No. 665,568. Patented Jan. 8, 1901.

C. M. KEMP.

GAS GENERATING APPARATUS.

(Application filed Apr. 17. 1900.)

(No Model.)

2 Sheets—Sheet 1.

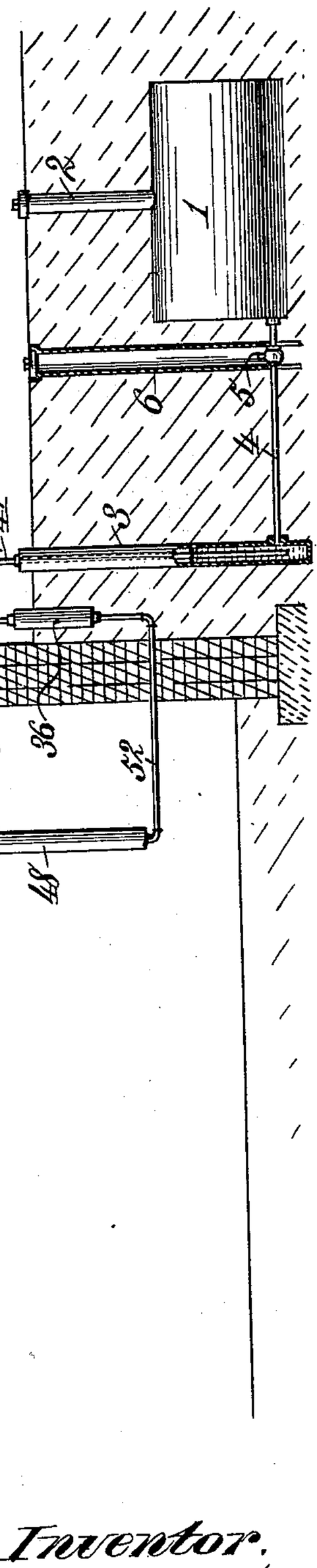
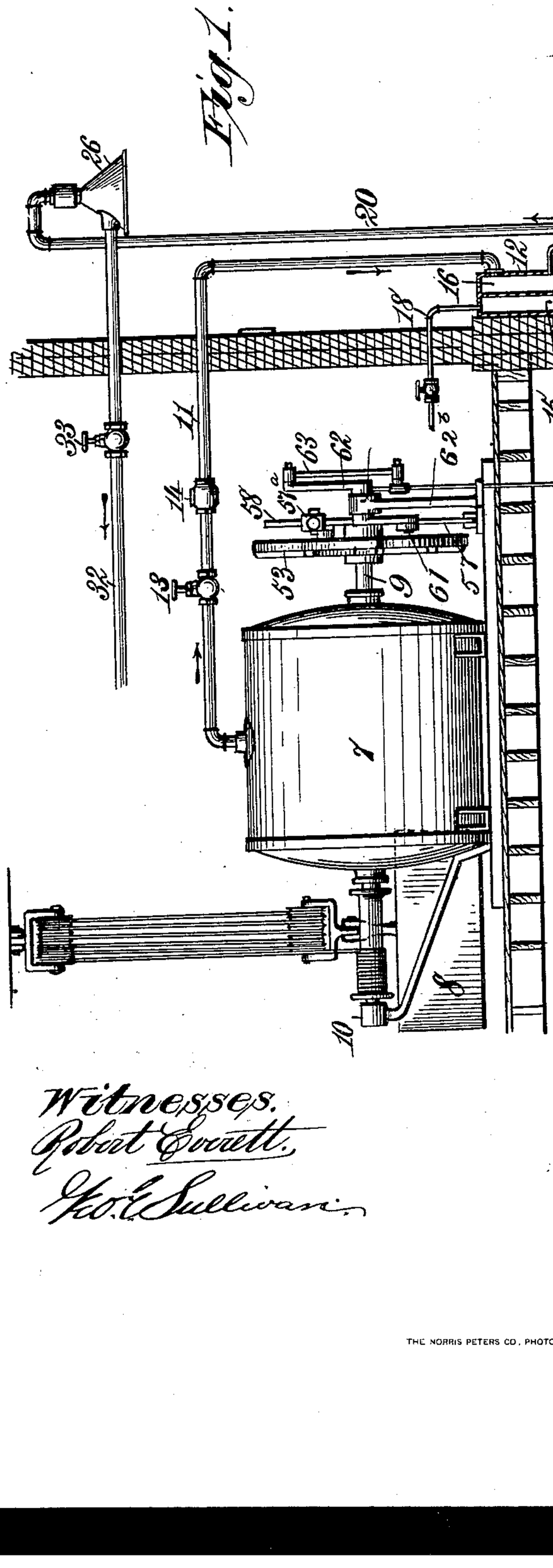


