J. J. NIX.

PROCESS OF MAKING GAS.

APPLICATION FILED JAN. 21, 1910.

986,495.

Patented Mar. 14, 1911.

2 SHEETS—SHEET 1.

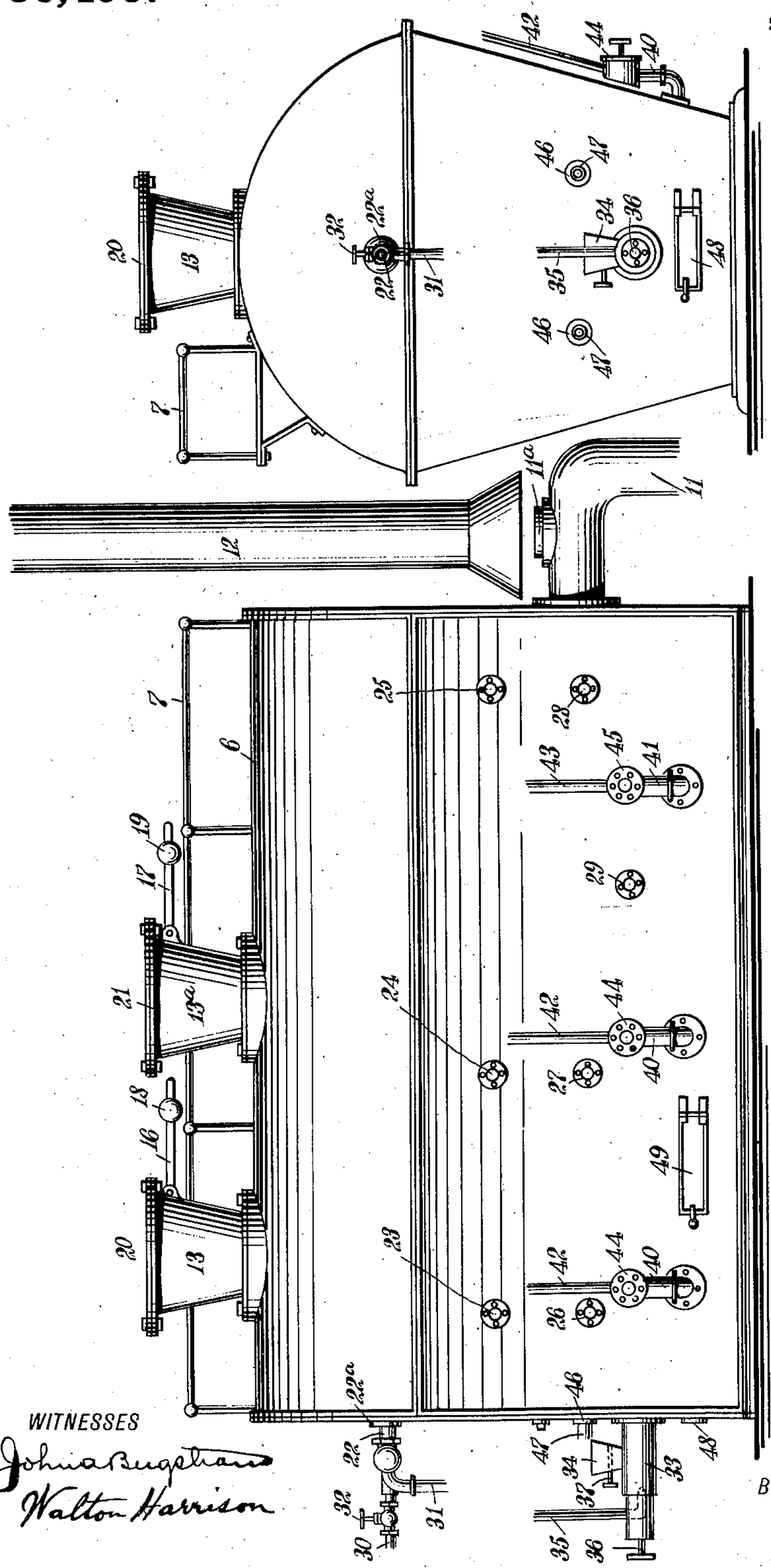

Fig. 2

Fig. 1

WITNESSES

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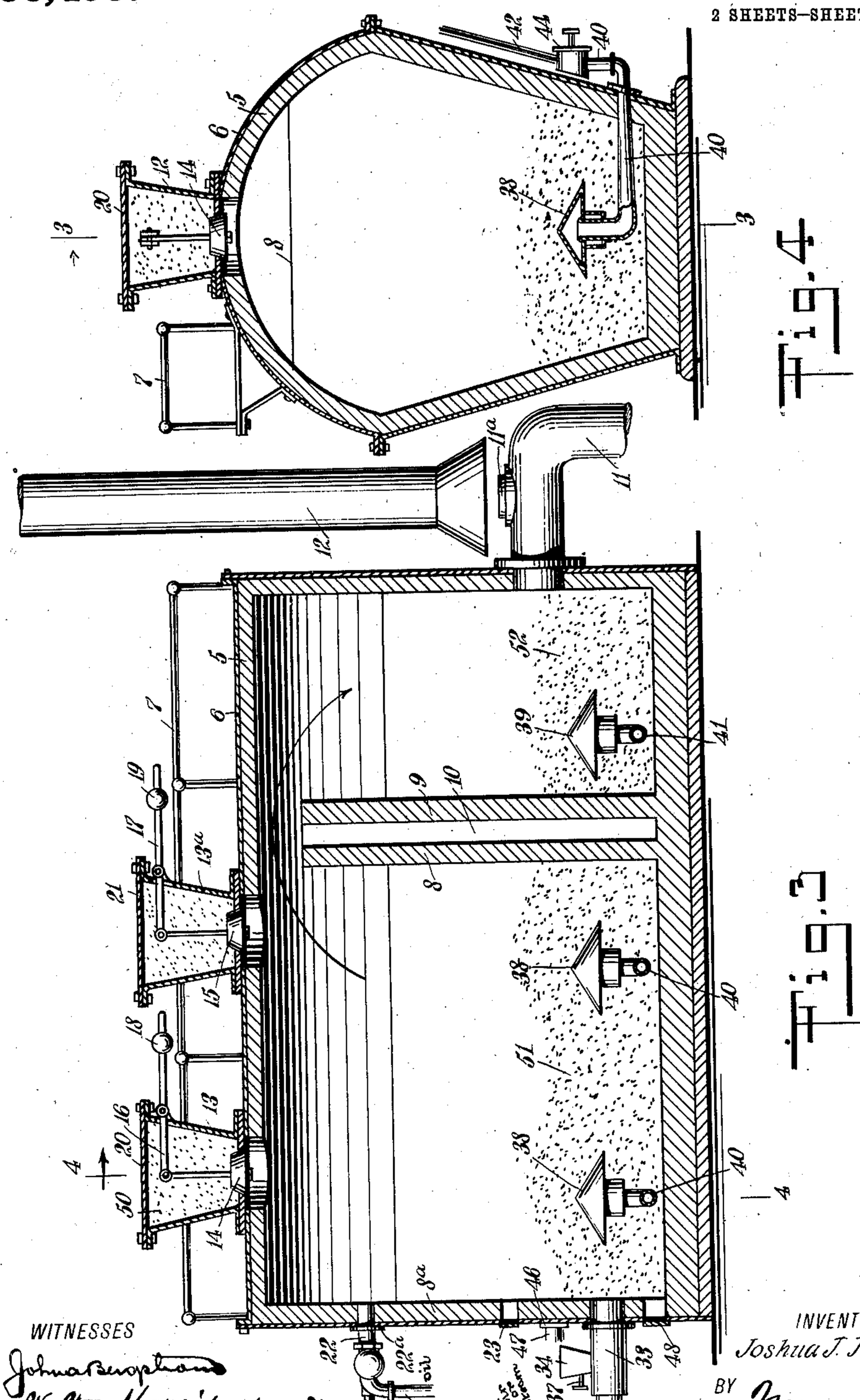

Fig. 4

Fig. 5

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UNITED STATES PATENT OFFICE.

JOSHUA JOHN NIX, OF ALHAMBRA, CALIFORNIA.

PROCESS OF MAKING GAS.

986,495. Specification of Letters Patent. Patented Mar. 14, 1911.

Application filed January 21, 1910. Serial No. 539,330.

To all whom it may concern:

Be it known that I, JOSHUA J. NIX, a citizen of the United States, and a resident of Alhambra, in the county of Los Angeles and State of California, have invented a new and Improved Process for Making Gas, of which the following is a full, clear, and exact description.

My invention relates to a process for making gas, my more particular purpose being to make a combustible gas cheaply and continuously with a minimum of waste of both heat and materials.

My invention comprehends, among other things, the heating of a furnace or other receptacle and the continuous precipitation therein of carbonaceous material in gaseous form, and the continuous supply to said carbonaceous material thus precipitated, of steam, or air, in order to form the combustible gas.

