

(No Model.)

2 Sheets—Sheet 1.

J. S. ROGERS & J. H. BAKER.
APPARATUS FOR MANUFACTURING GAS.

No. 465,085.

Patented Dec. 15, 1891.

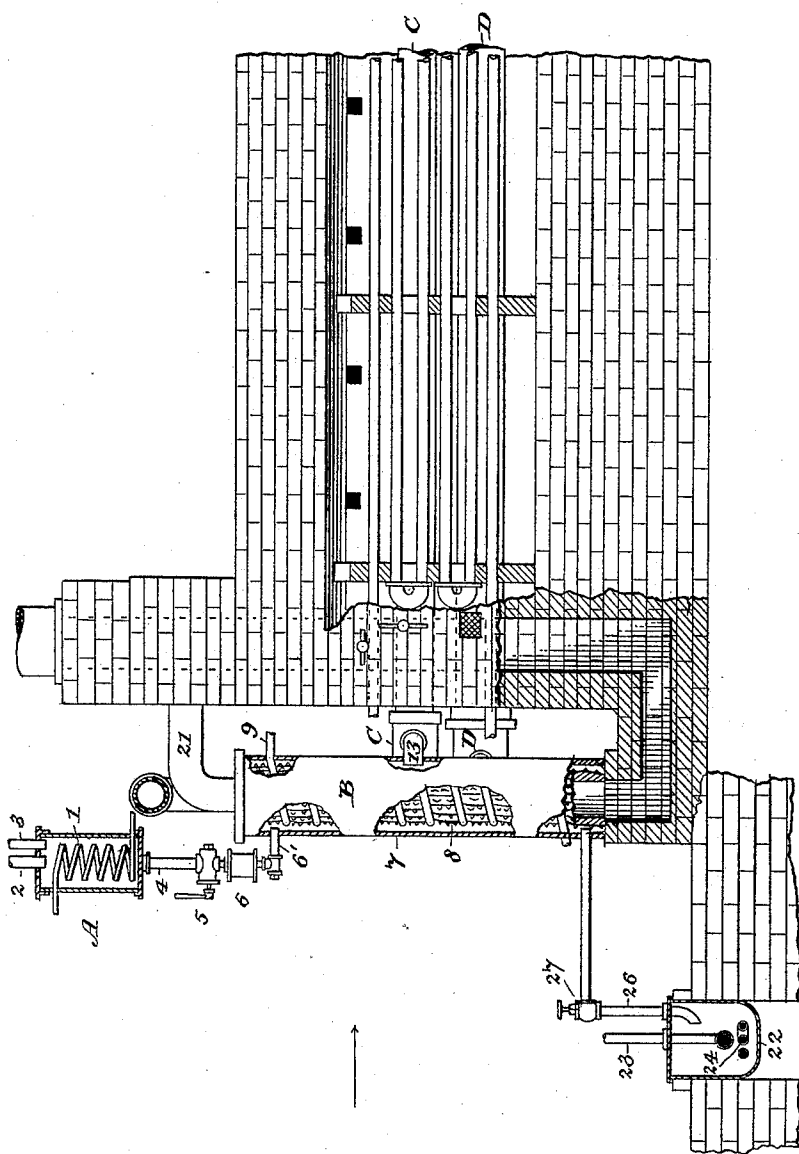


Fig. 1.

WITNESSES:

