of suction or vacuum at which the valve 47 shall open as well as the extent of opening of said valve by such suction or vacuum, a lock nut 53^a being employed to secure the nut 52 in any position to which it may be adjusted with reference to said stem.

Projecting from the base of the neck 3 and preferably in line, with the conduit 45 is a second air supply conduit 54, provided with a butterfly valve 55 mounted on a shaft 56.

Within the upper portion of the neck 3 is a throttle valve 57 of the ordinary butterfly type, said throttle valve being mounted upon a shaft 58. At its upper end, the neck 53 is provided with a flange 59 by means of which it may be secured to the intake manifold of the engine or to a conduit leading thereto.

Means are provided whereby the valves 30, 55, and 57, may be operated in unison and the throw of said valves relatively to one another may be varied as occasion may require. The shaft 56 is adjustably connected to the throttle valve shaft 58 by means of an arm 60 secured to shaft 56 by means of a set screw 61, an arm 62 secured in like manner to the shaft 58, and a turnbuckle link 63 connecting said arms. The lower end of the arm 60 is forked, as indicated at 60^a and is connected to the turnbuckle link by means of a bolt 64 mounted in said forks and extending through a slot 63^a at the bottom of said link. The lower end of the arm 62 is also forked, as indicated at 62^a, and is connected to the upper end of the turnbuckle link by means of a bolt 65. The lost motion connection between the valves 55 and 57 enables the latter valve to be moved a certain distance, if desirable, without operating the former; it also provides means whereby one of said valves may be conveniently adjusted with reference to the other.

The valve 30 extends outwardly beyond the casing 1 into a similarly located extension 24^a of the conduit section 24, being provided at its outer end with a pair of pins 30^a projecting into slots 24^b formed in such extension, said extension being threaded and provided with a lock nut 66. In the end of the bore of the extension is a cup 67, receiving therewithin one end of a spring 68, the opposite end of which bears against the outer end of the valve 30 and tends to hold the same in a position to close the port 26^a. Surrounding said cup is a washer 69 having a pair of prongs 69^a mounted in the slots 24^b and assisting to retain the spring in operative relation to the valve 30 and to a capped nut 70 mounted on the end of the extension 24^a and serving to retain the cup 67 and the spring 68 in place as well as to provide a means for adjusting the tension of the spring.

Pivoted to a pair of lugs 71 projecting from the casing wall is a yoked lever, the yoke legs or branches 72 whereof are adapted to engage the pins 30^a, the upper end of said lever carrying a roller 73 which in turn bears against the inner member of a

double cam sleeved upon a stud projecting from and supported by the casing. The stud is indicated generally at 74. The cam comprises a supporting disk 75 having an arm 76 projecting therefrom and provided with a plurality of apertures 76^a affording means whereby the cam may be variably rotated from the throttle valve.

The supporting disk is provided with segmental slots 75^a and a central sleeve 75^b on which it is rotatably supported. Co-operating with said supporting disk is a cam disk 78 having its inclined face presented inwardly or toward the casing 1 and also provided with segmental slots 78^a adapted to register with the slots 75^a. Co-operating with the cam disk 78 is a second cam disk 79 having its inclined face presented outwardly to co-operate with the inclined face of the disk 78. The disk 79 is provided with threaded apertures 79^a each of which is adapted to receive a screw 77 extending through the slots in the disk 75 and 78. The disks 78 and 79 are each shown as provided with a central aperture through which the sleeve 75^b extends, said sleeve being threaded on the stud 74 and having a squared end 75^c adapted to receive a wrench. By this construction, it will be evident that the cam 78 may be rotatably adjusted with reference to the disk 75 and the cam disk 79 may be rotatably adjusted with reference to the cam disk 78 to vary the throw of the cam as a whole and thereby the throw of the valve 30. When the cam disks shall have been properly adjusted with reference to each other and to the supporting disk, the disks may be secured in permanent relation to one another by setting up on the screws 77. Further adjustment of the cam assembly as a whole longitudinally with respect to the stud shaft may be secured by means of the central sleeve 75^a, lock nuts 75^d and 75^e being shown for the purpose of securing the cam assembly in proper position upon said shaft.