Fig. 1.



Witnesses.
Robt Everett.
Geo. E. Sullivan.

Inventor.
Clarence M. Kemp.
By J. Granville Meyers Jr.
Atty.

No. 665,568. Patented Jan. 8, 1901.

C. M. KEMP.

GAS GENERATING APPARATUS.

(Application filed Apr. 17, 1900.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

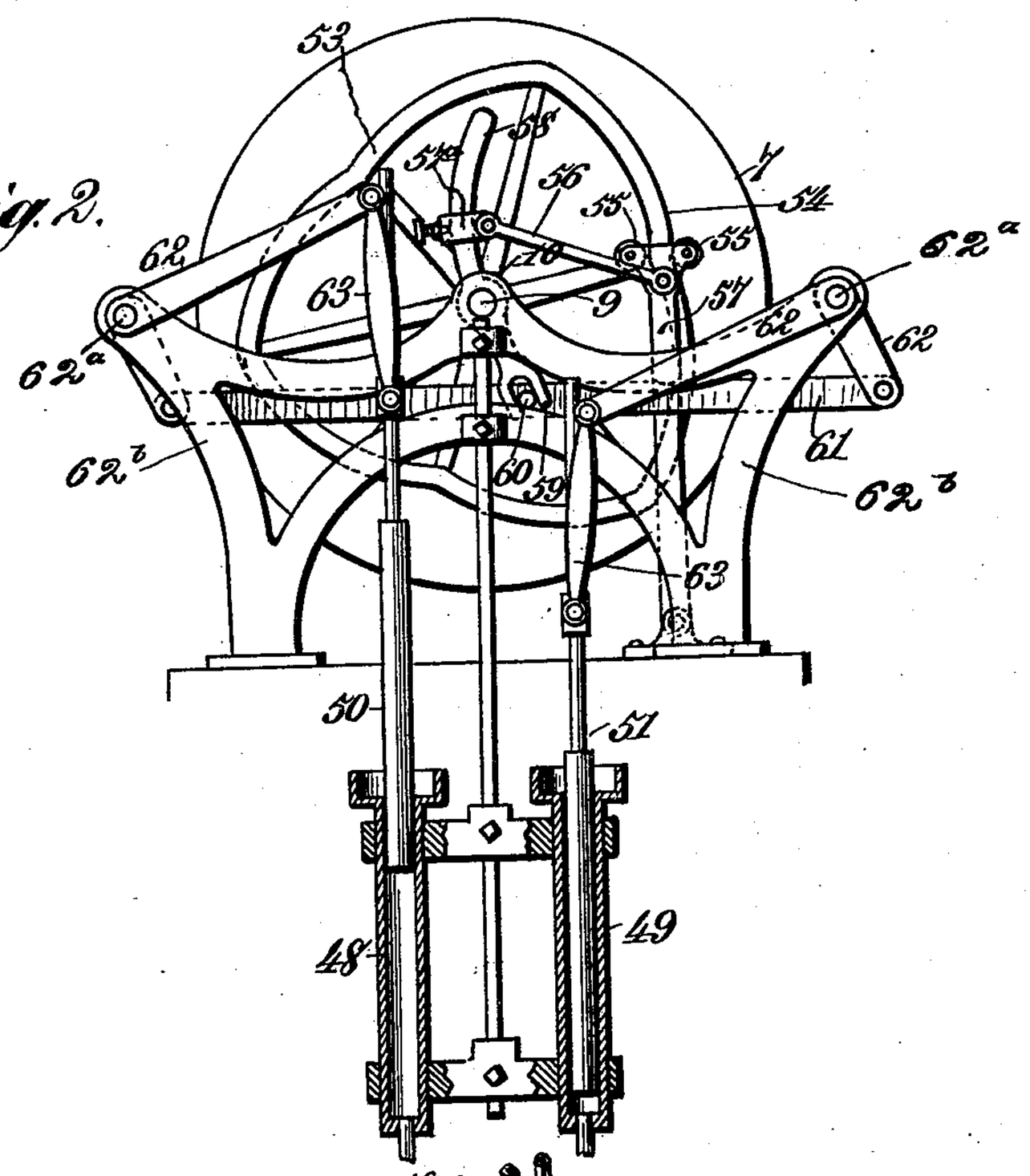
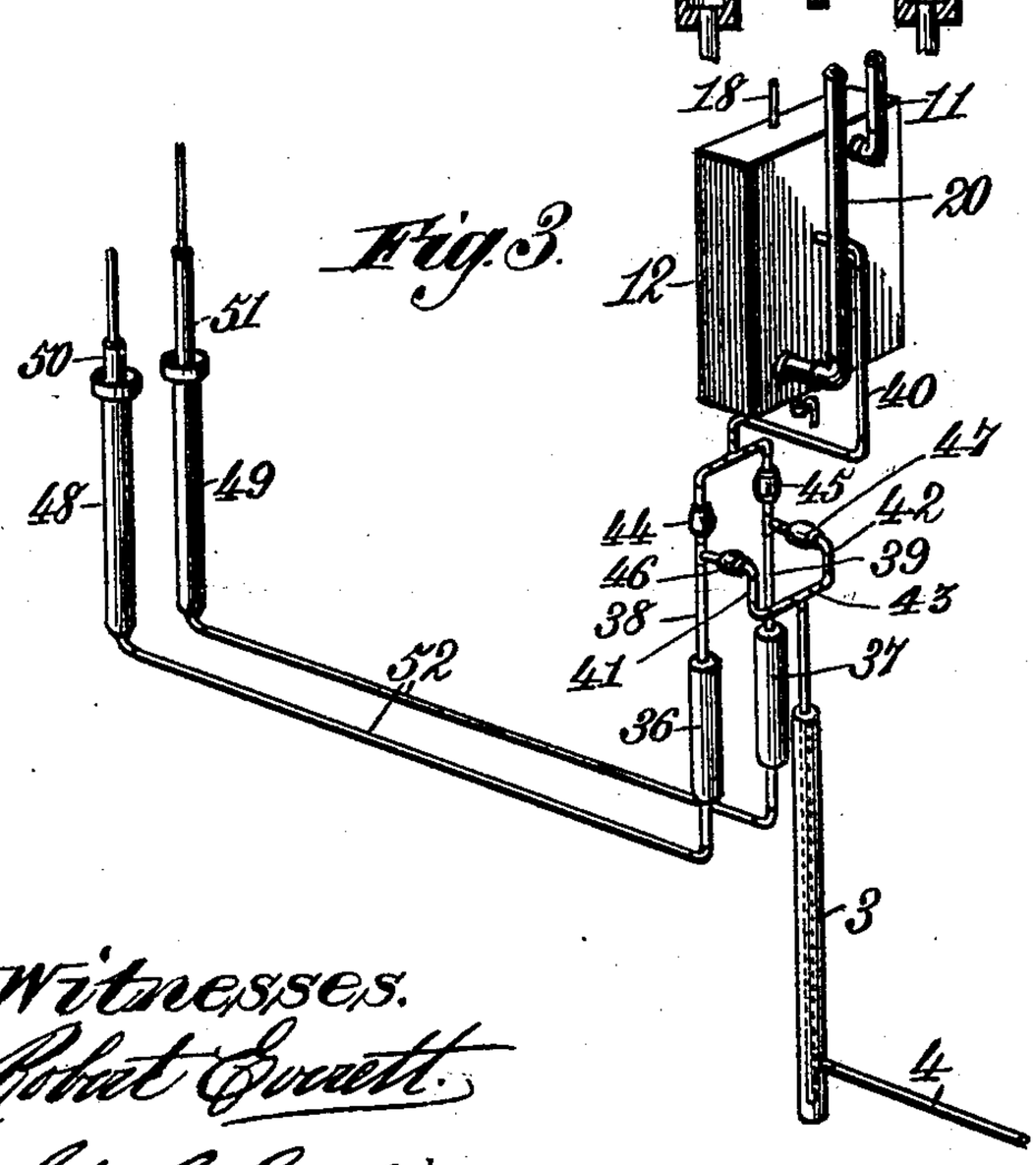