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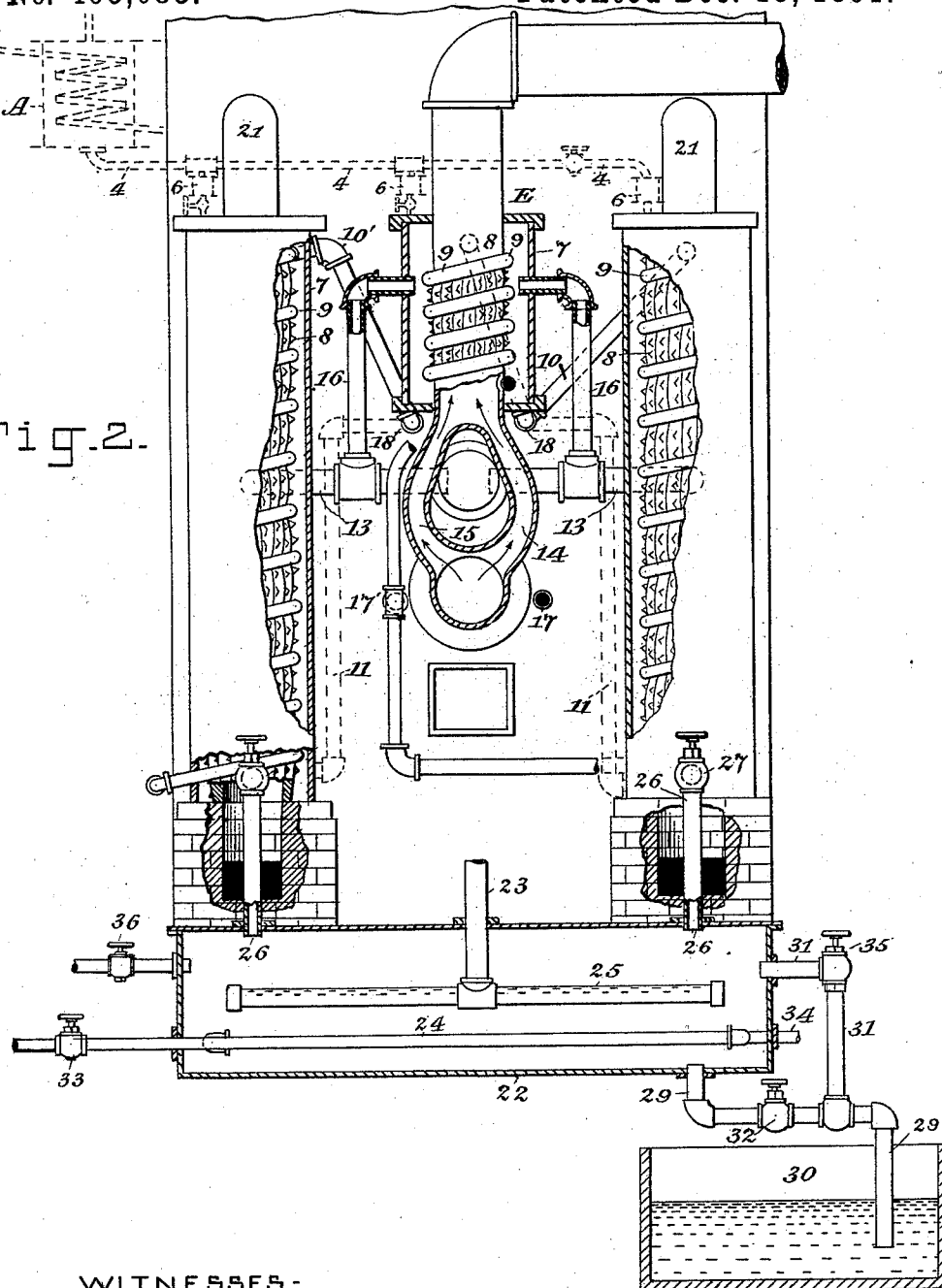
James S. Rogers, and James H. Baker
By Marble, Mason & Canfield,
their Attorneys.

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Fig. 2.



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UNITED STATES PATENT OFFICE.

JAMES S. ROGERS AND JAMES H. BAKER, OF SARATOGA SPRINGS, NEW YORK, ASSIGNORS TO THE ACME LIQUID FUEL COMPANY, OF NEW YORK.

APPARATUS FOR MANUFACTURING GAS.

SPECIFICATION forming part of Letters Patent No. 465,085, dated December 15, 1891.

Application filed January 5, 1891. Serial No. 376,820. (No model.)