80 denotes a second arm secured to the throttle valve shaft 58, as by means of a set screw 80^a, and having a series of apertures 80^b therethrough. A turnbuckle link 81 having forked ends 82 provides an adjustable connection between the arms 76 and 80, the arms and forked ends of the link being connected by means of bolts 83, adapted to enter suitably selected apertures 76^a and 80^b. This construction not only permits of a suitable variation between the throw of the throttle valve, valve 55, and the valve 30 (through the cam disk 75 and the connections) but also permits of the relative adjustment of said valves irrespective of such throw.

With the parts constructed and arranged as described the operation will be as follows, assuming that the valve 30 is in closed position and that the normal level of the liquid

in the float feed chamber is slightly below the port 26^a. The throttle valve is opened as far as desirable, thereby moving the valve 30 so as to permit a flow of liquid fuel through the port 26^a. The level of the liquid fuel in the float feed chamber being temporarily raised for the starting operation by suitable mechanical means, the liquid fuel will flow through the conduit section 24 and through the downwardly directed outlet 28 upon the heater body 34, to which current will have been supplied by a suitable switch in the battery circuit. The oil striking this heated surface will follow the groove provided therefor and will be vaporized. This vapor, mingled with air admitted through the permanent air port 13 passes into the chamber 2, the mixture will be ignited by the spark plug 39 and a flame will be produced by the combustion of such mixture in the chamber in the presence of the air admitted through the port 13 of the valve 12. The engine is then started in the usual manner. The suction produced by starting and operating the engine will cause the valve 12 to be unseated, a distance corresponding to such suction or vacuum, the valve being so designed and the tension of the spring 20 so adjusted that at all times there will be sufficient quantity of air within the chamber 2 to produce complete gasification of the liquid fuel supplied thereto. As soon as the engine is started the suction produced thereby will cause a reversal of the direction of liquid supplied through the port 27, the liquid being drawn upwardly through the outlet 29. The air admitted by the valve 12 is distributed to and diffused throughout the chamber 2, a jet of such air through the opening 37 passing upwardly through the through port 27 (comprising the outlets 28 and 29) and serving to atomize the entering liquid fuel, thus placing it in condition for proper and complete gasification through contact with the flame within said chamber. The atomization of the oil by the air supply through the aperture 37 is due to the fact that this aperture, because of its size, affords a path through which a greater part of the air admitted by the valve 12 may pass freely to the part of the chamber thereabove. The apertures 38, being relatively small, allow a smaller proportion of the air to pass therethrough, the flow of such air being retarded by frictional resistance, due to their small size. The openings 38 provide means for diffusing the air from beneath the plate 35 throughout the portion of the chamber 2 thereabove, this diffusion of air being an important consideration in securing the complete gasification of the fuel. As soon as the engine is started, current is cut off from the preliminary heating device 31-34. In actual practice, only about one-half of one percent. of the liquid fuel supplied to the chamber 2 will be required for the purpose of maintaining a gasifying flame therewithin, the remainder of the gas produced in such chamber passing through the flame extinguisher and through the neck connection 3 to the engine cylinders. On its way, additional air is mixed therewith through the automatically operating auxiliary air valve 47 and the valve 55, which valve may be operated from the throttle valve in conjunction with the liquid supply valve 30 through the connections hereinbefore described.

Reference has been made hereinbefore to the air port 13 through the valve 12. This port insures a permanent supply of air to the chamber 2 which is adequate for starting purposes at all times, while the plate 15 serves to diffuse and distribute the air admitted through the said valve to the plate 35 thereabove in such manner as to assist in the complete gasification of the fuel. The plate 15 extends across the bottom of the chamber 2 with its periphery in close proximity to the wall of said chamber, providing a narrow annular space therebetween. This plate serves the triple function of enabling the suction or vacuum in the chamber 2 to operate the valve 12 of smaller area attached thereto; it diffuses and distributes the air passing therearound to the portion of the chamber beneath the plate 35; and, should any fuel condense upon the wall of the chamber, the air flowing around the periphery of the plate catches such oil and delivers it to the upper portion of the chamber, where it is ignited.

