June 22, 1937. R. S. LANGE 2,084,530

GAS PRODUCER

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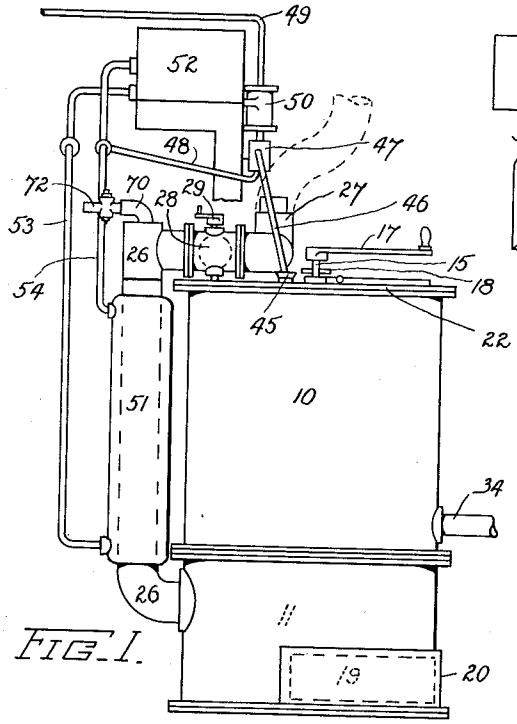

FIG. 1.

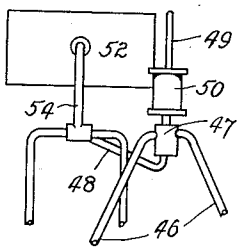

FIG. 3.

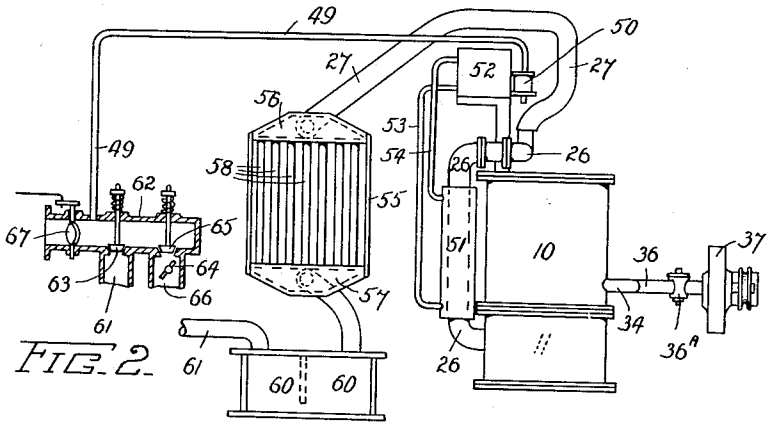

FIG. 2.

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FIG. 4

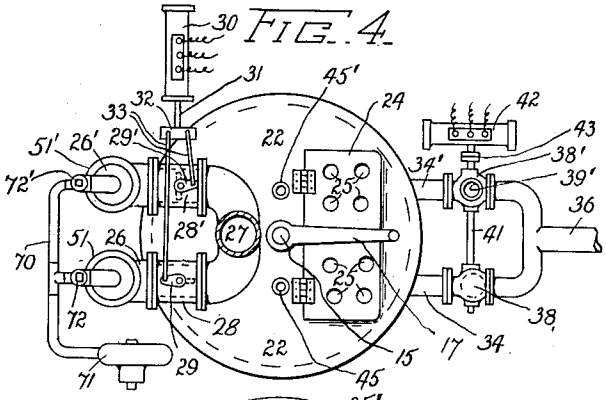


FIG. 5

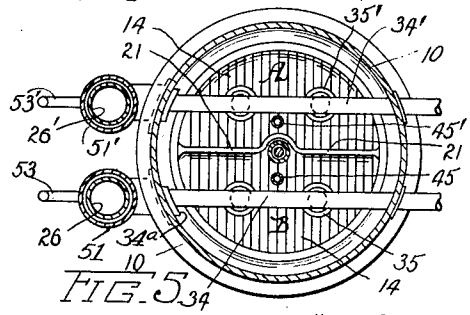
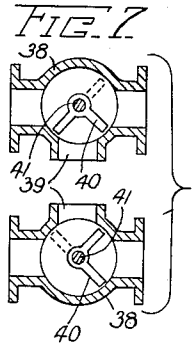