To all whom it may concern:

Be it known that we, JAMES S. ROGERS and JAMES H. BAKER, citizens of the United States, residing at Saratoga Springs, in the county of Saratoga and State of New York, have invented certain new and useful Improvements in Apparatus for Manufacturing Gas from Hydrocarbons and Hydrogen; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part hereof.

Our invention relates to the manufacture of heating and illuminating gas from hydrocarbons and hydrogen; and it consists in the construction and combination of parts or elements which constitute the apparatus employed, as disclosed in the following specification, of which the accompanying drawings form a part, and in which similar letters and figures of reference designate like or equivalent parts wherever found throughout the several views.

Figure 1 is a side elevation of a furnace provided with our improved apparatus for manufacturing gas, part of the side wall being removed and portions of the apparatus being broken away so as to show the interior construction, other parts being shown in section, and the rear part of the furnace, together with steam-pipes, retorts, &c., being broken off; and Fig. 2 is a front elevation looking in the direction of the arrow shown in Fig. 1, the furnace being shown only in outline, and portions of the vaporizers, connecting-pipes, retorts, &c., being shown in section.

The object of our invention is to produce a fixed gas of superior quality for heating or illuminating purposes from hydrocarbons and hydrogen by a simple and economical process, and in an apparatus cheaply constructed and readily understood and operated and which may be adapted to furnaces of ordinary construction with but little, if any, modification, or which may be used in connection with our improved form of furnace designed for use in connection with our improved apparatus for the manufacture of gas, as shown

and described in application for United States Letters Patent, Serial No. 354,122, filed by us June 3, 1890.

We are aware that many attempts have been made to produce a fixed gas such as we manufacture from hydrocarbons or from hydrocarbons and hydrogen by various processes and forms of apparatus, but so far as we know with only partial success, and this want of success has resulted principally from defects in the apparatus employed and in the methods pursued. Under our process we form the gas from hydrocarbons and hydrogen, after which atmospheric air may be mingled therewith, if desired, in the well-known manner and in any desired quantity. The purposes for which the gas is intended will govern to some extent the amount of air introduced. When the gas is to be used for heating, the quantity of both hydrogen and air employed is increased or diminished, as may be desired, and the heat and light giving qualities of the gas may be thus regulated by simply increasing or diminishing the amount of the hydrogen and air employed in its manufacture.

Referring to the drawings and the reference letters and numerals thereon, A, Fig. 1, designates a device for heating hydrocarbons, which consists of a casing closed at the top and bottom provided with a steam-coil 1, through which steam from any source is passed, both the inlet and outlet thereof being controlled by suitable valves of ordinary construction. Hydrocarbon is conducted to the heater by means of a pipe 2, filling all the space not occupied by the steam-coil 1. The hydrocarbon is taken from a storage-tank situated above the heater, and this tank, being kept filled at a uniform height by means of an automatic valve of well-known construction, allows a steady and equal pressure of the liquid to flow into the heater. The hydrocarbon thus brought into contact with the steam-coil is raised to a degree of heat which materially assists in its vaporization, and the temperature of the hydrocarbon in the heater can be shown at all times by placing a thermometer at some convenient point, as at 3. The hydrocarbon, being thus heated, is conducted through a pipe 4 and a regulat-

ing-valve 5 through a sight-glass 6, which enables the operator to see at all times the flow therethrough and assists in detecting instantly any irregularity in the feed, and then passes into the vaporizer B through the pipe 6'.