The extinguisher prevents any flame from passing out of the chamber 2 into the connections leading therefrom to the manifold and insures a supply of gas, unmixed with flame, at all times.

By the manner of connecting the throttle valve with the valves 30 and 55, we are enabled to vary the relative throws of said valves and to so correlate their movements as to insure a supply of liquid fuel and of additional auxiliary air in proportion to the throttle valve opening and to the engine demand.

The provision of the automatic air valve 12 enables us to secure a supply of air to the chamber 2 which is proportional to the liquid fuel admitted thereto, with the result that we obtain a supply of gas from said chamber which is proportional to the load and speed demands of the engine and also insure a substantially constant temperature in the gases flowing from said chamber.

Through the use of the plate 35, we atomize the liquid fuel and thereby prevent the formation of drops which would otherwise be deposited upon the wall of said chamber and gravitate to the bottom of the producer. Furthermore, this atomizing of

the liquid fuel with the air enables the flame within the producing chamber to effectually gasify the fuel.

By extending the conduit section 24 into 5 and across the chamber 2, the said section is subjected to the action of the flame, whereby the entering liquid fuel is given a pre-heating before it is atomized and the final gasification of such fuel is facilitated. The 10 outer end of the valve 30 and its operating connections are located outside the gasifying chamber protecting such connections and the spring 68 from detrimental heating and rendering them conveniently accessible for 15 assembling adjustment, replacement and repair.

By reason of the construction of the cam which operates the valve 30, the said cam may be moved inwardly and outwardly on 20 its shaft and the parts thereof are themselves relatively adjustable so as to vary as desired the opening and closing movements of said valve.

Having thus described our invention what 25 we claim is:—

1. In a device of the character described, the combination of a chamber having an outlet at its upper portion and an air supply valve in its lower portion and operative 30 by variations in the pressure on opposite sides thereof, a liquid fuel supply conduit extending into the said chamber and provided therewithin with a vertically extending through port located above said valve, 35 an air distributing and diffusing plate interposed between said port and said valve, a valve controlling the supply of liquid fuel to said through port, a heating device below the said port, an igniting device above said 40 port, a flame extinguishing device above said igniting device, an outlet connection leading from said chamber above said extinguishing device, a conduit for auxiliary air communicating with said connection and an 45 automatically operating valve therein, a second conduit for auxiliary air communicating with said connection and a valve therein, a throttle valve above said auxiliary air valves and adjustable connections between 50 said throttle valve the second auxiliary air valve, and the liquid fuel valve.

2. In a device of the character described, the combination of a chamber having an outlet connection and an air supply valve 55 operative by variations in the pressure on opposite sides thereof, a liquid fuel supply conduit extending into the said chamber and provided therewithin with a through port, an air distributing and diffusing plate 60 interposed between said port and said valve, a valve controlling the supply of liquid fuel through said port, a heating device in operative relation to said port, an igniting device in operative relation to said port, a 65 flame extinguishing device interposed be-

tween said outlet connection and said igniting device, a conduit for auxiliary air communicating with said connection and an automatically operating valve therein, a second conduit for auxiliary air communicating 70 with said connection and a valve therein, a throttle valve, and means for operating said throttle valve, the second auxiliary air valve and the liquid fuel valve.

3. In a device of the character described, 75 the combination of a chamber having an outlet connection in the upper portion thereof and a suction operated air supply valve in the lower portion thereof, said valve having a permanent air supply port there- 80 through, a liquid fuel supply conduit extending into said chamber and provided therewithin with a vertically extending throughport located above said valve, an air distributing and diffusing plate inter- 85 posed between said conduit and said valve and having a perforation in axial alinement with said port and a plurality of smaller perforations, a valve controlling the supply of liquid fuel through said port, a heating 90 device below said port, an igniting device above said conduit, a flame extinguishing device above said igniting device, a conduit for auxiliary air communicating with said connection and a suction operated valve 95 therein, a second conduit for auxiliary air communicating with said connection and a valve therein, a throttle valve, and adjustable connections between said throttle valve, the second auxiliary air valve, and the liquid 100 fuel valve.