Fig. 3.



Witnesses.
Robert Burnett.
Geo. E. Sullivan.

Inventor.
Clarence M. Kemp.
By J. Granville Meyers
Atty.

UNITED STATES PATENT OFFICE.

CLARENCE M. KEMP, OF BALTIMORE, MARYLAND.

GAS-GENERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 665,568, dated January 8, 1901.

Application filed April 17, 1900. Serial No. 13,235. (No model.)

To all whom it may concern:

Be it known that I, CLARENCE M. KEMP, a citizen of the United States, residing at Baltimore, Maryland, have invented certain new and useful Improvements in Gas-Generating Apparatus, of which the following is a specification.

This invention relates to gas-generating apparatus, and especially to that class of apparatus employed for manufacturing gas from a mixture of air and hydrocarbon vapor.

A serious objection attached to many of the machines of the character referred to consists in the fact that fire-insurance underwriters antagonize the adoption of any gas-machine which operates to introduce into the building any quantity whatsoever, no matter how small, of the hydrocarbon in its liquid state. Another objection resides in the fact that no adequate safeguards are provided for protecting the converter against conflagrations occurring in the building or from back fire or explosions through the gas-main. Another serious objection that has been found to exist heretofore in practice is owing to the difficulty, if not impossibility, of maintaining an exact and uniform proportion of the air and hydrocarbon supplied to the converter under all conditions, whether the consumption of the gas be great or small, and under all the varying conditions of its use.

It is the purpose of the present invention, therefore, to provide an improved gas-generating plant so constructed and arranged that while the operating parts of the plant may safely be housed in the building to be supplied with gas not the slightest portion or quantity of the hydrocarbon will be introduced into the building until it has first been volatilized and mixed with a definite quantity of air to convert it into gas.

It has for a still further purpose to combine with such an apparatus a liquid-piston pump so arranged that a fixed and invariable quantity of hydrocarbon will be supplied to the converter at each complete stroke of the pump irrespective of the rate of consumption of the gas and the consequent rapidity of operation of the pump and to combine therewith means for supplying air to the converter in exact and uniform proportionate quantities with the hydrocarbon.

Finally, it has for its object to provide an apparatus of the character described which will be simple in construction and efficient, thoroughly automatic, reliable, and safe in operation and by means of which gas of a superior and absolutely uniform quality may be produced economically and in the exact quantities needed for immediate consumption.

To these ends my invention consists in the features and in the construction, combination, and arrangement of parts hereinafter described, and particularly pointed out in the claims, reference being had to the accompanying drawings, forming a part of this specification, wherein—

Figure 1 is a view in elevation of the entire apparatus. Fig. 2 is a sectional end view showing the proportional air-blower and pump-cylinders. Fig. 3 is a diagrammatic perspective view illustrating the pumping apparatus.