The object of the vaporizer B is to vaporize the hydrocarbon rapidly, perfectly, and with the greatest economy. It consists of a cylindrical pipe or casing 7, inclosing a pipe or casing 8, the outer casing being closed and the inner one open at the top and bottom. The smaller or inclosed pipe or casing 8 is so arranged as to serve as an escape-flue for a short distance of the heated gases or products of combustion in such a manner as to make a large portion of the heat of such gases or escaping products of combustion available for the purpose of vaporizing the hydrocarbons. Hydrocarbons, being admitted into the chamber between the outer and inner casings or pipes near the top and preferably against the surface of the inner pipe or casing 8, are more or less fully vaporized, according to the degree of heat attained by such pipe. To increase this heat and radiate it as much as possible, conical projections are cast or otherwise formed on the surface of this pipe 8, and to still further assist in the process of vaporization this pipe is creased or grooved spirally from top to bottom, and in this groove is wound or coiled a pipe 9, preferably of copper or iron, which fits snugly within the said groove, sinking about half its diameter therein. Through this pipe 9 is passed superheated steam, taken preferably from steam-pipes arranged within the furnace, as hereinafter described. This superheated steam may be caused to enter the coiled pipe 9 at the top by means of pipes 10, as shown in Fig. 2; or it may, if preferred, be introduced at the bottom by means of pipes 11, as shown in dotted lines in said Fig. 2. The hydrocarbon in a heated condition passes into the vaporizer at the top, as shown, and, impinging upon the surface of the inner pipe 8, strikes the steam-coil 9 and follows around it, traversing the whole length thereof from top to bottom. If from any cause particles of hydrocarbon leave the coil and drop, they are at once caught either on the surface of or the projections on the pipe 8 or on the lower coils of the pipe 9, and the result is to vaporize all or nearly all of the hydrocarbon before it reaches the bottom of the chamber. If for any reason a portion of the hydrocarbon is not vaporized, it is allowed to run off through a pipe at the bottom of the vaporizer and thence to a receptacle, as hereinafter described.

As fast as vapor is formed it is allowed to escape through a pipe 13, which communicates with the vaporizer above the bottom thereof, as shown in Figs. 1 and 2, by which it is conveyed into one branch C of a retort located within the furnace, and, passing through this branch of the retort and return-

ing through the return branch D, each of said branches being heated to a high degree, it is converted into a fixed gas and emerges from the return branch of the retort D through the pipes 14 and 15, as shown in Fig. 2. These pipes 14 and 15 in the form of apparatus illustrated, in which three vaporizers are employed in connection with one furnace, after passing around the upper end of the branch of the retort C, unite and pass through a small or central vaporizer E, which in internal construction is identical with that of the large vaporizers B, it having a central pipe or flue 8 grooved and covered with conical projections, and having a steam-pipe 9 wound or coiled around it, through which superheated steam is passed and against all of which hydrocarbon is thrown for the purpose of vaporization, as hereinbefore described.

The vapor formed in the central vaporizer E passes through pipes 16, as shown in Fig. 2, which communicate with the pipes 13, which convey the vapor from the large vaporizers, and thus all the vapor formed from the several vaporizers is admitted to the upper branch C of the retort. The hot fixed gas which passes through the inner pipe 8 of the central vaporizer necessarily throws off a large amount of heat, which is used, as shown, for vaporizing hydrocarbons exactly as the escaping products of combustion are utilized in the main vaporizers B. It will be seen that all the gas formed from the hydrocarbons and hydrogen, as hereinafter described, by the apparatus illustrated, passes through the inner pipe 8 of the central vaporizer. It is then cooled to the required degree, if necessary, by any of the well-known methods, after which it may be reduced to the required candle-power by the admission of atmospheric air, and is conveyed into a gas-holder in the usual manner by an exhaustor such as in ordinary use.

The drawings show a system of steam-pipes for superheating the steam after it comes from the generator. These pipes are arranged longitudinally on the braces which support the separate branches of the retort. As shown, steam enters these coils at 17, Fig. 2, and emerges at 18, and is conducted thence by pipes 10 to the top of one of the large vaporizers B and to the central vaporizer E. After passing through these vaporizers it again enters the superheating-coils at 17' and emerges at 18', from which point it passes to the other large vaporizer through the pipe 10', and is then preferably conducted to a water-heater and utilized for the purpose of heating water before it is supplied to the boiler.

It is evident that the exact arrangement of pipes above described need not be followed closely in practice, as in some instances it might probably be preferable to connect the steam-supply with the bottom of the vaporizers by means of pipes 11, as shown in dotted lines. It is evident that we may limit ourselves to a single vaporizer in connection

with the retort or increase the number beyond that herein described and shown, the arrangement of steam-pipes and other details of construction being such in all cases as may be rendered necessary by the number of vaporizers employed.

