(No Model.)

E. N. DICKERSON.

PROCESS OF AND APPARATUS FOR PRODUCING GAS.

No. 541,429. Patented June 18, 1895.

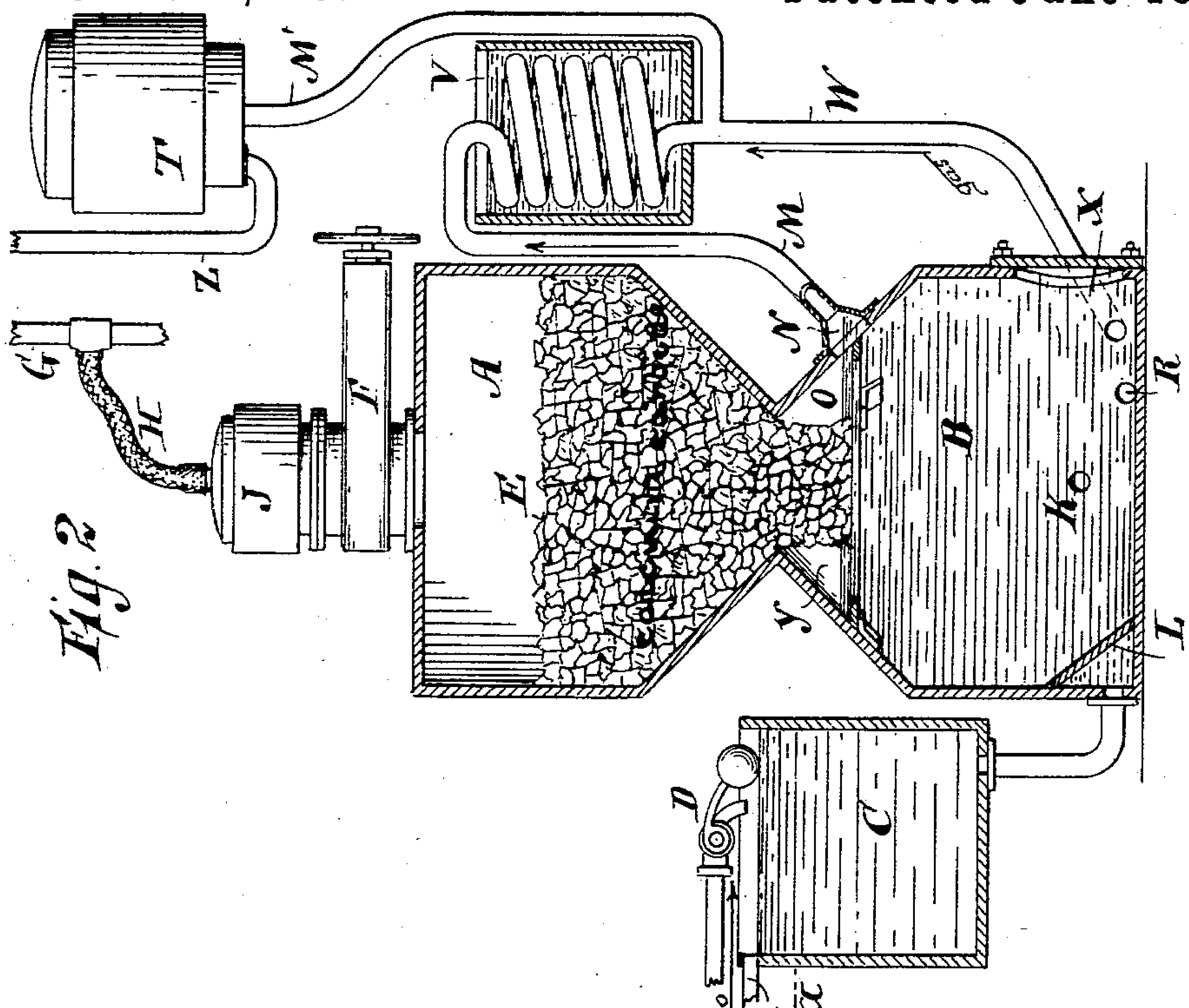

Fig. 2

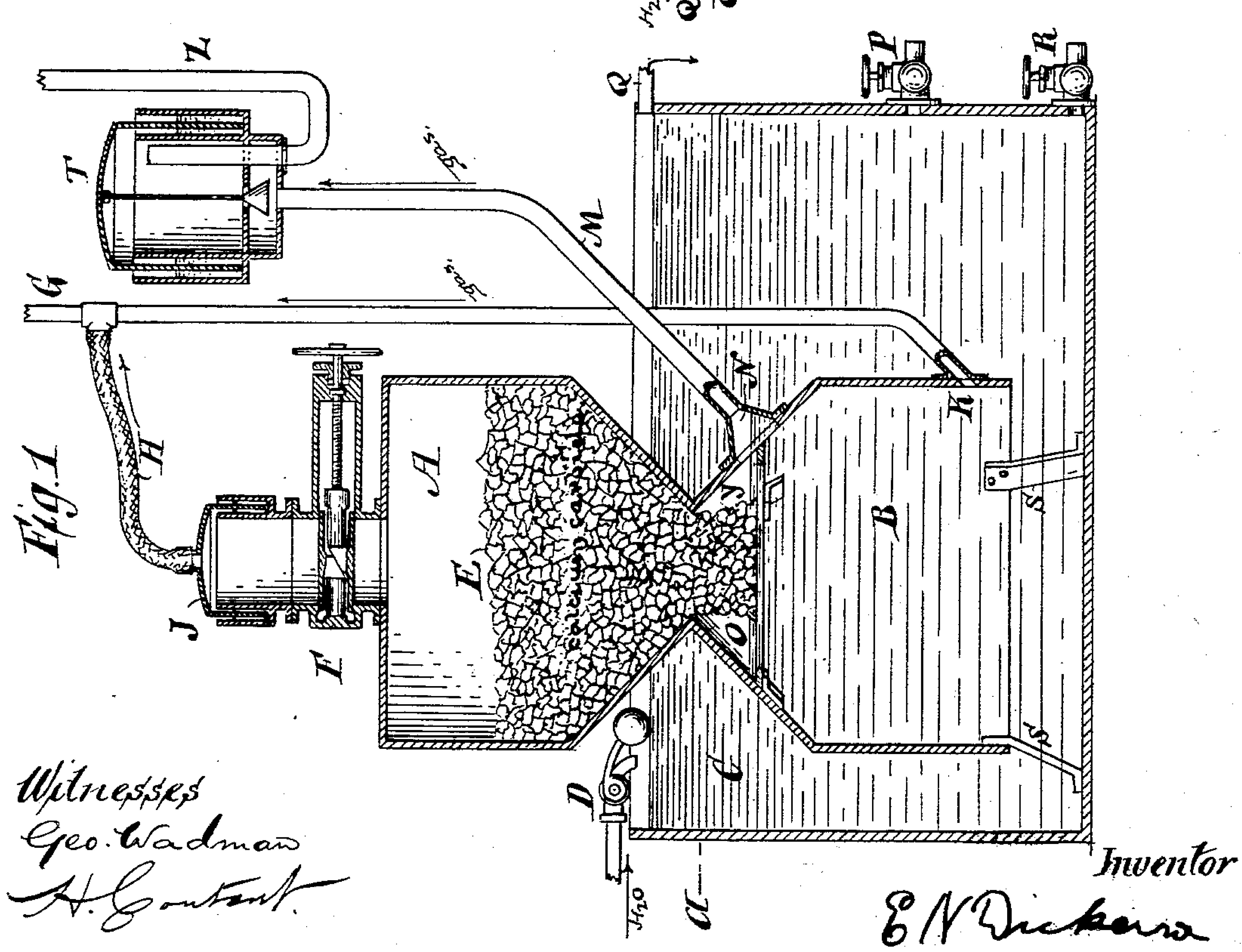

Fig. 1

Witnesses
Geo. Wadman
H. Contant.

Inventor
E N Dickerson

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

EDWARD N. DICKERSON, OF NEW YORK, N. Y.

PROCESS OF AND APPARATUS FOR PRODUCING GAS.

SPECIFICATION forming part of Letters Patent No. 541,429, dated June 18, 1895.

Application filed January 18, 1895. Serial No. 535,342. (No model.)

To all whom it may concern:

Be it known that I, EDWARD N. DICKERSON, of the city, county, and State of New York, have invented a new and useful Improvement in Processes of and Apparatus for Producing Gas, of which the following is a full, true, and exact description, reference being had to the accompanying drawings.

This invention relates to an improved process, by means of which gas can be produced by the union of a solid and a liquid, and the supply of gas be automatically regulated and determined, so that only so much gas is produced as is consumed.

My invention is especially designed as applicable to a method of producing acetylene by the union of calcium, or other metallic carbide, and water.

My invention is designed to supply a house, or other point of consumption, with the desired quantity of gas at the desired pressure.

My apparatus also enables the ready disposal of the refuse solid material, and, in one form shown, the refuse material can be removed without opening the interior of the apparatus to the atmosphere.

My apparatus also automatically supplies both the solid material and the water which are to be united to form the gas.

I have discovered that the union of calcium carbide and water causes an increase in volume in the resulting lime, which becomes a calcium hydrate, and that, in consequence, the lime which is so converted has a tendency to clog in conical vessels with the apex downward or in cylindrical vessels in which the conversion may occur. My apparatus, therefore, in this respect, introduces a new function, namely: the function of producing the gas from the material automatically fed into a chamber which is not filled by the material.