FIG. 7



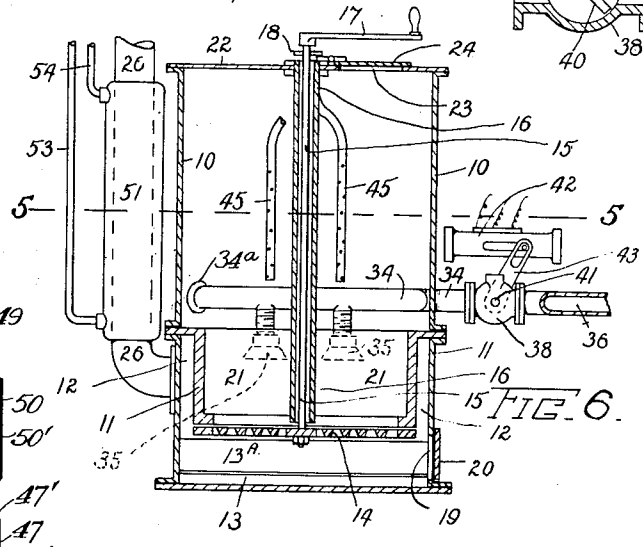
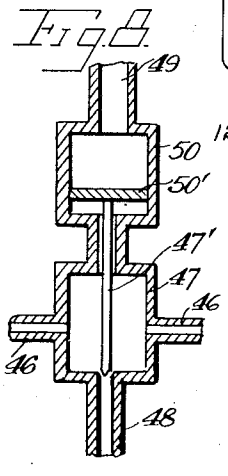


FIG. 8



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Patented June 22, 1937 2,084,530

UNITED STATES PATENT OFFICE

2,084,530

GAS PRODUCER

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Application September 13, 1935, Serial No. 40,499
In New Zealand October 18, 1934

4 Claims. (Cl. 48—63)

This invention has been devised with the object of providing improved gas generating or producing means for use more particularly with internal combustion engines, but useful in all other circumstances for the production of a gas for power, lighting or heating. The means devised are by their novel features of construction particularly adapted for installation as the power agency for motor driven vehicles of all kinds, but are equally of service in respect of stationary engines.

These generating means are of the well known suction producer gas type under which gas is generated or produced by causing air, and water or steam, to be drawn through a furnace of coal, coke or like fuel.

An important feature of this invention is concerned with a manner of constructing the generator or producer apparatus whereby in its combination with the engine, or other suction force, the air and water supply to the furnace are caused by the engine induction or such force to produce a downflow through the lower part of the furnace and the combustion of the furnace fuel is brought about by means of an updraught created in the bottom portion of the fuel charge, through air control means of suitable nature.

A further important feature in the invention comprises a construction providing for a dual operation in two separate furnace chambers, the induction action upon which is caused to be alternated, so that when the induction from the engine is cut off from one chamber the full force of the updraught caused by a gas pump in a controlled manner will act on this chamber, and vice versa. This brings about an uninterrupted supply of gas to the engine and thus renders the producer very suitable for use with multi-cylindered engines wherein the induction is almost continuous.

Other features of the invention are concerned with the details of construction of the apparatus devised for carrying out these functions and which are hereinafter referred to.

In describing the invention's construction it will be described in relation to a single furnace divided into two separate side by side compartments formed by the provision in the furnace chamber of the generator of a vertically extending divisional plate, but it will be readily understood that two separate furnace chambers may be used, although such would not be so convenient. It is also described in relation to its use with an engine for obtaining the induction effect. It will be understood, however, that any other inductive force may be employed to produce the gas from this apparatus, without altering its general features of construction and operation.

In the accompanying drawings:—

Figure 1 is a side elevation of the generator portion of the combination.

Figure 2 is a general view of the whole arrangement of parts combining with the generator and showing on an enlarged scale and in section the induction and mixture control valves for the engine.

Figure 3 is a detail view of an arrangement of water and (or) steam supply pipes to the generator that will be hereinafter more fully referred to.

Figure 4 is a plan of the generator.

Figure 5 is a sectional plan thereof taken on the line **5**—**5** of Figure 6.

Figure 6 is a sectional elevation of the generator.

Figure 7 shows on an enlarged scale the construction and relative arrangements of valves for controlling the draught in the two furnaces of the generator.

Figure 8 is a fragmentary sectional view of the valve for controlling admission of water or steam to the generator of the present invention.