Referring to the drawings, the numeral 1 indicates a hydrocarbon-storage tank or reservoir of any approved construction and which, as shown, is buried underground at a suitable distance from the building to be supplied with gas. As usual, the tank 1 is provided with a filling-pipe 2, which extends aboveground.

The numeral 3 indicates a stand-pipe also buried underground and communicating near its lower end by a pipe 4 with the tank 1. A valve 5 is arranged in the pipe 4, by means of which the supply of hydrocarbon may be cut off from the stand-pipe, and a valve box or casing 6 is arranged over the valve and extends aboveground to afford convenient access to the valve.

All the parts above described are buried beneath the ground at a convenient distance from the building for the sake of safety and as required by fire-insurance underwriters.

Arranged within the building at any convenient place or upon any desired floor or story thereof is a rotary proportional air-blower 7 of ordinary construction well known to those skilled in the art and operated by a weight-motor 8, also of well-known or approved construction, which, it will be apparent, will drive the blower 7 either fast or slow, giving it a speed and capacity for feeding air

to the converter accurately proportioned to and dependent upon the demand on the plant; but instead of the weight-motor shown any type of motor suitable and most convenient for the purpose may be employed. The blower is mounted on and revolves with a central shaft 9, which is journaled in suitable fixed bearings 10. From the air-blower a pipe 11 leads to a converter 12, arranged outside the building, and is provided with a gate-valve 13 and a check-valve 14, opening toward the converter, the purpose of the check-valve being to prevent the passage of any gas from the converter into the air-pump when the latter is at rest. The converter consists of a hollow metallic casing divided into two compartments 15 and 16 by a vertical partition 17, the chamber 16 being the air and gas mixing chamber, and, as shown, the air-pipe 11 enters the upper portion of said chamber. A steam-pipe 18 enters the upper part of the chamber 15, and from the lower part thereof leads a waste-pipe 19 for conveying off the water of condensation. From the lower part of the chamber 16 leads a pipe 20 for conveying the gas from the converter, said pipe leading into the upper end of a fire-check 26 of suitable construction, and from said fire-check 26 a gas-pipe 32, provided with a gate-valve 33, leads into the building and to the points of consumption.

The liquid hydrocarbon is pumped from the stand-pipe 3 into the converter by a liquid-piston pump constructed and operated as follows: The numerals 36 and 37 indicate two suction-chambers arranged side by side outside the building and each comprising a vertical cylinder closed at its opposite ends. Communicating with the upper ends of said chambers are two pipes 38 and 39, each connected at its upper end to one end of a pipe 40, common to them both, said pipe at its other end entering the converter and preferably at a point intermediate the ends of the converter and opposite the partition therein, for the purpose hereinafter made apparent. Connected to the pipes 38 and 39 are two pipes 41 and 42, which are also connected to one end of a pipe 43, common to them both, said pipe at its other end leading down into the lower portion of the stand-pipe 3. In the pipes 38 and 39 are arranged check-valves 44 and 45, which open upward or away from the suction-chambers, said valves being arranged above the points at which the pipes 41 and 42 connect with the pipes 38 and 39, and in the said pipes 41 and 42 are arranged similar check-valves 46 and 47, which open toward the suction-chambers. Also arranged side by side and in convenient relation to the operating mechanism are two vertical pump-cylinders 48 and 49, in which are arranged two reciprocating plungers 50 and 51. The lower ends of the pump-cylinders communicate with the lower ends of the suction-chambers by means of pipes 52 of relatively small diameter. A suitable quantity of mercury is introduced into the pump-cylinders below the plungers and by means of the pipes 52 will flow into the lower ends of the suction-chambers. As shown, the pump-cylinders are arranged at a somewhat lower level than the suction-chambers, so that normally the mercury will fall by gravity to the lower ends of said suction-chambers. By making the pipes 52 of small diameter an economy in the amount of mercury necessary to be supplied to the pump is effected—a highly-desirable result, owing to the initial cost of the mercury.

