

(No Model.)

2 Sheets—Sheet 1.

L. H. NASH.

COMBINED FUEL CONVERTER AND GAS ENGINE.

No. 322,062.

Patented July 14, 1885.

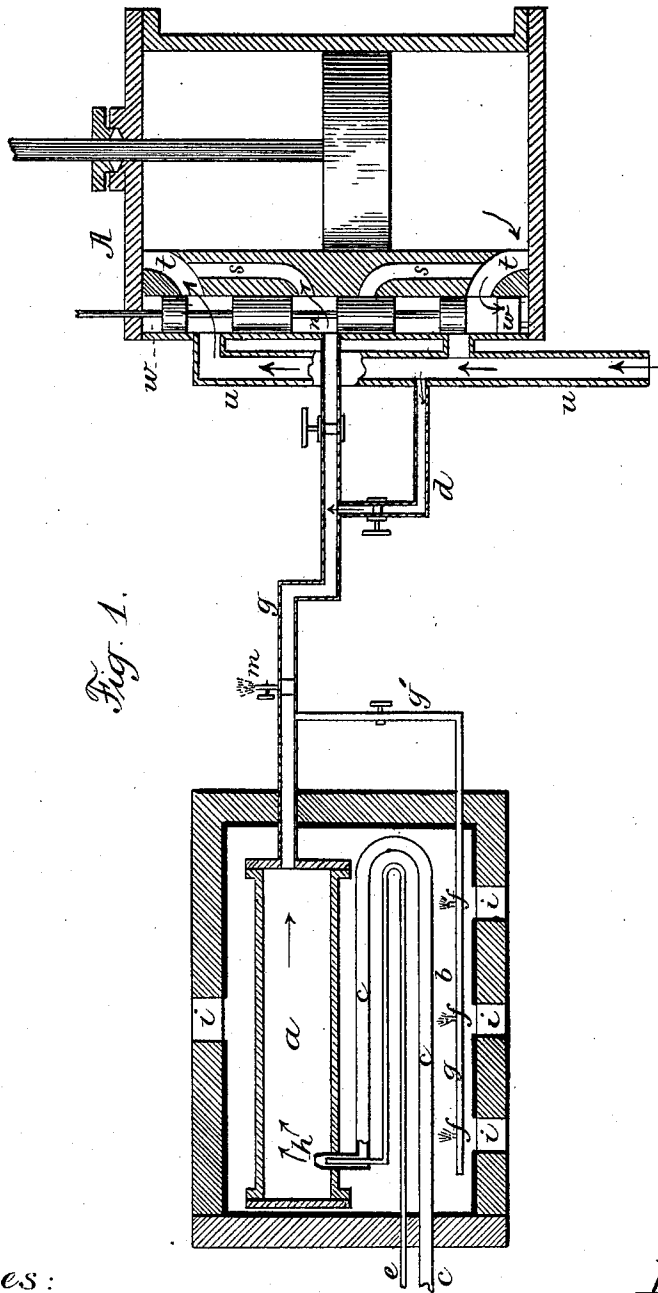


Fig. 1.

Witnesses:

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Howell Bartle

Inventor:

pro Lewis H. Nash
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(No Model.)

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Fig. 2.

