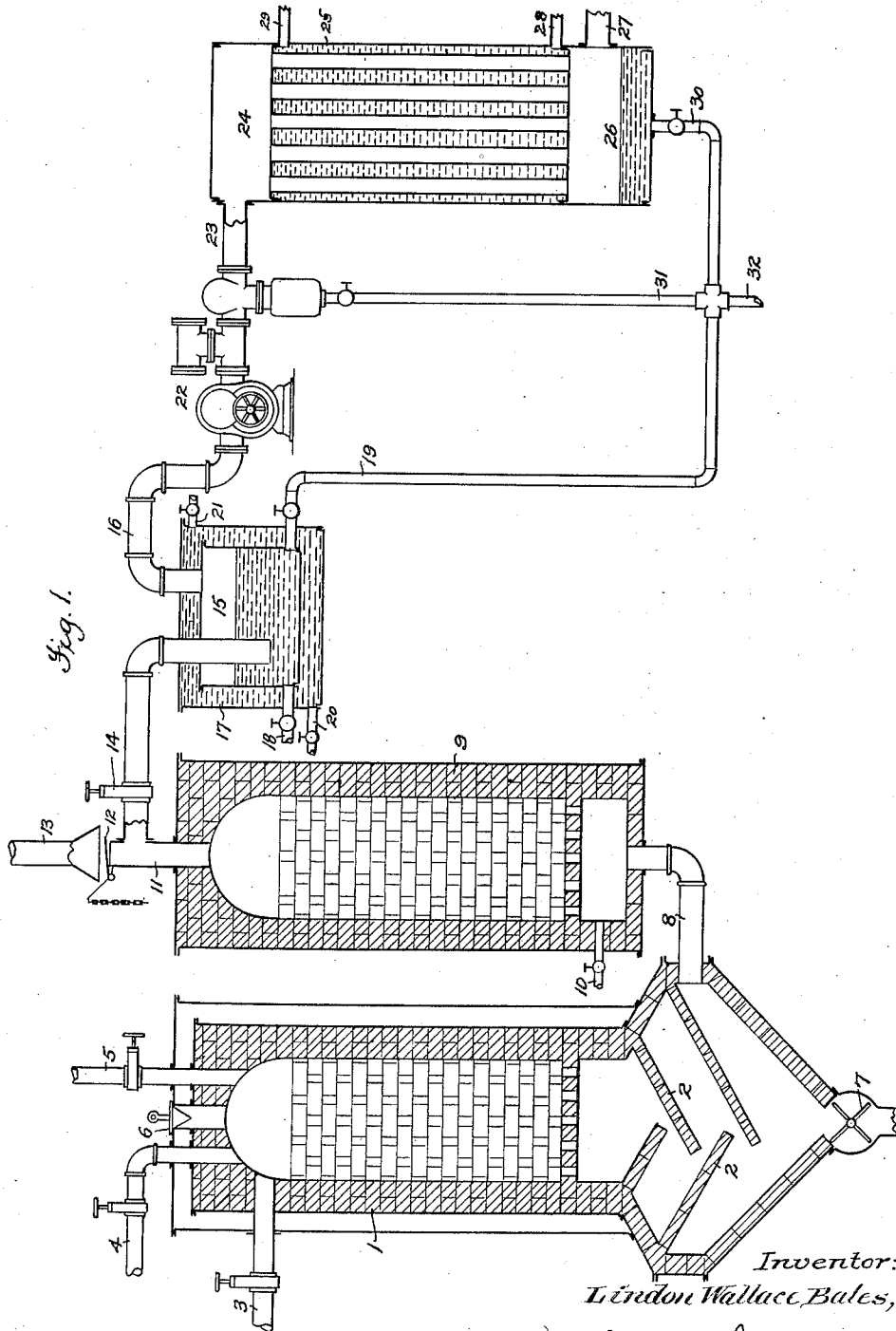


L. W. BATES.
METHOD OF PRODUCING GAS.
APPLICATION FILED FEB. 19, 1920.

1,373,704.

Patented Apr. 5, 1921.