In the arrangement shown the pump is a double-acting one and operates as follows: The plungers 50 and 51 are alternately reciprocated in opposite directions by the mechanism presently to be described and alternately raise and lower the mercury in the suction-chambers 36 and 37. For example, let it be assumed that the plunger 50 is descending and the plunger 51 ascending. Then the mercury will be lowered in the suction-chamber 37 and as it falls will open the valve 47 and close the valve 45, thereby drawing in a quantity of hydrocarbon from the stand-pipe 3 into the chamber 37. At the same time the mercury in the chamber 36 will be raised and as it rises will close the valve 46 and open the valve 44 and will therefore force the hydrocarbon previously drawn into the chamber 36 up through the pipes 38 and 40 into the converter. When the strokes of the plunger are reversed, the operation of the suction-chambers will obviously be the reverse of that just described, and hence as long as the plungers are working the supply of hydrocarbon pumped from the stand-pipe and discharged to the converter will be continuous. In order that each portion of the revolution of the rotary air-blower shaft may communicate a definite portion of a stroke to the pump-plungers, I provide the following-described mechanism for actuating said plungers. Fixed on the blower-shaft 9 is a cam-wheel 53, provided with a rim that is formed, as shown, to present cam-faces 54. Engaging the inner and outer faces of said cam-ring are two antifriction-rollers 55, that are carried on the free end of an arm 57, the other end of said arm being pivoted to the base, and pivotally attached to the upper end of arm 57 is a link or bar 56, the other end of said bar 56 having a sleeve 57^a pivotally attached thereto, said sleeve being adjustably fixed by a set-screw on a segment-shaped rocker-arm 58, having its fulcrum on the shaft 9. The lower end of the rocker-arm 58 is forked, as at 59, and straddles an antifriction-roller 60, journaled on a swinging link 61, intermediate the ends of the latter. The opposite ends of the link 61 are respectively pivotally connected to one end of bell-crank levers 62, the other ends of said bell-crank levers being connected by pitmen 63 to the pump-plungers 50 and 51. The said bell-crank levers 62 are each pivoted at 62^a to the frame or bracket 62^b, as shown in Fig. 2. It will be readily understood that as

the cam-wheel revolves with the rotary air-blower it will communicate an oscillating movement to the arms 56, 57, and 58 and, through the medium of the swinging link 61 and the bell-crank levers and pitmen, will reciprocate the pump-plungers alternately in opposite directions. By adjusting the link on the rocker-arm 58 toward or from the fulcrum of the latter the length of the stroke of the pump-plungers will manifestly be altered.

Having described the construction and operation of my improved gas-generating plant in detail, it only remains to explain the general operation of the same as a whole.