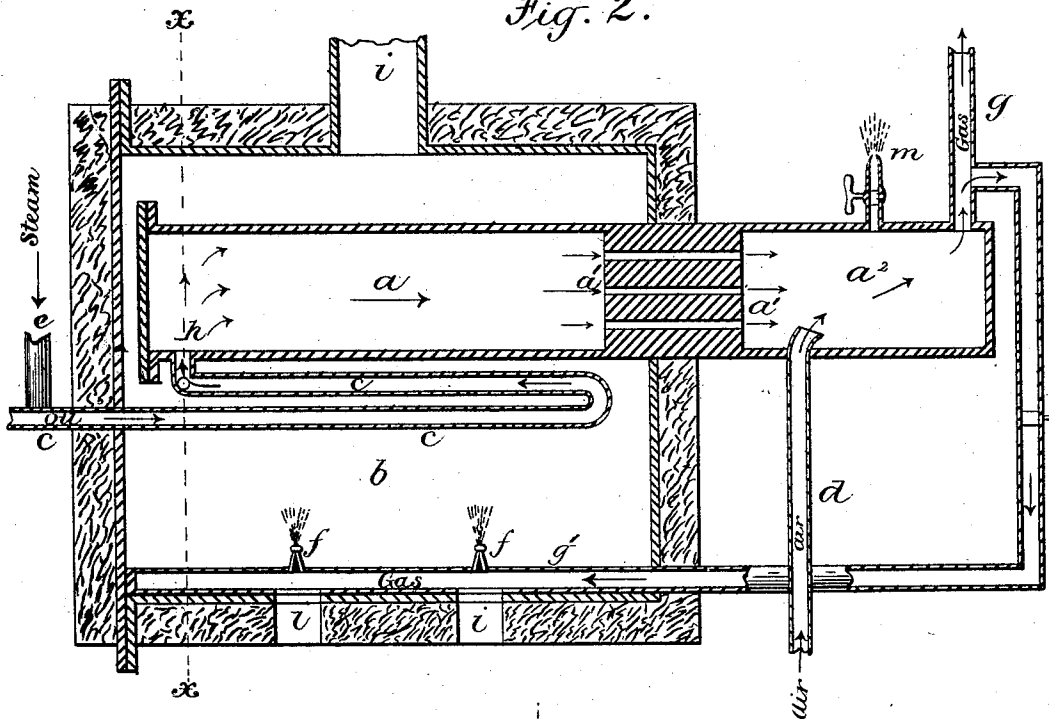
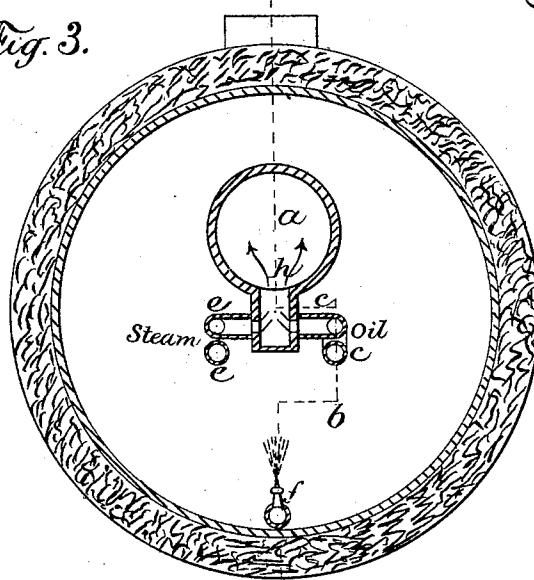


Fig. 3.



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UNITED STATES PATENT OFFICE.

LEWIS H. NASH, OF BROOKLYN, ASSIGNOR TO THE NATIONAL METER COMPANY, OF NEW YORK, N. Y.

COMBINED FUEL-CONVERTER AND GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 322,062, dated July 14, 1885.

Application filed November 27, 1882. (No model.)

To all whom it may concern:

Be it known that I, LEWIS HALLOCK NASH, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Combined Fuel-Converter and Gas-Engine, of which the following is a specification.

My invention is directed to a combination, with the valve system of a gas-engine, of a gas generator or converter for producing and supplying gaseous fuel under pressure direct to engines working upon the principle of receiving and igniting a mixture of air and gas within its cylinder to produce power by the expansive force of the air introduced under compression and heated by the combustion of the charge. By this combination liquid fuel is subjected to a preliminary preparation under high heat to produce a gaseous fuel that will ignite and burn freely under a comparatively slow combustion without producing sediment in the cylinder. This preliminary preparation of hydrocarbon oil is to effect the decarbonization of the liquid fuel by steam under sufficient pressure to drive the gas so produced and prepared out of the generator or converter directly into the engine, where it is used without further compression, thus producing a generator which not only prepares the gaseous fuel, but so prepares it in direct communication with the engine without compressing the fuel by mechanical means. The fuel so prepared is introduced separately with air under compression into the cylinder so as to burn completely in air, so that the heat of combustion must of necessity be given first to the air and be used in expanding it. Thus a comparatively small charge of fuel will give sufficient heat to increase the pressure of the gases as high as it is practicable to use them, as contradistinguished to that pressure produced by an explosive charge, in which the heat is rapidly abstracted by the engine-walls.

In using the explosive mixture the temperature produced at the instant of ignition is very high, and it falls almost instantly through the absorption by the engine-walls, so that almost the whole heat at the highest point is lost. By my preliminary preparation and method of burning the gases they do not con-

tain sufficient air in such preparation and use to burn instantly within the cylinder, and therefore no such high temperature is attained; but the heat developed by the combustion of the fuel is rapidly absorbed by the air, so that it expands, driving the piston.

The amount of time required in this combustion may be regulated to some extent by the amount of air supplied to the gas within the engine. A larger amount of air will produce a quicker combustion.