4. In a device of the character described the combination of a chamber having an outlet connection and an air supply valve 105 operative by variations in pressure on opposite sides thereof, said valve having a permanent air supply port therethrough, a liquid fuel supply conduit extending into said chamber and provided therewithin with a throughport, an air distributing and diffusing 110 plate interposed between said port and said valve and having a perforation in axial alinement with said port and a plurality of smaller perforations, a valve controlling the supply of liquid fuel through said port, a 115 heating device in operative relation to one of the outlets of said port, an igniting device in operative relation to the other outlet of said port, a flame extinguishing device interposed between said igniting device and 120 the outlet connection, a conduit for auxiliary air communicating with said connection and an automatically operating valve therein, a second conduit for auxiliary air communicating with said connection and a valve 125 therein, a throttle valve, and adjustable connections between said throttle valve, the second auxiliary air valve, and the liquid fuel valve.

5. In a device of the character described, 130

the combination of a chamber having an outlet connection at the top thereof and a suction-operated air valve at the bottom thereof having a permanent air supply port therethrough, a liquid fuel supply conduit extending into and across said casing and having a vertical throughport provided with oppositely directed outlets each having a lip surrounding the same, a valve slidably mounted in said conduit and controlling said port, a distributing plate movable with said air valve and interposed between the same and the said port, an air distributing and diffusing plate extending across said casing between the said port and the air valve, said plate having an aperture therethrough registering with said port and provided with a multiplicity of smaller apertures in addition to the first mentioned aperture, a preliminary heating device located below said port, an igniting device in said casing above said port, a flame extinguishing device in said chamber above said igniting device, an outlet connection extending from the chamber, an auxiliary air supply conduit communicating with the said connection and an automatically operating air valve therein, a second conduit for auxiliary air also communicating with said connection and a valve therein, a throttle valve beyond said auxiliary air conduits, and adjustable connections between said throttle valve the valve in the second auxiliary air supply conduit and the liquid fuel valve.

6. In a device of the character described, the combination of a chamber having an outlet connection and an automatic air valve provided with a permanent air supply port therethrough, a liquid fuel supply conduit extending into said chamber and having a throughport provided with oppositely directed outlets each having a lip surrounding the same, a valve slidably mounted in said conduit and controlling said port, a distributing plate movable with said automatic air valve and interposed between the same and the said port, an air distributing and diffusing plate extending across said casing between the liquid fuel supply conduit and the air valve, said plate having an aperture therethrough registering with said port and provided with a multiplicity of smaller apertures in addition to the first mentioned aperture, a preliminary heating device in operative relation to said port, an igniting device in operative relation to said port, a flame extinguishing device in said chamber between said igniting device and the outlet connection, an auxiliary air supply conduit communicating with the said connection and an automatically operating air valve therein, a second conduit for auxiliary air also communicating with said connection and a valve therein, a throttle valve beyond said auxiliary air conduits, and adjustable con-

nections between said throttle valve, the valve in the second auxiliary air supply conduit, and the liquid fuel valve.

7. In a device of the character described, the combination, with a chamber, of a liquid fuel conduit having an outlet communicating with said chamber, a device for preliminarily heating the liquid fuel supplied to said chamber, a device for initiating and maintaining a gasifying flame in said chamber, a valve operating automatically to supply air to said chamber in accordance with pressure conditions therein, and means interposed between said valve and the said outlet for diffusing the air admitted by said valve to the generating portion of said chamber.

8. In a device of the character described, the combination, with a chamber, of a liquid fuel supply conduit projecting thereinto and having a throughport adapted to supply fuel in opposite directions into said chamber, a preliminary heating device arranged to receive the fuel supplied from one of the branches of said port, an igniting device in said chamber in operative relation to the other branch of said port, means for supplying air to said chamber, and means cooperating with the air supplying means for directing a portion of such air through such port thereby to atomize the liquid fuel.

9. In a device of the character described, the combination, with a chamber, of a liquid fuel supply conduit projecting thereinto and having a branched outlet with a lip surrounding the delivery end of each branch, said outlet adapted to supply fuel in opposite directions into said chamber, a preliminary heating device arranged to receive the fuel supplied from one of the branches of said outlet, an igniting device in said chamber, means for supplying air to said chamber, and means cooperating with the air supplying means for directing a portion of such air through such outlet thereby to atomize the liquid fuel therein.