2 SHEETS—SHEET 1.



Inventor:
Landon Wallace Bates,

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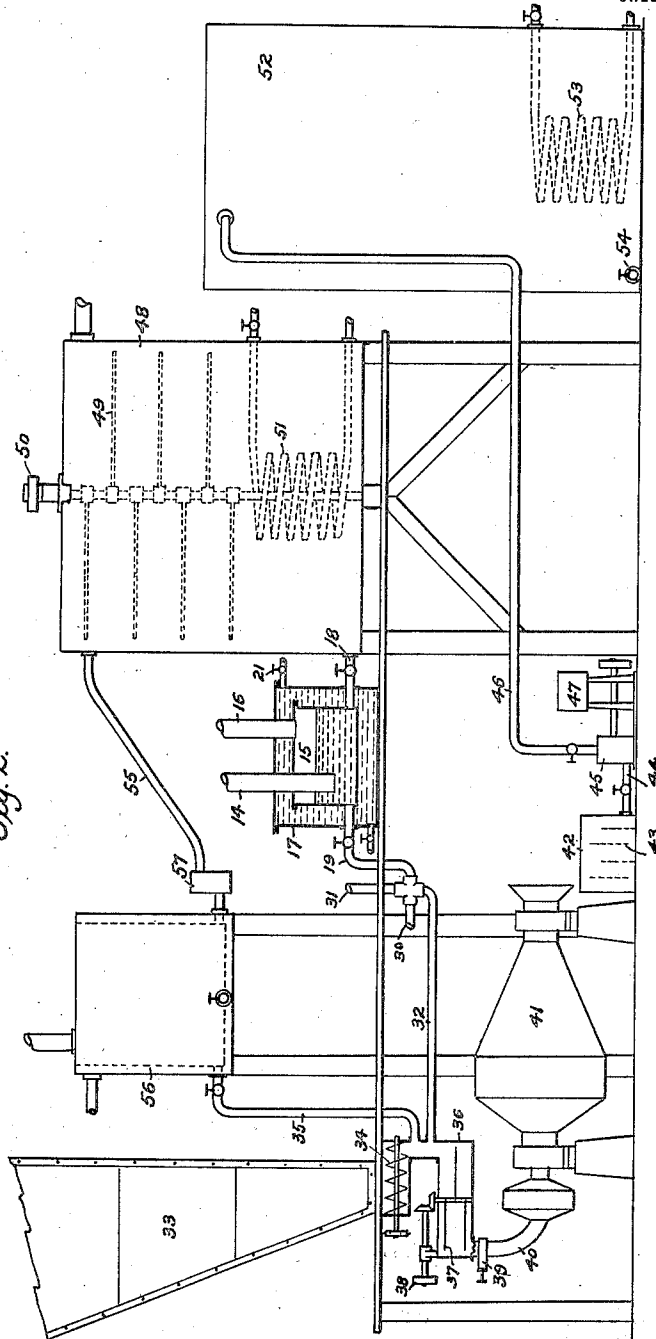
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Fig. 2.



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UNITED STATES PATENT OFFICE.

LINDON WALLACE BATES, OF MOUNT LEBANON, NEW YORK.

METHOD OF PRODUCING GAS.

1,373,704.

Specification of Letters Patent.

Patented Apr. 5, 1921.

Application filed February 19, 1920. Serial No. 359,810.

To all whom it may concern:

Be it known that I, LINDON W. BATES, a citizen of the United States, and a resident of Mount Lebanon, in the county of Columbia and State of New York, have invented certain new and useful Improvements in Methods of Producing Gas, of which the following is a specification.

This invention relates to a process for making gas for heating, illuminating and other purposes. More specifically it refers to the method of employing liquid hydrocarbon and solid carbonaceous substance in such a fashion as to produce simultaneously and initially a combined coal and oil gas, or coal, oil and water gas, called "Amalgas."

Heretofore coal and oil have been used separately to form gas. Oil gas has been used in a carbureter as a later enrichment of the coal or water gas. The way has, however, recently been found whereby coal and oil, or like liquid hydrocarbon and solid carbonaceous substances, may be combined into a stable liquid or mobile fuel and simultaneously burned. The manner of so doing is described in my copending application Serial No. 315,497, filed August 5th, 1919, directed toward a "Fuel and method of producing same." The use of stabilizing agents in small amounts, such as lime-rosin grease or equivalent substances, or the use of somewhat larger amounts of peptonizing agents having stabilizing qualities such as coal distillates or like liquid derivatives of carbonaceous or equivalent substances, will produce adequate fuel stability and suspend in liquid fuel up to about 40% by weight of pulverized coal in oil alone or with some tar. All suitable combustible liquids and carbonaceous solids may be used. The manner of combining the components is stated fully in the said application, and consists in a mechanical blending or pulverizing treatment, or a heat treatment in a combined treatment. The treatment and stabilizing substances produce an equilibrium in the mixture so that the particles of solid substance do not precipitate out for a given desired length of time. The present process takes such fuel and uses it to make a superior or cheaper gas according to a simplified gas-making process, having an optional closed circuit fuel production feature as well.