The gas producer or converter is adapted alike for crude petroleum and for the light and more volatile oils, the object being to convert the combustible into a decarbonized gaseous state and force it from the converter under pressure sufficient to drive it into the power-cylinder as it is so produced, and thus avoid compressing the gas and air within an air-compressor or by the back-stroke of the engine, as now done.

In gas-engines as now used a residuum of carbonaceous matter is left in the cylinder by the previous charge, which often retains its high temperature, and a spark of the hot mass might light the charge prematurely. Moreover, such accumulation prevents the proper working of the engine; but by decarbonizing the gas by steam, and with a supply of air in the cylinder only sufficient to completely burn the charge, the gas will burn clean and leave no deposit, since all the constituents of the fuel which will not evaporate into gas will be left in the generator or converter and can be removed, keeping the cylinder and its connecting-pipes free from the collection of carbon.

This gas generator or converter adapts the gas-engine for general use where there is no gas-supply available and it is desired to use liquid fuel. The liquid fuel is reduced to a gaseous state in the presence of steam under a very high temperature in the generator; and the oxygen of the steam uniting with the carbon of the oil forms carbonic acid or carbonic oxide, leaving principally hydrogen gas under pressure sufficient to pass directly into the engine.

In reducing any hydrocarbon oil for use in a gas-engine, it is only necessary to introduce enough steam to combine with the carbon of

the oil, so that the resulting product shall be gaseous. This is effected by causing the oil and steam to flow into a highly-heated chamber in regulated quantities in spray or jets in contact with the heated surfaces of such chamber.

The pressure under which the gas is produced in the mixing chamber or tube must be sufficient to overcome whatever pressure is being maintained within the power-cylinder of the engine. The preparation of the gas under pressure in the generator avoids the use of a gas-compressing pump and provides unlimited supply of gas, the flow of which can be regulated by a throttle-valve, and its proper preparation be determined and effected as it is being produced. In such capacity the converter forms both the generator and a pump, and constitutes an attachment for and an important factor in the operation of the engine in the particulars stated and in the particular of collecting all the matters of deposit resulting from the production of the gas, and thereby prevents their deposit in the engine-cylinder.

The accompanying drawings represent a gas producer or converter combined with the valve system of a gas-engine, in which Figure 1 represents a sectional view of a gas generator or converter as combined with the working-cylinder of a gas-engine; Fig. 2, a similar view of a gas generator or converter having a slightly-different construction, and Fig. 3 a cross-section on the line *x x* of Fig. 3.

The gas-generator consists of one or more air-tight cylinders or pipes, *a*, arranged within a suitable heating-chamber, *b*, and communicating by a pipe, *c*, with the reservoir for the hydrocarbon oil, and by a pipe, *e*, with a steam-generator. The hydrocarbon oil is introduced into the gas generator or converter chamber in jets in a heated state with steam, their respective pipes being heated within the chamber, which heats the generator or converter cylinder, and they communicate with the latter at the same point. The heating-chamber *b* is incased with non-conducting material to retain the heat within said chamber, which is produced by gas-jets *f* of a gas-pipe, *g'*, entering the inclosing-chamber *b* beneath the gas-generator and its communicating pipes. Steam enters the generator at *h* in contact with the liquid fuel, producing jets directed so as to mix thoroughly together as they enter the converter, where the well-known chemical combination takes place between the steam and the hydrocarbon to produce decarbonization. It is preferable to have the steam-pipe *e* terminate in an ejector within the pipe *c*, through which the oil enters, so as to blow the oil into the cylinder *a*, where it is converted into gas in direct communication with the working-cylinder of the engine.

Heated air may be introduced into the generator or into the gas by the pipe *d*, to aid in the absorption of the vapors from the oil; and the temperature of the generator must be kept

low enough to prevent the gases from igniting on meeting the air, when both air and gas are mixed therein. The air thus used serves to carry the oil-vapor by absorption, and to be present at combustion to combine with the carbon in the cylinder to prevent smoke and facilitate combustion. The air for this purpose need not be introduced directly into the generator, but may be introduced into the pipe which conveys the gas to the engine; or the cylinder of the generator may be extended outside of the heating-chamber *b*, and provided with a partition or tubular body, *a'*, of metal or wire, through which the gases pass from the generator into the outside cooler-chamber, *a''*, of the generator-cylinder, into which the air is admitted under pressure. When the air is introduced directly into the generator, it should not be in close proximity to the gas-jets.

The gas-burners *f* may be supplied from the pipe *g*, which conducts the gas to the engine-valves, or from any other source; and the heating-chamber has suitable openings, *i*, at the top and bottom to supply the burners with air and for lighting.