In giving effect to the invention a cylindrical furnace casing **10** is provided such being made of material and strength suitable for its purpose and according to prevailing practices. This casing in its lower portion is provided with a grate well **11** fixed therein so that an annular space **12** (Figure 6) closed at its top is left between it and the inside of the casing, and an ashpit **13** is left beneath its bottom. A circular grate **14** is provided to cover the bottom of the grate well, fitting up beneath it, and such grate is held in position by being secured at its centre to the lower end of a rod **15** that is arranged to extend vertically up through a guide tube **16** held in the casing centre, and out through the top of the casing. A crank handle **17** is fastened to the upper end of this rod so that the grate may be oscillated through a given angle by the rod in order thus to agitate it and clear it of ash accumulations whenever required. The rod **15** is held in its raised position to keep the grate in position against the lower part of the grate well **11** by means of a pin **18** passing through it and resting on the top end of the guide. By withdrawing the pin, the rod and grate may be dropped away from the grate well, and if required the grate can be freed from the rod and withdrawn through an opening **19** made

in the casing wall for that purpose, and which opening is kept normally sealed by a cover 20 suitably secured over it.

The furnace grate space is divided into two separate compartments or furnace A and B by means of the diametrically extending division plate 21 (Figure 5) extending through the height thereof and thereby in effect forming the two furnaces of the producer. The ashpit 13 also is divided into two divisions or compartments by a similarly placed division plate 13A. The casing is covered by a cover 22 and a fuel supply opening 23 is formed therein to extend across both zones and this opening covered by a hinged flap door 24 which may have air vents 25 therein. The fuel may thus be fed to the furnaces through this opening and such furnaces charged in the manner common to gas producers of this type.

Each compartment or furnace may be fitted with any suitable means whereby the fuel therein may be kept free from clinker and in a free running condition to keep up the supply. Mechanically actuated agitators may be employed for this purpose.

The gas produced in each furnace or compartment A and B is adapted to be drawn downward through the grate 14 into the ashpit 13 and up into the annular space 12. In respect of each furnace or compartment outflow pipes 26 and 26' lead upward from the annular space and these two pipes at their upper ends connect with the main pipe 27 through which the inductive force of the engine concerned, acts to induce the outflow of gas from and also the entry of atmosphere to the furnaces in the manner hereinafter described.

Said pipes 26 and 26' are fitted with ordinary butterfly valves 28 and 28', respectively, controlling the passage of gas therethrough, the valve spindles having crank arms 29 and 29' (Fig. 4) secured thereto for turning them. These two crank arms 29 and 29' are then connected to mechanism whereby they may be operated to alternately open and close the valves 28 and 28' but in reverse relationship one to the other so that when one opens the other closes, and vice versa. Mechanism for this purpose may conveniently consist in an ordinary reciprocating solenoid 30 well known in the art and which receives its current from the ignition plant of the engine with which the producer is concerned. This solenoid has its core 31 provided with a crosshead 32 to which the rods 33 connecting the respective crank arms 29 and 29' with the crosshead are attached. Or, instead of this solenoid, an ordinary vacuum actuated motor as commonly used for actuating windshield wipers, and operated by the engine induction, may be used for actuating the valves in the manner desired.

In each furnace or compartment A and B, at a suitable height from the grate 14, a horizontal draught pipe 34 and 34' is fitted to extend in from the outside of the casing 10. One end of pipe 34 is supported by the opening in casing 10 through which it extends and the other (closed) end is supported by bracket 34a fixed on the interior of casing 10. Such draught pipe is provided with two or more branches 35 and 35' leading downward therefrom and positioned roughly to cover the sectional area of the furnace or compartment in their capacity. These branches are made adjustable in their height from the level of the grate, for example, by being screw mounted on the downwardly extending branches of pipes 34, in order to regulate the depth of the fire in the circumstances hereinafter referred to. The ends of the draught pipes 34 and 34', which extend outside the casing, connect with a main pipe 36 which leads to a suction pump 37 (Fig. 2) driven by any suitable connection with the engine concerned and by means of which a suction effect is produced in pipes 34 and 34'. A control valve 36A is fitted in the main pipe 36 for governing such suction effect. Pipes 34 and 34', before they connect with the main pipe 36, have valve fittings 38 and 38' arranged within them (shown in detail in Fig. 7) for controlling the air supply to the furnace. These fittings 38 and 38' have ports 39 and 39', respectively, opening to atmosphere, and have double seat valves 40 and 40' arranged therein and mounted on spindle 41—that is, so constructed that in one position, connection is made between the main pipe 36 and the draught pipe 34 concerned with this fitting, while connection through port 39 with the atmosphere is cut off, and in a second position caused by the appropriate turning of the spindle 41, connection is established between the pipe 34 and the atmosphere while connection with the pipe 36 is shut off. When pipe 34 communicates with pipe 36, pipe 34' communicates through open port 39' with the atmosphere, and when the spindle 41 is shifted so that pipe 34 communicates through port 39 with the atmosphere, pipe 34' communicates with pipe 36.