The salient points of the new process are these: 1st, the employment of liquid hydro-

carbon and solid carbonaceous substance combined in advance to form simultaneously the gas product; 2nd, the omission of the separate step of oil gas enrichment of coal or water gas; 3rd, the disposition of the ash released by the combustion of the particles of solid in the composite fuel; 4th, the use of liquid hydrocarbon instead of water in the wash box to collect tar and lampblack and make further fuel.

The advantages of employing such composite fuel in gas-making are manifest. The duration of the process may be reduced as the enrichment step may be eliminated. The combustion of the coal is more complete as the particles are small in the fuel. Lampblack and other carbonaceous solids, including those too fine in mesh to be used as fuel on grates or in a generator, may now be usefully employed to make gas. The type and grade of gas may be regulated in advance by selecting a composite fuel which will produce the desired gas. At present, the quality of gas depends in part upon regulation of the flow of oil gas into the poorer coal or water gas during the process.

It is, of course, important to remove the fine ash powder from the gas before the latter passes through the wash box, else the fuel therein produced will be less pure than it might be. The passage of the gas through the wash box, tar extractor, condenser and pipes cleans the gas itself rather thoroughly. Fortunately there are a number of ways of meeting the ash disposal problem. The simplest way is to use cokes or coals low in ash, or to remove the ash before the coal is colloidalized with the liquid to form the stable mobile fuel. The flotation or other water washing method of ash removal may be used for this purpose. There are also several other wet or dry methods of de-ashing the carbonaceous substance. To separate ash from the gas when fuel containing ash is used, there are also a number of alternatives. A system of baffle plates is preferred, since this involves no delay in the process. Screens may be used if located at a sufficient distance from the heat. Electrical precipitators may also be employed. A water bath is a further alternative. There are many ways of removing ash, and the baffle plate method is selected herein simply as typical to represent the ash removal step of the process.

Since chemical science now knows the

way of stabilizing solid particles and tar droplets in oil, the wash box need no longer contain water to collect these gas impurities, but may contain oil or other such liquid treated or adapted to form therein and with these particles and droplet, a fuel or to form a mixture which may be later colloidalized by subjecting it to the requisite treatment with or without the addition of further components. The wash box may be filled with ordinary oil or with fixated oil. In the first case it will be usually necessary to add the stabilizing substances or fixateurs before employing the fuel. If the oil is or contains coal distillate, having peptonizing qualities, it is already adapted to stabilize particles and droplets, and in some cases the gas and its heat alone may give the adequate homogeneity to produce a stable fuel. It may be necessary to water jacket the wash box containing liquid hydrocarbon or to otherwise cool it, since the temperature of the gas when it enters is very high, or a secondary water-containing wash box may be used for cooling purposes. A steam trap may be interposed before the wash box. The oil or other liquid in the wash box may be stationary or in circulation. It is better for it to be gradually flowing in and out. The fuel produced in the wash box or the subsequently treated wash box mixture may be used again for gas making or may be dedicated to other fuel purposes. On passing through liquid hydrocarbon the gas is absorbed to some extent, but any such loss from the gas is an enrichment of the wash box fuel and in any event the gas does not lose much in passage. Gas absorbed in the wash box may be driven off again and recovered. The wash box serves also to recover the toluol in the gas, which is a distinct economic benefit. The closed circuit fuel production in the wash box is a notable feature of the process or mixture, since wash boxes have not heretofore been placed to such use.

The process herein described may be illustrated diagrammatically. The accompanying Figure 1 shows a vertical cross-section of a gas producing plant, using the method herein proposed. Fig. 2 shows how the plant may be combined with a colloidalizing plant similar to that described in my copending application, Serial No. 344,753 filed December 10th, 1919, directed toward "Apparatus for the production of mobile fuels."

The generator and superheater, filled with checker-board brickwork, are heated previous to the beginning of the gas-making operation in the usual fashion of the "up run" of the oil gas process or otherwise. In usual practice the temperature will not materially differ from that used in oil gas making, namely a maximum of about 1400°

F. But if high percentages of solids are used in the fuel the temperature may have to be adjusted thereto and the duration of the steps may have to be modified. No fixed rule can be given as this will vary according to the fuel, as it does indeed in the ordinary oil, coal and water gas processes. The duration of the steps and their sequence are hereafter given for use with a typical composite fuel carrying up to about 30% by weight of coal particles pulverized so that about 85% will pass a 200 mesh screen and stabilized in oil with about 1% of lime-rosin grease or with about 10% coal distillate such as water gas tar or with lesser percentages of both.