My apparatus will be readily understood from the accompanying drawings, and its mode of operation will be hereinafter more fully referred to.

Figure 1 represents a vertical elevation, mostly in cross-section, of my apparatus in its preferred form; and Fig. 2, the same view of a modification.

In my drawings similar letters refer to similar parts; and I will first describe the apparatus shown in Fig. 1, which description will generally apply to Fig. 2, and I will hereinafter point out more specifically the modification as shown in Fig. 2.

A, represents a closed chamber containing the calcium carbide E to be converted. It is closed by a suitable gas-tight gate valve F. As these valves are seldom absolutely tight (though practically so), I prefer to arrange above the gate valve F a gas seal J, which is a cup dipping into an annular chamber containing the sealing liquid. This cup is connected by a flexible pipe H with the escape G, by means of which any escaping gas can be led away to a place where its odor or presence will not be disagreeable or dangerous. The chamber A is readily filled when desired, by opening the valve F, thereby allowing any gas therein above the pressure of the atmosphere to escape, and then removing the cup and filling the material in through a funnel. Of course, at this time the water in the apparatus is removed below the grating O, hereinafter to be described.

The lower part of the chamber A is an inverted cone, as shown, and the opening through which the carbide is to fall should be preferably at least ten inches in diameter assuming the carbide to be in lumps approximately one and a half or two inches in transverse section. Below the inverted cone of the chamber A this chamber again expands, as shown, into an upright cone, in which, and at a suitable distance, say eight inches below, a grating O is placed. In a suitably proportioned apparatus this may be about twenty-two inches in diameter. This grating may be of any suitable form, though I find round bars like an ordinary fire grate about three-quarters of an inch from each other operate well. The gas outlet is shown at M, and should be large enough to extend above the grating and below it to a small extent. This is shown by the conical outlet N connecting with the pipe M. Of course, this special arrangement is non-essential. The pipe M, however, should preferably be large enough not to hold any water which may be forced up into it from the lower chamber B. The pipe M is provided with a gas regulator T, which allows gas to escape to the delivery pipe Z only at the desired pressure. Many such forms of gas regulators are known, but the one shown in the drawings is convenient and efficacious. It should preferably be made of considerable size, having a diameter of the bell of at least twenty inches. It will be observed that the conical upper portion of the chamber B has such relation to the grating O and the contracted aperture of the upper cone, as that the material falling will not occupy the entire space above the grating O, but will leave an annular space Y greater or less in area around the central supporting column. The action of the water in the chamber B rising above the grate is such as to convert the calcium carbide into calcium hydrate, which is a fine powder, and which falls through the grate. At the same time an expansion, of the material, due to the conversion, is allowed, by reason of the existence of the chamber Y surrounding the column of material. The generation of gas produces a great number of heat units, which tend to evaporate in the apparatus a considerable amount of moisture. If the gas produced is allowed to escape through the material E and thence through the upper part of the apparatus, these vapors are drawn upward and affect the entire body of material, tending to pulverize and compact the same. I therefore withdraw the gas, preferably at or about its point of production, without allowing it to pass to any appreciable extent through the unconverted material.

In order to reduce the heat, the whole apparatus is preferably set in a tank of water C, being supported therein by suitable supports S, so that the lower edge of the chamber B is distant, say a foot, from the bottom of the tank. The normal water level may be as shown in the drawings, being maintained by an automatic water supply D, which supplies additional water in case the water level drops below the level *a* in the operation of the device. The maintenance of this water level—that is, a constant supply of water from a source exterior to the apparatus itself—is very important, otherwise a rapid consumption of water in this class of apparatus would constantly reduce the level, and therefore diminish the pressure within the apparatus. It is most important that when, from any cause, the generation on the grate slackens, there should be a sufficient height of water to cause the interior level to rise well within the chamber A so as to clear the same.

The chamber B is provided with an escape outlet K, which may connect with the escape pipe G. This is useful as a safety valve, as will be hereinafter described.

The tank C is preferably provided with a drain-pipe P, sufficiently above the level of the opening K to retain the gas at normal pressures, say the pressure of the system in the chamber B, when the water has been drained to the level of P. The tank is also provided with a drain cock R for emptying the same when desired. It will be seen that the tank C extends beyond the opening of B. This enables the refuse lime falling upon the floor or into a removable tray beneath B to be removed by withdrawing the tray or shoveling out the lime into the extending part of tank C, which, in practice, is made large enough for a man to stand in. Of course, in large works, any well-known form of chain and bucket remover can be operated beneath the chamber B to remove the falling lime.