These two valve fittings 38 and 38' are arranged side by side and their valves 40 and 40' are upon a common spindle 41 so that both may be actuated by the same mechanism. They are however so relatively arranged, as for instance by causing the air port 39' in fitting 38' to open upwards and port 39 in fitting 38 to open downwards, as shown in the drawings, that the movement of the spindle 41 in one direction will open the one valve to atmosphere and close the other to the atmosphere and a movement in the reverse direction will reverse these connections, also simultaneously reversing the connections of the pipe 34 and 34' with the main pipe 36. For thus actuating the spindle in these reverse directions a second electric solenoid 42 may be employed such actuating a crank arm 43 (Figure 6) affixed to the spindle.

The actuation of these valves 38 and 38' and the valves 28 and 28' are made to synchronize, as for instance by an appropriate control of the current supply to their actuating solenoids, and is so directed that when the valve 28 of one furnace or compartment is open the valve 38 opens to atmosphere, while the valve 28' of the other furnace or compartment is closed and the valve 38' of that furnace or compartment is connected with the suction pump 37 through the main pipe 36, and then these conditions are reversed in respect of the two furnaces or compartments. Thus in the operation of the generator when the engine is running its induction acts first on one furnace to draw the gas therefrom, the gas then being replaced by air entering the pipe 34 from the atmosphere through port 39 of its valve 38, and then as the valves 28 and 38 are again actuated changes over the induction and air supply to the other furnace, the two zones therefore being worked in alternation. In operation, valves 28 and 38 are simultaneously shifted to a position in which valve 28 is open and port 39 controlled by valve 38 is open. With the valves in this position, the suction from the engine draws the gas through the pipes 26 and 27 from the space 12 surrounding the fire-box

and from the ashpit 13 generated by the fuel on the grate. This suction also draws down through the fuel charge a certain amount of air entering by the vents 25 and the steam issuing from the pipes 45 and at the same time a further amount of secondary air along the pipes 34 and 35 from the valve 38, the port 39 of which is open to the atmosphere to oxidize the carbon of the fuel. This charge of air mixes with the live coals and is drawn down as far as grate 14. At this instant, the solenoids 30 and 42 come into action, close valve 28 and actuate valve 38 to close port 39, but place pipe 34 in communication with pipe 36, which is connected to the suction pump 37. This creates a suction effect in the grate well at the part where the ends of the pipes 35 are situated which draws down air through the vents 25 and steam from the pipes 45, thus maintaining the combustion of the fuel during the time the inductive action of the engine is inoperative. At the same time the suction draws a small volume of gas from the furnace into the pipes 35 and 34 so that when the change over of the valve 38 is effected, the inductive action of the engine will draw into the furnace a mixture of gas and air from the pipes 35 and 34 and thus avoid a quantity of free secondary air alone being initially drawn into the incandescent fuel immediately on the change over. The action of the suction pump is only momentary and does not discharge any great amount of gas to the atmosphere. In this way, the heat value of the gas supplied by the generators is kept substantially constant.

Once again, all the valves are changed over and the gases again take up the direction, as shown by the arrow.

The water, or steam, supply to the furnace zones is obtained through pipes 45 and 45' that extend vertically down through each furnace or compartment and through the fuel packed therein. Such pipe may be perforated at different points in its length to provide for the water, or steam, entering the mass of fuel. The two pipes 45 and 45' are fed from branches 46 (Figures 1 and 3) leading from the cylinder 47 of a needle valve chamber into which chamber the water, or steam, enters through a pipe 48. The needle valve 47' is designed to be opened by the engine induction acting through a pipe 49 upon a piston 50' within a cylinder 50 positioned above the cylinder 47, and which plunger is connected to the stem 47' of the needle valve to open and hold it open as the suction of the induction acts on the plunger. The water, or steam, is thus only fed to the furnace when the engine is running.

Provision may be made to heat the water supply to the needle valve chamber, and for this purpose a jacket 51 is arranged around each gas outlet pipe 26 and the water supply is contained in an overhead tank 52 having pipe connections 53—54 leading to and from the jacket spaces arranged in the well known circulating principle. The return connection 54 of this system branches to the pipe 48 leading to the needle valve. The heat of the gas passing through the pipes 26 will thus serve to heat the water flowing through the jackets to a high degree, and in some cases to boiling temperature, so that it will be supplied to the furnace through the means described, in the form of stream, or heated water and therefore more readily convertible into steam in the furnace.