Colloidal fuel is suitably admitted to the generator 1 through a valve 4 and is atomized and ignited so as to heat and make gas in the generator and superheater. The fuel should be preheated to 130° F. to 180° F. or over to flow and atomize readily and facilitate the gas-making operation. It is atomized through a burner or suitable orifice under pressure, as is usual in oil gas making practice. Other heating means may be employed. An opening 6 may be used for cleaning purposes. The ash resulting from the combustion of the fuel is partially or fully precipitated into a pit through gate 7 by the action of the baffle plates 2.

When the brickwork is suitably hot, valve 14 is closed and cover 12 is opened. For three minutes or thereabouts air is admitted through valves 5 and 10 and steam through 4. At the close of this initial step, colloidal fuel is introduced through valve 4. The gas and vapors pass to the superheater 9 through pipe 8 and pass thence into the air through pipe 11, cover 12 and funnel 13.

The fuel is heated in the generator and superheater for some nine minutes. Then the air is turned off at valves 5 and 10, and valve 14 is opened, and valve 12 is closed. Thereupon colloidal fuel and steam alone pass into the generator and superheater for about nine minutes. At the close of this step the fuel is cut off and steam alone is introduced through valve 4 for two minutes to drive the gases through the generator and superheater into the wash box 15. This may be surrounded by a water jacket 17, into which water enters through pipe 20 and leaves through 21.

The gas, while passing through the wash box, filled with liquid hydrocarbon which enters through pipe 18 and leaves through 19, is cleansed of some or all of the lamp-black, tar, toluol, ammonia liquor and other impurities. It is also cooled down to about 190° F. Through pipe 16 the gas passes to a tar separator of any known type. In Fig. 1 a Smith tar extractor 22 is shown. The separator still further removes the tar, liquids and particles from the gas. The col-

lection box connects with pipe 19 through pipe 31. Finally the gas may be passed through pipe 23 to any further suitable cleansing mechanisms, if any, such as condenser 24, containing water 25 which is admitted at 28 and leaves at 29. The condenser cools the gas and separates the remaining by-products. From the condenser the gas passes through pipe 27 into a purifier, such as a purifier filled with ferric oxid to remove the sulfur compounds. The gas so produced may be stored or directly used. The collection box 26 of the condenser connects also with pipe 19 through pipe 30. Under favorable circumstances the tar extractor and condenser may be omitted, depending upon the completeness of the tar and particle extraction in the wash box.

It has been remarked that the colloidalizing process may be combined with the gas making process. Thus the mixed oil, tar and particles from the wash box, if suitably homogenized, may be directly used as fuel. If, however, the commingling is not sufficient or if the oil will carry further particles or tar and it is desired to so load it then the liquid may be colloidalized with more carbonaceous particles, tar or oil as described in my said copending applications. To do so the oil in tank 48 enters the wash box through pipe 18. The liquid with its partial load then passes through the wash box and through pipe 19 and the four-way valve into pipe 32. From there it goes into the premixer 36.

The oil in tank 48 may be fixated by stabilizing substance from tank 56, which flows or is pumped therein by pump 57 through pipe 55. Crushed carbonaceous substance enters the premixer 36 from hopper 33 through a conveyer 34. Stabilizing substance may be conveyed directly to the premixer through pipe 35. The components, with further oil added from 48 if desired, are premixed by agitator 37 driven from 38 and then pass through a control valve 39 and pipe 40 to a pulverizing mill 41. In Fig. 2 this is of the Hardinge type, but any suitable coal pulverizing mill may be used. If already pulverized coal is used and placed in hopper 33 then the mill may be simply a blending or paint mill. From the mill the fuel may pass under and over a series of baffle plates 43 in a tank 42 to deposit the larger particles. Instead of such plates a "slimer" or small tube-like ball mill to further reduce the particles may be employed. The stable fuel is then pumped through pipe 44 by pump 45 actuated by motor 47 or caused to flow from the mill or small tank 42 through the pipe 46 into the tank 52 where it is stored for use. Heat may be applied to the fuel in the mill or in tank 52. The tanks 48 and 52 may contain agitators or coils to

advance peptonization, blending of liquids or to congeal the fuel in storage. Coils are diagrammatically indicated by 51 and 53. The agitator 49 in tank 48 is driven from 50. The outlet 54 of tank 52 is shown also. The combination in some such fashion in a closed circuit of gas and fuel making is most important.