My invention further comprehends the precipitation of hot solid carbons, and more particularly carbons which have undergone one distillation and upon this account may be considered as by-products for the purpose of supplying carbon for the gas as made.

My invention further contemplates the injection by aid of compressed air, steam or the like, of powdered carbonaceous material into a previously heated region, to enable said powdered carbon to facilitate the formation of the gas.

My invention comprehends various other steps, the ultimate purpose of which is to improve in general the known processes for making combustible gases.

While I do not limit myself to the use of any particular form of apparatus carrying out my invention, I nevertheless for convenience herein illustrate one particular form of apparatus suitable for carrying out my process.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of the gas furnace complete; Fig. 2 is an end elevation of the gas furnace, showing it as it would appear to an observer stationed at the left of Fig. 1; Fig. 3 is a longitudinal section through the furnace on the line 3—3 of Fig. 4, looking in the direction of the arrow; and Fig. 4 is a vertical cross section on the line 4—4 of Fig. 3, looking in the direction of the arrow.

A fireproof receptacle 5 having generally the form of a furnace is provided externally with a metal jacket 6. A hand rail 7 is mounted upon the jacket for the convenience of the operator. The furnace is provided with walls 8, 9 between which is a space 10, and is further provided with a front wall 8ª. At 11, is a pipe which may be connected to an exhaust fan or other appropriate mechanism for producing in the furnace a partial vacuum. This pipe 11 is provided with a discharge outlet 11ª, over which is a chimney 12. This discharge outlet is normally kept closed, but may be opened at the start in order to permit the escape of gases formed in starting the device into operation.

Mounted upon the furnace are hoppers 13, 13ª and at the bottoms of these hoppers are discharging bells 14, 15 of the usual valvular form and adapted to eject the contents of the hoppers into the furnace. Levers 16, 17 are used for operating the bells 14, 15 and are provided with counterweights 18, 19 to balance these bells. The hoppers are also provided with lids 20, 21 whereby they may be closed at will.

At 22 is an atomizer burner and at 23, 24, 25, 26, 27, 28 and 29 are peep holes through which the operator may observe the internal workings of the furnace. The atomizer burner 22 is connected with an air supply pipe 30 and an oil supply pipe 31, the air supply being regulated by aid of a hand valve 32.

At 33 I provide an ejector for delivering powdered carbon or carbonaceous material into the furnace. This injector includes a hopper 34, mounted upon it and adapted to contain the powdered material. A pipe 35 leads to the injector and is used for delivering thereinto compressed air or steam.

If desired, the pipe 35 may simply admit air at atmospheric pressure, but in this event it is necessary to form a partial vacuum in the furnace, in order to cause the difference in atmospheric pressure to drive the powdered carbonaceous material.

A hand valve 36 regulates the supply of air or steam admitted through the pipe 35. The hopper 34 is provided with a hand feed 37, whereby the supply of the carbonaceous material may be controlled at will. Mount-

ed centrally within the furnace are two burners 38 disposed at one side of the partitions 8, 9, and another burner 39 located upon the opposite side thereof. Connected with these burners are pipes 40, 41 and leading to these pipes are smaller pipes 42, 43 for conveying steam or compressed air thereinto.

At 44, 45 are dampers for controlling the supply of air to the burners 38, 39. Below the atomizer burner 22 I locate two other atomizer burners 47 exactly alike. These burners are connected in position by aid of collars 46, the atomizer burner 22 being similarly mounted by aid of a collar 22ª.

At 48, 49 are doors which may be opened occasionally to allow the apparatus to be cleaned out.

The hoppers 13, 13ª are charged with by-product carbon, preferably coal, which has already undergone one distillation but which still contains some volatile hydrocarbon.

At 51 is a quantity of carbon or carbonaceous material which has passed through the hoppers 13, 13ª. At 52 is another quantity of carbonaceous material which, in being precipitated, is passed over the partitions 8, 9, as indicated by the arrow in Fig. 3.