A generator thus made and actuated has combined with it the usual cooler 55 (Figure 2) into and through which the gas is conveyed from the gas main pipe 27 and which cooler may be of any approved design suitable for installation with the engine. In the drawings it is shown as being formed by an upper entry header 56 and a lower outlet header 57 connected together by tubes 58 which are exposed to the atmosphere or which when the combination is installed in a motor vehicle or in a stationary engine plant may be subjected to the draught of a radiator fan. Also such cooler may be shaped to conform with the lines of the vehicle.

Associated with the cooler is a scrubber 60 through which the gas is carried after leaving the cooler, such scrubber being of any known nature and acting to clean the gas by passing it through a cleaning medium with which the scrubber is fitted.

The gas is cause to pass through the cooler and the scrubber by the engine suction acting through the induction main 61 (Figure 2) thereof. This may lead to a controlled mixing chamber by means of which the gas is mixed with air to aid its combustion in the engine. Such a mixing chamber is shown in enlarged sectional detail in Figure 2. It comprises a tubular chamber 62 connected with the engine intake at one end and into the side of which the gas main 61 enters, the entry being covered by a non-return valve 63 that opens with the engine suction. An air entry 64 also enters this chamber side and has its inlet governed by a similar non-return valve 65. This air entry is fitted with a choke valve 66 by means of which it may be more or less closed to regulate the amount of air for mixture with the gas. The chamber 62, at its engine intake end, is fitted with the throttle valve 67 so that the gas supply to the engine may be thereby controlled to regulate its speed in the usual manner.

The suction pipe 49 for actuating the needle valve controlled supply of water to the furnace leads from this chamber 62.

It will be apparent that instead of having a single furnace generator divided into two zones, two side by side separate furnaces may be used with equal effectiveness, the other parts then being associated with these in respectively corresponding manners to the ways in which they are associated with the two zones of the single furnace structure.

For starting up the generator pipes 70 and 70' are provided to enter the upper end of gas outlet pipes 26 and 26' and such exhaust pipes are connected with an exhaust electric or hand force pump 71 (Figure 4) so that the necessary draught may be forced into the furnaces. Each of these pipes 70 has a stop valve 72 arranged therein for closing it off when not required.

In the working of this generator, or producer, therefore the portion of the fuel charge that is kept burning will be only that which is in the grate well and which is mainly below the draught vent pipes 35, and of a depth as is governed by the adjustment of such vents. The fuel from above the burning portion extending right up to the flap door 24 is left intact and only settles down as the fuel in the furnace well beneath is consumed.

Numerous variations may be made in the shape and assembly of the various parts composing the generator without departing from the general principles governing their functions and operations. It is to be understood therefore that the

invention is not limited in its scope to the exact forms and combinations shown in the drawings and described herein.

I claim:—

1. A gas generator of the multiple furnace type having a grate, an ashpit divided into separate compartments, an induction pipe leading from the ashpit compartments of each furnace, induction means connected to each induction pipe, gas control valves in each induction pipe, means for mechanically operating the said valves in cooperative sequence with one another for alternate induction and non-induction effect on each furnace, air supply means adapted to deliver air directly into the body of the fuel at the lower part of the furnace, a gas pump connected to said air supply means, valve means adapted to alternately connect the air supply means with the atmosphere and the gas pump, means for synchronizing the movements of the gas control valves and the air control valves to give a coordinated result, and means for supplying steam to the body of fuel in said generator.

2. In a gas generator as claimed in claim 1, an air supply pipe in each furnace having downwardly extending branches and an adjustable vent mounted on each branch adapted to vary the distance of the mouth of the vent from the grate of the furnace.

3. In a gas generator as claimed in claim 1, water supply means comprising an overhead tank, a pipe leading from said tank, a needle valve fitting attached to said pipe, a pipe leading from said fitting into the body of each furnace, and means for operating said needle valve by suction produced by the induction means connected to each induction pipe.

4. A gas generator of the multiple furnace type having a grate, an ashpit divided into separate compartments, an induction pipe leading from the ashpit compartment of each furnace, induction means connected to each induction pipe, a damper-like valve in each induction pipe, a solenoid having an operative connection with both of said valves for operating in cooperative sequence with each other for alternate induction and non-induction effect on each furnace, air supply means adapted to deliver air directly into the body of the fuel at the lower part of the furnace, a gas pump connected to said air supply means, valve means adapted to alternately connect the air supply means with the atmosphere and the gas pump, a solenoid having an operative connection with said air valve means for actuating them in alternate sequence, both of said solenoids being actuated in synchronism to give a coordinate result, and means for supplying steam to the body of the fuel in said generator.

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