It is obvious that the details of the present process of gas making and the possible accompanying fuel manufacture may be varied within broad limits without departing from the scope of this invention. Thus the duration of the steps, degree of heat, sequence of operations, pipe connections, use of special parts, amounts of fuel, steam and air used, dimensions of apparatus, and character of the fuel may be changed to suit particular needs. For example, the superheater may be omitted in certain exceptional cases or may be divided into two heating sections as in the oil gas process. The term "generator" taken broadly, includes the gas making chambers. So also there is the recognized possibility of adding other steps to the gas making process. For instance, the present process may be combined with the coal, oil or water gas process. Carbureting or enriching Amalgas with oil gas is not excluded. Other gases may be added to the Amalgas in the generator or superheater or may be mixed with the air and steam in the generator before the liquid fuel is introduced, or may be united with Amalgas afterward. Such further gas may be introduced into the generator through valve 3. The details of apparatus parts and of certain special steps are reserved for presentation on another occasion.

Each of the innovations herein described represents a material advance in the gas making art. The utilization for fuel of the lampblack and tar while making gas is of especial consequence. So also the ability to predetermine in advance the gas character by using fuel of given composition instead of waiting until the operation has begun to regulate the flow of oil to this end, enables wide variations to be made in the kinds of gas produced to meet special requirements of illuminating or heating power.

Having thus stated the nature of my invention what I claim is:

1. That method of making gas which consists in the atomization into and ignition of stable mobile fuel comprising liquid hydrocarbon and pulverized solid carbonaceous substance in a mixture of air and steam in a generator heated to a temperature sufficient to transform the particles of solid carbonaceous substance and the liquid hydrocarbon into gas, the removal of ash from the gas, and the subsequent passage of

the gas through a wash box containing liquid hydrocarbon to remove tar and lampblack therefrom.

2. That method of making gas and while
5 so doing making a combination including oil; tar and lampblack, which consists in the atomization into and ignition of stable mobile fuel comprising liquid hydrocarbon and pulverized solid carbonaceous substance
10 in a mixture of air and steam in a generator heated to a temperature sufficient to transform the particles of solid carbonaceous substance and the liquid hydrocarbon into gas, the removal of ash from the gas,
15 and the subsequent passage of the gas through a wash box containing liquid hydrocarbon to remove tar and lampblack therefrom.

3. That method of making gas which
20 consists in heating a generator to a temperature sufficient to transform oil and particles of solid carbonaceous substances into gas, then introducing air and steam into the generator, then introducing and igniting
25 therein stable mobile fuel comprising liquid hydrocarbon and pulverized solid carbonaceous substances, then terminating the flow of fuel, then introducing steam into the generator which drives the gas through a
30 wash box containing liquid hydrocarbon.

4. That method of making gas which consists in heating a generator to a temperature sufficient to transform oil and particles of solid carbonaceous substance into gas
35 by atomizing therein and igniting stable mobile fuel comprising such ingredients, then introducing air and steam into the generator, then atomizing and igniting fur-

ther stable mobile fuel therein, then terminating the flow of fuel, then introducing 40 steam into the generator which drives the gas through a wash box containing liquid hydrocarbon.

5. Those steps in the method of making gas which consist in the atomization into 45 and igniting of stable mobile fuel comprising liquid hydrocarbon and pulverized solid carbonaceous substance in a mixture of air and steam in a generator heated to a temperature sufficient to transform the particles 50 of solid carbonaceous substance and the liquid hydrocarbon into gas, and the removal of ash from the gas.

6. That step in the method of making gas of predetermined character which consists 55 in the atomization into and igniting of stable mobile fuel comprising liquid hydrocarbon and pulverized solid carbonaceous substance in a mixture of air and steam in a generator heated to a temperature suffi- 60 cient to transform the particles of solid carbonaceous substance and the liquid hydrocarbon into gas.

7. That step in the method of producing gas which consists in combining air, steam, 65 gas an atomized and ignited stable mobile fuel comprising pulverized carbonaceous substance and liquid hydrocarbon in a generator heated to a temperature sufficient to transform the particles of carbonaceous 70 substance and the liquids into gas.

Signed at New York city in the county of New York and State of New York this 17th day of February, A. D. 1920.

LINDON WALLACE BATES.