10. In a device of the character described, the combination, with a chamber having an outlet, of a liquid fuel supply conduit extending into said chamber and having a throughport one of the branches whereof extends toward such outlet, an igniting device interposed between such port and said outlet, a preliminary heating device arranged to receive fuel from one of the branches of said port, an air supply connection communicating with said chamber on the opposite side of the port from the outlet, and an air distributing and diffusing plate interposed between the air supply connection and the conduit and having an aperture therethrough registering with said port.

11. In a device of the character described, the combination, with a chamber having an outlet, of a liquid fuel supply conduit ex-

tending into said chamber and having a throughport one of the branches whereof extends toward such outlet, a preliminary heating device arranged to receive fuel from one of the branches of said port, an air supply connection communicating with said chamber on the opposite side of the conduit from the outlet, means for directing a jet of the air entering said chamber through said port, and means for igniting the mixture of fuel and air in said chamber.

12. In a device of the character described the combination of a chamber, a liquid fuel supply conduit having an outlet within said chamber, a valve operative by suction or vacuum within said chamber for admitting air thereto, and an air distributing and diffusing device within said chamber and interposed between said valve and said outlet and having means for directing a jet of air in operative relation to said outlet to atomize the liquid supplied therefrom.

13. In a device of the character described, the combination of a chamber, a liquid fuel supply conduit having an outlet within said chamber, an air supply valve operative by suction or vacuum within said chamber for admitting air thereto and having means for admitting a predetermined amount of air to said chamber independently of its movement, and an air distributing and diffusing device interposed between said valve and said outlet and having means for directing a jet of air in operative relation to said outlet to atomize the liquid fuel supplied therefrom.

14. In a device of the character described, the combination of a chamber, a liquid supply conduit having a port within said chamber, an air supply valve operative by suction or vacuum in said chamber for supplying air thereto and having a port adapted to admit a permanent supply of air to said chamber, and a plate interposed between said valve and said port and having an aperture arranged to direct a jet of air in operative relation to said port to atomize the fuel issuing therefrom and additional apertures for diffusing the air into said chamber.

15. In a device of the character described, the combination, with a generating chamber, of a liquid fuel supply conduit having a port for supplying fuel to said chamber, an air valve operative by suction or vacuum in said chamber for supplying a variable quantity of air thereto and having means for admitting at all times a predetermined supply of air to said chamber, a distributing and diffusing plate for the air admitted by said valve and interposed between said valve and said port, and means for igniting the mixture of air and fuel supplied to and within said chamber

16. In a device of the character described, the combination, with a generating chamber, of a liquid fuel supply conduit having a port for supplying fuel to said chamber, an air valve operative by suction or vacuum in said chamber for supplying a variable quantity of air thereto and having means for admitting at all times a predetermined supply of air to said chamber, a distributing and diffusing plate for the air admitted by said valve and interposed between said valve and said port, a plate of greater area than said valve and connected thereto and interposed between the said valve and the said distributing and diffusing plate and means for igniting the mixture of air and fuel supplied to and within said chamber.

17. In a device of the character described, the combination, with a generating chamber, of a liquid fuel supply conduit extending into said chamber and having a throughport, an air valve operated by suction or vacuum in said chamber, said air valve having means for admitting a predetermined supply of air to said chamber independent of its movement, an air distributing and diffusing plate interposed between said air valve and said throughport and having an aperture therethrough registering with said port and provided with a multiplicity of smaller apertures additional to the first mentioned aperture, an igniting device interposed between the said plate and the said valve, and a plate of greater area than said valve and connected thereto and interposed between the said valve and the said igniting device.

18. In a device of the character described, the combination, with a generating chamber, of a liquid fuel supply conduit extending into said chamber and having a throughport, an igniting device in said chamber on one side of said conduit, an air valve operated by suction or vacuum in said chamber and arranged on the opposite side of said conduit from the said igniting device, and an air distributing and diffusing plate interposed between said air valve and said throughport and having an aperture therethrough registering with said port and provided with a multiplicity of smaller apertures additional to the first mentioned aperture.