As hereinbefore stated, in this apparatus the escaping products of combustion from the retort-furnace are also employed to assist in the process of vaporizing the hydrocarbons, the construction being such that the escape-flues are in communication with the inner casings 8 of the vaporizers B, as shown in dotted lines at 19 in Fig. 1 and in section at 20 in Fig. 2, and by means of dampers or valves provided for this purpose all the products of combustion or heated gases escaping from the retort-furnace may be conducted into and through the vaporizers, from which they are conducted to the chimney by means of pipes 21. None of the foregoing construction, however, nor the method of its operation, forms any part of the present invention, having been fully described and claimed in the application hereinbefore referred to, and the object in showing and describing the same herein is only to show the best method and apparatus known to us for carrying into effect the invention forming the basis of this application, which we will now proceed to describe.

In this method of producing gas from hydrocarbons and hydrogen we prefer to mingle the hydrogen with the hydrocarbon after the latter has been vaporized, as we have found this process to produce the best results. For this purpose we provide a tight box or casing 22, which constitutes a receptacle for the hydrogen, which may be produced in any desired manner. This box or receptacle may be of any desired shape or size and is provided with a pipe 23, in communication with the hydrogen-supply. Within this box 22 is a steam-coil 24, and above the steam-coil is a pipe 25, connected with pipe 23 within the box. Communicating with the interior of the box 22 are one or more pipes 26, each having a valve 27, and these pipes 26 are also in communication with the vaporizer B at 28. Connected, also, with box 22 at some convenient point, preferably at or near the bottom, is a pipe 29. This pipe leads to a box or catch-basin 30, where it is sealed. Another pipe 31, having a valve 35, communicates with box 22 at or near the top thereof, and with pipe 29 between a valve 32 therein and the seal. Hydrogen is admitted to the box 22 through pipe 23, which communicates with pipe 25, preferably closed at the ends and perforated, as shown, by which means the hydrogen is uniformly distributed. Steam, preferably superheated, is admitted to coil 24 through valve 33, and, traversing the coil, leaves it through outlet 34. By opening valves 27 any hydrocarbon not vaporized in the vaporizer B will flow into box 22 through pipes 26 and will come in contact with the

steam-coil located therein. The steam-coil will reduce some of the hydrocarbon to vapor, and this vapor will find its way with the hydrogen up through the pipes 26 into the vaporizers B and into the retort. The hydrogen will also pick up certain quantities of the unvaporized hydrocarbon in the pipes 26, and thus all the hydrocarbon capable of being vaporized will be converted into a vapor and thence into a fixed gas in the retort. The impurities and foreign matter in the hydrocarbon, which will not vaporize and therefore cannot be converted into gas, will remain in the box 22 and can be drawn off at any time through the pipe 29 by opening valve 32 and collected in the seal 30. If allowed to remain in the box until it is filled to the point where pipe 31 is attached, they will flow out into the seal 30 if the valve 35 is left open. To thoroughly cleanse the box 22 at any time, steam is admitted through valve 36, valves 27 and 35 being closed and valve 32 left open.

The above-described operation of the box 22 and its attachments and the hydrogen which enters the same in vaporizing the hydrocarbon which escapes from the vaporizers B and returning the same to the vaporizers and thence to the retort is only incidental, and while forming one feature of our invention is secondary to the main idea thereof, which involves the mingling of hydrogen with the vapor of hydrocarbons and the superheating of the product. As herein described, it will be seen that the mingled hydrogen and hydrocarbon vapors pass from the vaporizers B into the retort C D, where they are superheated and converted into a fixed gas.

The advantages gained by this method of producing a fixed gas from hydrogen and hydrocarbons are many. By putting all the hydrocarbon into the retort in the form of a vapor the possibility of "coking" in the retort from any cause is absolutely avoided. The amount of hydrocarbon converted into a fixed gas in a given time is materially increased, since the work of fixing the gas is half accomplished before the vapor is admitted into the retort. The cost of vaporizing the hydrocarbon is reduced to a minimum, as the heat required to keep the retort in proper condition for "fixing" the gas is sufficient to superheat the steam necessary in the process of vaporization, and the escaping products of combustion also materially aid therein, the heat therefrom being otherwise thrown away.