Let it be assumed that gas is being consumed in the building. Then the air-blower will be rotated by the weight or other motor at a speed proportionate to the rate at which the gas is consumed and will supply air into the upper part of the converter in measured quantities and at a uniform ratio to the amount of gas being consumed. At the same time the blower will, through the medium of the described mechanism, operate the mercury-pump and cause the latter to pump up from the stand-pipe the hydrocarbon and deliver the latter into the heated converter, whereby it is instantly volatilized, and mixing with the air supplied by the meter, also heated after its entrance into the converter, is converted into gas, which passes through the fire-check and thence into the gas-main and distributing-pipes to the burners, where it is consumed. It is obvious that the greater the number of burners that are in operation the greater the speed of the blower will be, and hence the latter will operate to supply the air to the converter in measured quantities exactly proportionate to the amount of gas being consumed. Furthermore, as the blower drives the mechanism which actuates the mercury-pump, whenever said blower operates to pump any quantity of air whatsoever into the converter will cause a positive movement of the pump-plungers in exact ratio corresponding to the action of the blower, and in consequence of the described construction and arrangement of the mercury-pump a definite quantity of hydrocarbon will be discharged into the converter in an exact proportion to the quantity of air supplied thereto. The pumps usually employed in machines of the character described do not in practice always operate to supply the hydrocarbon to the converter in a uniform manner—that is to say, in quantities exactly proportionate to the amount of gas being consumed and the amount of air being supplied—owing to the leakage that always occurs where but few burners are being used, and hence the pump in being operated very slowly will operate to pump an insufficient quantity of hydrocarbon or none at all, causing the lights to become extinguished and as the burners are left open constituting an element of great danger. Pumps depending on tight pistons cannot be kept tight enough to operate on hydrocarbon when the speed of the pump is very slow, and as the power of a blower-pump of the type shown is limited said pump will be checked in its movement, because of the great friction, thus causing a stoppage of the gas or great fluctuations in the pressure and delivery. By means of the mercury-pump described such a result can never occur, as the liquid-piston prevents any leakage past it through the pump, and whether the action of the pump be fast or slow, in accordance with the demand on the plant, the suction-stroke of the liquid-piston will be effective, and it will operate to supply to the converter, no matter what the rate of consumption of gas may be, only its exact proportion of oil, which will invariably be in exact ratio to the quantity of air supplied by the blower. Moreover, friction is reduced to a minimum or almost eliminated by means of the mercury-pump, and the action of the latter is rendered strictly synchronous with the action of the blower by means of the described mechanism, which also eliminates all dead-centers. By the described arrangement no liquid hydrocarbon ever enters the building, as the liquid-piston, being absolutely gas and fluid tight, effectually guards against the passage of either the fluid hydrocarbon or the inflammable vapor therefrom through the pump and into the building, and no hydrocarbon enters the pumps or their connecting-pipes and only enters the suction-chambers, the same being then delivered to the converter and made into gas, and, furthermore, the gas is always of a uniform quality, owing to the exact mixture of the air and hydrocarbon vapor, the fire-check preventing firing back to the converter and tank in case a conflagration occurs in the building.

It will be obvious that, if desired, the pump-cylinders, plungers, and their immediate connections may also be arranged outside of the building by making the necessary connections between the shaft of the blower and the pump-plunger mechanism, such as will readily suggest themselves to and be within the province of any mechanic.

The arrangement of parts makes it impossible for any flow of hydrocarbon into the building, as the hydrocarbon has to be brought from a supply placed at a lower point and only in exceedingly-limited quantities for the current needs.

In lieu of the rotary blower shown a proportional meter to which the air is supplied from any suitable blower may be used, in which case the weight-motor can be dispensed with and its performance, as described, will be the same.

Throughout this description and in the drawings I have described and shown an ordinary form of rotary air-blower for delivering air to the converter; but I do not wish to be understood as limiting myself to this specific type of air-delivering means, for it will

be obvious that I may employ any form of air deliverer or pump capable of delivering a measured or definite quantity of air at each stroke or during a part of its operation.

Having described my invention, what I claim is—

1. In a gas-generating apparatus, the combination with a converter; of a blower to supply said converter; means for driving said blower; a hydrocarbon-storage tank; a pump for delivering hydrocarbon from said tank to said converter, comprising a pump-cylinder; a reciprocating plunger therein; and a suction-chamber; and connections between said pump and converter and said blower, whereby said converter, tank and suction-chamber may be isolated from said blower.

2. In a gas-generating apparatus, the combination with a converter; of a blower to supply said converter; means for driving said blower at a speed regulated by the demand on the plant; a hydrocarbon-storage tank; a pump for delivering hydrocarbon from said tank to said converter, comprising pump-cylinders, reciprocating plungers therein actuated by said blower, a liquid-piston operated by said plungers, and suction-chambers connected with said cylinders and communicating with said tank and converter; and connections between said converter and pump and said blower; whereby said converter, tank and suction-chamber may be isolated from said blower.