19. The combination, with a vertical chamber having means for igniting a mixture of air and fluid fuel, of a conduit having a port for supplying liquid fuel to said chamber, an air distributing and diffusing plate extending across said chamber below said port, an upwardly opening air valve below said plate and having means for admitting at all times a predetermined supply of air to said chamber, and a plate connected to said valve above the latter and extending

substantially across said chamber with its periphery in close proximity to the wall of said chamber.

20. In a device for generating gas by subjecting a mixture of heavy liquid hydrocarbon and air to the action of a flame produced by the combustion of a portion of such mixture, the combination of a gas generating chamber having an air inlet and an outlet, a liquid fuel conduit having a throughport interposed between said inlet and outlet, means for delivering a portion of the air supplied by said inlet as a forcible jet into the throughport, thereby to atomize the fuel, and means for igniting the mixture of air and fuel supplied to and within said chamber.

21. In a device for generating gas by subjecting a mixture of heavy liquid hydrocarbon and air to the action of a flame produced by the combustion of a portion of such mixture, the combination of a gas generating chamber having an air inlet and an outlet, a liquid fuel conduit having its delivery end interposed between the inlet and outlet, means for delivering a portion of the air supplied by said inlet as a forcible jet across the delivery end of the conduit thereby to atomize the fuel, and means for igniting the mixture of air and fuel supplied to and within said chamber.

22. In a device of the character described, the combination of a generating chamber having an air inlet and an outlet, a conduit having its delivery end interposed between the inlet and outlet, means for delivering a portion of the air supplied by said inlet as a forcible jet across the delivery end of the conduit thereby to atomize the fuel, means for diffusing the remainder of such air throughout the said chamber, and igniting means located within said chamber and between the delivery end of the conduit and the outlet.

23. In a device of the character described, the combination of a generating chamber having an air inlet and an outlet, a conduit having its delivery end interposed between the inlet and outlet, a plate extending across said chamber between said inlet and the delivery end of the conduit, said plate having an opening adapted to supply a jet of air across such delivery end of the conduit and a plurality of air diffusing openings additional to such jet opening, and means for igniting the mixture of air and fuel supplied to and within said chamber.

24. In a device for generating gas by subjecting a mixture of heavy liquid hydrocarbon and air to the action of a flame produced by the combustion of a portion of such mixture, the combination of a gas generating chamber having an outlet and an air inlet opening, a liquid fuel conduit extending into said chamber between said inlet

opening and said outlet, a valve controlling said inlet opening and operable by the suction or vacuum in said chamber, and means for igniting the mixture of air and fuel supplied to and within said chamber.

25. In a device of the character described, the combination of a generating chamber having an outlet and an air inlet opening, a liquid fuel conduit extending into said chamber between said inlet opening and said outlet, a valve controlling said inlet opening and operable by the suction or vacuum in said chamber, said valve having means irrespective of its movement for admitting air to said chamber, and means for igniting the mixture of air and fuel supplied to and within said chamber.

26. In a device of the character described, the combination, with a generating chamber having an air inlet and an outlet, of a liquid fuel supply conduit having an outlet for supplying liquid fuel to said chamber between its inlet and outlet, an air valve operative by suction or vacuum in said chamber for supplying air thereto from said inlet, a plate of greater area than said valve and connected thereto and interposed between the said valve and the conduit outlet, and means for igniting the mixture of air and fuel supplied to and within said chamber.

27. The combination, with a chamber having means for igniting a mixture of air and fluid fuel, of a conduit, having an outlet for supplying liquid fuel to said chamber, an air valve in operative relation to said outlet, a plate connected to said valve and extending substantially across said chamber with its periphery in close proximity to the wall of said chamber, and means for igniting the mixture of air and fuel supplied to and within said chamber.