The pipe *g*, by which the gaseous fuel is conducted to the engine, is provided with a burner, *m*, outside of the generator heating-chamber, by which to test the quality of the gas produced, to show that the flame burns without smoke.

The generator-cylinder is constructed with heads, which can be made accessible and removed at any time for cleaning it of the accumulation of matter which is deposited therein from the decarbonization of the oil.

The hydrocarbon oil being injected in a heated state in fine jets or spray with steam, the oxygen of the latter combines with the carbon of said oil and releases a portion of the hydrogen thereof, converting the oil into a gas mixed with a proportion of carbonic acid, carbonic oxide, and some vapor of water.

Since steam is only required to take up sufficient of the carbon in the fuel, it is important to use as little steam as possible, and add enough air to absorb the vapors which might condense in the engine and the gas-supplying pipe, and to facilitate combustion within the engine.

The gas-conducting pipe *g* is shown in Fig. 1 as connecting the gas generating and preparing chamber *a* with the valve-space *n* of the engine *A*, from whence at the proper time the gas is admitted to the ports *s s*, and thence into the passages *t t*, for supplying the charge of compressed air from the pipe *u*, leading to the air-compressor. The exhaust-ports for the waste gases from the engine are shown at *w*.

It is obvious that the employment of air in the preparation of the gas may be dispensed with, and such preparation effected by steam alone; but, however prepared, my invention contemplates such preparation in a mixing-chamber in direct communication with the valve system of the engine.

In Fig. 3 the generating-cylinder proper re-

ceives only the steam and the hydrocarbon in jets directed so that they will mix thoroughly under high heat and the oil be decarbonized, while the air is received under compression in a chamber, a^2 , which forms an extension of the generator-chamber, into which the decarbonized gas flows through a system of tubes or wire-gauze, so as to be reduced in temperature before being brought in contact with the air. This outside chamber receives the air in a cool condition, which, absorbing the vapors of the gas, passes out and into the engine mixed with the gas.

It will be understood that the gaseous fuel from the converter and the air from the compressor may be supplied to the working-cylinder in separate single volumes unmixed, or in separate layers, as described in an application for a patent filed by me for improvement in gas-engines, September 9, 1882, under Serial No. 71,455, whereby a slow combustion is effected, so that the charge is rendered non-explosive, while the quantity of air mixed with the gas before it enters the engine can be regulated so as to determine the time of such combustion. When the gas-converter is applied to an engine using the gas and air in a mixed charge, as hitherto, the amount of air supplied to the fuel before entering the engine need only be in sufficient quantity to absorb and carry the vapors of the oil.

While I have described the production of gas from oils in the presence of steam to decarbonize it, yet it is obvious that gas may be produced from naphtha, which is so volatile that it requires no decarbonization by steam; but a regulated quantity of air only is mixed with it within the converter to absorb and carry the vapors with the gas into the engine without further compression.

The several pipe-connections of the gas-generator and the engine are provided with cocks by which to control and regulate the generation of the gas and its supply to the engine. When the oil is introduced into the generator without the injecting force of steam, it must be under a suitable pressure.

I claim—

1. The combination, with a gas-engine, of a gas-generator consisting of an air-tight reducing-chamber having oil and steam supply-pipe connections heated within an inclosing-chamber, and having a direct communication with the valve system of the engine, whereby the gas is produced, decarbonized, and supplied direct from the producing and mixing chamber under pressure sufficient to enter the engine-cylinder, substantially as described, for the purpose specified.

2. In combination with the valve system of a gas-engine, a gas-generator consisting of a heated air-tight chamber, into which oil is introduced under pressure with steam, and means for introducing air under compression into said mixing-chamber or its gas-discharging connection, substantially as described, for the purpose specified.

3. In combination with the valve system of a gas-engine, a gas-generator consisting of an air-tight cylinder, a , suitable pipes for supplying hydrocarbon oil and air under pressure with steam to said cylinder, an inclosing heating-chamber for said cylinder, and means, substantially such as described, for heating said air-tight gas producing and mixing cylinder and its oil-supplying pipe.

4. The combination, with the valve system of a gas-engine, of a gas-generator therefor, consisting of a heated reducing-cylinder, a , having pipe-connections with the working-cylinder, a pipe for introducing hydrocarbon oil under pressure into said cylinder, a steam-jet to spray the oil therein, a chamber inclosing said generator, and gas-burners placed within said inclosing-chamber supplied from the producer and heating the oil before its introduction into the generator, substantially as described.

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

LEWIS H. NASH.

Witnesses:

A. E. H. JOHNSON,

J. W. HAMILTON JOHNSON.