The operation of my device is as follows: Having filled the hoppers 13, 13ª with carbon which has already undergone one distillation, and which is therefore by-product carbon, and having also filled the hopper 34 with finely divided carbon or carbonaceous material, the burners 22, 47 are lighted and are adjusted for complete combustion. That is to say, the supply of air and of fuel is so regulated as to completely consume the fuel thus supplied, the resulting product being, of course, CO_2. No great amount of fuel is thus worked up, however, for my purpose in bringing about this complete combustion is merely to heat the furnace at the start. While the atomizer burners 22 and 47 are to some extent independent of the burners 38, 39, and may, if desired, be operated while the burners last mentioned are in action, this is not essential as the burners 38, 39 may be operated even when the burners 22 and 47 are idle. This being done, I set the burners 38, 39 into operation, supplying them abundantly, through the pipes 40, 41 or through either one of these pipes as desired, with liquid fuel, yet so restricting the air supply into the burner or burners used for admitting air, that it is unable to form carbon-dioxid (CO_2) but readily makes carbon-monoxid (CO). The mass of carbonaceous material having been previously precipitated and now being heated to incandescence, and also being permeated with carbon-monoxid formed constantly throughout this mass by action of the restricted quantities of air reaching said mass, is in suitable condition to form combustible gas by the addition of steam. The steam is admitted through the pipe 35 or, if desired, through either one of the pipes 42, 43. Where one of these pipes is used for admitting steam, the other is employed for supplying fuel as above described. While usually the steam and air are admitted at the same time, this is not in all instances necessary. The restricted volume of air may first be admitted and when the carbonaceous material is heated to incandescence in contact with such air, the steam may be admitted afterward. Now, either for the sake of economy in working up waste materials, or to insure that the carbon within the furnace is in proper condition to assist in forming the gas, I may, by aid of the hand feed 37, admit into the furnace a supply of finely divided carbon or carbonaceous material through the hopper 34. In doing this I may continue to admit steam through the pipe 35, if desired, or not, depending upon how much steam is otherwise supplied and also depending, to some extent, upon the proportions of the apparatus.

The mechanism may also be used as follows: Liquid fuel being admitted through the atomizer burners 22, 47, causes, as above indicated, the formation within the furnace of carbon dioxid, and when this is brought into contact with the heated mass 51 of carbon within the furnace and steam is supplied, the carbon dioxid (CO_2) is converted into carbon monoxid (CO).

In the process above described the free hot carbon is constantly precipitated or liberated at the required rate of gas consumption, thus rendering the production of the gas considerably cheaper.

The process also renders the quality of the gas decidedly more uniform than is usually case when the gas is made from oil alone. That is to say, when oil alone is used a combustion gas is formed which varies greatly in its purity and therefore correspondingly varies in its composition.

With the process above described, the gas made is comparatively pure and has therefore a regular and definite rate of combustion, which is a great consideration where the gas is to be used for running an engine.

It may be observed that when the hoppers at the top of the furnace are used, the carbon passed through them into the furnace contains some moisture and remains resting upon the bottom for some little time, being gradually consumed. The atomized carbon acts somewhat similarly, gathering upon the bottom of the furnace, but is taken up more quickly than is the case with the solid carbonaceous material from the upper hoppers.

While I prefer to use powdered carbon for

the lower hopper 34, I find that other forms of carbonaceous material, if suitably powdered, will answer, in a measure at least, the same purpose. I also find that other forms of carbon may be injected in the way above described with reference to the hopper 34.

The gas formed by the process above described, contains a larger proportion of carbon monoxid (CO) than is the case with gases made directly from oil. The capacity of a given furnace or generator is upon this account largely increased.

In carrying out my process I find it comparatively easy to maintain a uniform temperature, and consequently to make a gas having uniformity of composition. That is to say, while the gas is a mixture it is a comparatively constant mixture.

In my process all free carbon is eventually formed into carbon monoxid (CO) or carbon dioxid (CO_2) and by the aid of steam is made into gas admixed, of course, to some extent, with other gases. As indicated by the arrow in Fig. 3 there is a down draft on the right of the partition 9, the purpose of this being to facilitate the precipitation of the carbon at the right of the partition 9, so that the burner 39 is better enabled to do its work upon the carbon thus precipitated.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. The method herein described, of making a combustible gas, which consists in precipitating carbonaceous material into a receptacle, heating said carbonaceous material with a restricted supply of air, inducting into said receptacle a supply of powdered carbon by aid of a partial vacuum, and supplying to said first-mentioned carbon and said powdered carbon within said receptacle a supply of steam.

2. The method herein described, of making a combustible gas, which consists in reducing carbonaceous fuel to gaseous form, providing a supply of powdered carbon, drawing the same by aid of a partial vacuum into contact with said carbonaceous fuel in said gaseous form, and supplying steam to the mixture of said powdered carbon and said carbonaceous material in gaseous form.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOSHUA JOHN NIX.

Witnesses:

OLIVE M. TEAGARDEN,

GEO. W. JONES.