Having fully described our invention, we claim and desire to secure by Letters Patent—

1. The combination, in an apparatus for producing gas from hydrocarbons and hydrogen, of a hydrocarbon-heater in communication with a hydrocarbon-supply, a vaporizer in communication with the heater by means of a pipe, a hydrogen box or receptacle in communication with a hydrogen-supply and with the vaporizer by means of pipes, and a

retort also in communication with the vaporizer above the bottom thereof, substantially as shown and described.

2. The combination, in an apparatus for producing gas from hydrocarbons and hydrogen, of a hydrocarbon-heater in communication with a hydrocarbon-supply, a vaporizer in communication with the heater, a hydrogen box or receptacle in communication with a hydrogen-supply, with the vaporizer, and with a seal, and a retort also in communication with the vaporizer above the bottom thereof, the construction being such that the residuum or substances that cannot be vaporized are discharged from the vaporizer through the hydrogen-box, substantially as shown and described.

3. In an apparatus for producing gas from hydrocarbons and hydrogen, the combination, with a hydrocarbon-vaporizer and means for supplying hydrocarbons thereto, of a hydrogen box or receptacle in communication therewith and with a hydrogen-supply and provided with a steam-coil located therein, substantially as shown and described.

4. The combination, in an apparatus for producing gas from hydrocarbons and hydrogen, of a hydrocarbon-vaporizer in communication with a hydrocarbon-supply, and a hydrogen box or receptacle in communication therewith and with a hydrogen-supply, the hydrogen box or receptacle being also provided with a steam-coil located therein in communication with a steam-supply, and the hydrocarbon-supply being in communication with a perforated tube or pipe located within the box or receptacle, substantially as shown and described.

5. The combination, with the vaporizer B, of the hydrogen-supply receptacle in communication therewith provided with a pipe 29 in communication with the receptacle near the bottom thereof and with a seal 30, and the pipe 31 in communication with the receptacle near the top thereof and with the pipe 29, substantially as shown and described.

6. The combination, with the hydrocarbon-vaporizer B in communication with a hydro-

carbon-supply, of a hydrogen box or receptacle in communication therewith near the bottom thereof and also in communication with a hydrogen-supply, and a seal connected with the receptacle by means of a pipe which communicates therewith near the bottom thereof and with a pipe which communicates therewith near the top thereof, substantially as shown and described.

7. The combination, with a vaporizer B, of a hydrogen-receptacle, as 22, in communication therewith, the receptacle being provided with a steam-supply 36 and with a discharge-pipe 29, substantially as shown and described.

8. In an apparatus for producing gas from hydrocarbons and hydrogen, the combination, with a series of vaporizers in communication with a hydrocarbon-supply, of a hydrogen-receptacle in communication with each of the vaporizers and with a hydrogen-supply, and a seal in communication with the hydrogen-receptacle by means of communicating pipes, one of which communicates with said receptacle at or near the bottom thereof and the other at or near the top thereof, substantially as shown and described.

9. In an apparatus for producing gas from hydrocarbons and hydrogen, the combination, with a series of vaporizers, each of which is in communication with a hydrocarbon-supply, of a hydrogen-receptacle in communication with a hydrogen-supply and with each of the vaporizers near the bottom thereof, and a seal in communication with the hydrogen box or receptacle, the receptacle being also provided with means whereby the residuum or substances that cannot be vaporized are discharged from the vaporizer through the hydrogen box or receptacle into the seal, substantially as shown and described.

Signed at Saratoga Springs, in the county of Saratoga and State of New York, this 31st day of December, A. D. 1890.

JAMES S. ROGERS.
JAMES H. BAKER.

Witnesses:

WINSOR B. FRENCH,
MARTIN T. CROOKS.