3. In a gas-generating apparatus, the combination with a converter, of a blower to supply said converter, means for driving said blower at a speed regulated by the demand on the plant, a hydrocarbon-storage tank, a double-acting pump for pumping hydrocarbon from said storage-tank to said converter comprising two suction-chambers connected with said tank and converter, two pump-cylinders communicating with said suction-chambers, reciprocating plungers therein, mechanism actuated by said blower to reciprocate said plungers alternately in opposite directions, and liquid-pistons in said pump-cylinders operated by said plungers; whereby the action of the pump is continuous and effective at varying speeds, and leakage through the pump is prevented, and connections between said pump and blower, and said suction-chambers, tank and converter whereby they may be isolated from said pump and blower.

4. In a gas-generating apparatus, the combination with a converter, of a blower to supply said converter, means for driving said blower at a speed regulated by the demand on the plant, a hydrocarbon-storage tank, a double-acting pump for pumping hydrocarbon from said storage-tank to said converter comprising two suction-chambers intermediate said tank and pump, two pump-cylinders arranged at a lower level than said suction-chambers and communicating therewith, plungers in said cylinders, connections between said blower and said plungers to reciprocate the latter simultaneously in opposite directions, and liquid-pistons in said cylinders operated by said reciprocating plungers; whereby the action of the pump is continuous and effective at varying speeds, and leakage through the pump is prevented, and connections between said pump and blower, and said tank, converter and suction-chambers, whereby they may be isolated from said pump and blower.

5. In a gas-generating apparatus, the combination with a converter, of a blower to supply said converter, means for driving said blower at a speed regulated by the demand on the plant, a hydrocarbon-storage tank, a pump for pumping hydrocarbon from said storage-tank to said converter comprising a pump-cylinder, a plunger therein reciprocated by said meter, a liquid-piston operated by said plunger, a suction-chamber intermediate said storage-tank and said pump, valved connections between said suction-chamber and said storage-tank and converter, so that the said tank, suction-chamber and converter may be isolated from the said pump and blower, and a pipe of relatively small diameter connecting said suction-chamber with said pump-cylinder whereby a liquid-piston of small volume may be used.

6. In a gas-generating apparatus, the combination with a converter, of a blower, means for driving said blower at a speed regulated by the demand on the plant, an air-pipe leading from said blower to said converter, a hydrocarbon-storage tank, a stand-pipe connected with said tank, and a pump to draw hydrocarbon from said tank and supply said converter comprising a suction-chamber having a valved connection with said stand-pipe, a valved connecting-pipe leading from said suction-chamber to said converter, a pump-cylinder communicating with said suction-chamber, a plunger therein, mechanism actuated by said blower to reciprocate said plunger, and a liquid-piston operated by said reciprocating plunger; whereby the action of the pump is effective at varying speeds and leakage through the pump is prevented, and connections between said pump and blower and said tank, suction-chamber and converter by means of which they are isolated from said pump and blower.

7. In a gas-generating apparatus, the combination with a blower and means for driving said blower, of a converter, a hydrocarbon-storage tank to supply said converter, a pump for pumping hydrocarbon from said tank to said converter and comprising a suction-chamber intermediate said storage-tank and said converter, a pump-cylinder, a reciprocating plunger therein driven by said blower, and a liquid-piston in said cylinder operated by said plunger whereby said storage-tank, suction-chamber and converter and the hydrocarbon therein are isolated from the rest of the apparatus.

8. In a gas-generating apparatus, the combination with a converter, of a blower to supply said converter, means for driving said blower, connections between said blower and said driving means whereby the speed of the blower is regulated by the demand on the plant, a hydrocarbon-storage tank, connections between said tank and said converter, a liquid-piston pump to deliver hydrocarbon from said tank to said converter, connections between said pump and said blower to drive said pump at a speed proportioned to the speed of said blower whereby the supply of hydrocarbon may be regulated to the air-supply and connections between said pump and blower and said tank and converter, whereby they may be isolated from said pump and blower.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CLARENCE M. KEMP.

Witnesses:
THOS. C. BAILEY,
JOHN S. COLE,