28. In a device of the character described, the combination of a chamber, a liquid fuel supply conduit communicating therewith, a valve operative by vacuum or suction in said chamber for admitting air thereto, means independent of the movement of said valve for admitting a permanent supply of air to said chamber, a spring resisting the opening of said valve, means for varying the resistance offered by said spring to such opening of said valve, and means for igniting the mixture of such air with the liquid fuel in said chamber.

29. In a device of the character described, the combination of a chamber, a liquid fuel supply conduit projecting thereinto and having a through port providing oppositely directed discharge outlets, the lower outlet having an annular lip surrounding the same, a preliminary heating device below the lower outlet, and an igniting device within said chamber.

30. In a device of the character described,

the combination of a chamber, a fuel supply conduit projecting into the said chamber and provided with a port therein and a preliminary heating device detachably secured to said chamber and extending in operative relation to said port, said device comprising an insulating body having a liquid receiving groove and a resistance element mounted in said groove.

31. In a device of the character described, the combination of a chamber, a liquid fuel supply conduit projecting into said chamber through the wall thereof and having a downwardly directed discharge port within said chamber and a preliminary heating device detachably connected to the wall of said chamber and extending beneath and substantially parallel with said conduit and beneath the port thereof, said device comprising an insulating body having a spiral groove extending therearound, and a resistance element mounted in said groove.

32. In a device of the character described, the combination of a generating chamber having an air port, a preliminary heating device above said port, a liquid fuel supply conduit extending into said chamber and provided with a through port above and having one of its branches directed toward said heating device, an igniting device in said chamber above said conduit and the other branch of said through port, and a flame extinguishing device above said igniting device.

33. In a device of the character described, the combination of a generating chamber having an air port and an outlet, a liquid fuel supply conduit projecting into said chamber between said port and outlet and having a through port one of the branches whereof is directed toward said air port and the other branch toward said outlet, and an igniting device interposed between said conduit and said outlet.

34. In a device of the character described, the combination of a generating chamber having an air port and an outlet, a liquid fuel supply conduit projecting into said chamber between said port and outlet and having a through port one of the branches whereof is directed toward said air port, an igniting device interposed between said conduit and said outlet, and a preliminary heating device interposed between the air port and the through port and arranged to receive liquid fuel from the branch of said through port which is directed toward said air port.

35. In a device of the character described, the combination of a generating chamber having an air port and an outlet, a liquid fuel supply conduit extending into said chamber between said port and outlet and

having a vertically extending through port, a preliminary heating device in said chamber below the lower branch of said through port, an igniting device in said chamber above said conduit, and a flame extinguishing device above said igniting device.

36. In a device of the character described, the combination of a generating chamber, a liquid fuel conduit extending therethrough and having a throughport intermediate of its ends in said chamber and a fuel supply bore extending to said port from one end thereof, a valve mounted in the opposite portion of said conduit from said bore for controlling the supply of liquid fuel to said port and having an operating portion located outside said chamber, means for supplying air to said chamber at one side of said through port, an igniting device in said chamber on the opposite side of said through port from such air supply, means located outside of said chamber for operating said valve, and means for extinguishing the flame produced by said igniting device.

37. In a device of the character described, the combination of a generating chamber, a liquid fuel supply conduit extending there-through and having a through port intermediate of its ends in said chamber and a supply bore extending to said port from one end thereof, a reciprocating valve mounted in the opposite portion of said conduit from said bore and having an operating portion located outside said chamber, a lever coöperating with said operation portion of said valve and located outside said chamber, means for supplying air to said chamber at one side of said through port, an igniting device in said chamber on the opposite side of said through port from such air supply, a flame extinguishing device, a valve for admitting air to the gaseous mixture beyond said flame extinguishing device, a throttle valve, and operative connections between said valves.

38. In a device of the character described, the combination of a generating chamber having an air inlet and an outlet, a liquid fuel conduit extending through said chamber and having a port intermediate of its ends in said chamber and a liquid fuel supply bore extending from one end thereof to said port, a valve coöperating with said bore and mounted in the opposite portion of the conduit therefrom and extending outside said chamber, an igniting device interposed between said conduit and said outlet, and means for extinguishing the flame produced by said igniting device.

In testimony whereof, we hereunto affix our signatures.

EDWARD A. WEST.
EDWARD E. PARSONS.