The apparatus shown in Fig. 2, is substantially the same, excepting that the chamber B is a closed chamber. It is supplied with water from the water tank C which delivers back of the screen L, which has openings at the sides and is merely used to keep some of the lime from passing into the connecting pipe between the tank C and the chamber B. The opening K may connect with the escape pipe G, as in Fig. 1. In Fig. 1, the pipe M passes through a body of water, which therefore serves as a condenser of any vapors which may escape with the gas, and which vapors condensing, flow back through the pipe M into the water. Instead of this arrangement, a separate condenser can be used, as shown in Fig. 2, in which B represents a water chamber containing the coil which bifurcates, one part M′ leading to the regulator, and one part W leading back to the lower part of the chamber B. Any moisture condensing in the coil in V or in the pipe M′ will flow back again through the pipe W. The chamber B is provided with a tight fitting man-hole X for removing, at intervals, the deposited lime.

It will be understood that in both the apparatuses, where the chambers A are of considerable size, strengthening brace-rods may be employed.

The operation of my apparatus will now be readily understood. The apparatus being empty of water, the chamber A is filled with calcium carbide. Then water is allowed to enter through the pipe D. This water rises until it comes in contact with the body of carbide E in the chamber B. Gas is then generated, which passes by the pipe M to the regulator T and the delivery Z. As soon as the pressure in M is in excess of the desired pressure in Z, the regulator T closes and the excess of pressure in the chamber A forces the water in B downward, when it escapes into the tank C. The pulverized lime falls through the chamber B to the bottom. As soon as the pressure is decreased, the water again comes in contact with the calcium carbide, and, as a matter of fact, a very accurate automatic regulation occurs, as a rule, in practice, by sufficient water coming in contact with the calcium carbide to supply the necessary amount of gas without any violent fluctuations. If, however, no gas should pass by the pipe M for a considerable period of time, the vapors of water would gradually attack the calcium carbide, even though the water itself was not in contact with it. In this case, the excess of gas so formed gradually fills the chamber B, the water in B falling, and, in order not to produce excessive pressure in the apparatus, the overflow pipe Q prevents the raising of the level of the water in the tank C. The chamber B should be large enough to take charge of any such excess of gas which might be formed from the vapors of water; but to prevent escape in the place where the apparatus is located when the water level has fallen below the opening K, any excess of gas will then escape through the pipe G, which, of course, should be made large enough to allow the water to run out of it when the gas level reaches the outlet K. Any water of condensation from the escaping gas in pipe M returns as before described. When it is desired to remove the lime from the apparatus shown in Fig. 1, the water is shut off from the pipe D and the valve P is opened. The lime beneath the chamber B can then be readily removed without opening the apparatus, and, if desired, calcium carbide can then readily be added by first opening the valve F and then removing the cover J.

In the apparatus shown in Fig. 2, the lime is removed by emptying the apparatus of water through the pipe R, and then opening the man-hole X, having previously opened the valve F.

In case of any clogging of the carbide in the chamber Y, the water will rise sufficiently high to envelop and attack the carbide there. If by any chance the chamber Y should be packed with material so as to become gas tight, which gas might then extend below the level of the grating O and thereby prevent the contact of the water with the carbide, in case the pipe M connected only above the grating O, in such case the pipe M, having an opening beneath the grate, will allow the excess of gas to escape and the water to again come in contact with the carbide. It is obvious, likewise, that instead of the water tank C, shown in Fig. 1, a water jacket can be used in connection with Fig. 2, extending from about the level of the grating upward as far as may be necessary to abstract the excessive heat units generated by the conversion. It will be observed that in this apparatus the governor T controls the water supply D, since the water itself is consumed in effecting the combination and the demand for the gas, and therefore the consumption of the material being governed by the governor T, such governor likewise determines the action of the valve D.

It is obvious that the mechanical arrangement and shape of the parts can be varied without affecting the principle of my invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The process of manufacturing gas, which consists in automatically bringing into contact a solid and liquid material which by their union form a gas, and in automatically supplying an excess of water from a source external to the apparatus, thereby maintaining a constant minimum level in the apparatus and governing the same by the consumption of the gas, substantially as described.

2. The process of manufacturing gas, which consists in automatically bringing into contact a solid and liquid material which by their union form a gas, and in automatically supplying an excess of water and governing the same by the consumption of the gas, the pressure of which gas in the supply is determined automatically, thereby maintaining a constant pressure at the burner and a variable pressure in the apparatus substantially as described.

3. The process of generating gas and removing refuse material, which consists in bringing a liquid and solid in contact with each other by causing the liquid to rise up to and through the material, thereby allowing the refuse of the solid material to fall through the liquid, and of removing said refuse from the apparatus by withdrawing said refuse horizontally from beneath the gas generator, and then vertically through a surrounding body of water, without opening the gas generator to the atmosphere, substantially as described.

4. The combination in a gas generating apparatus of a chamber for containing the gas-producing solid material, of another chamber for containing water connecting with said first chamber by a constricted orifice, and of a perforated support for the solid material below said orifice in a chamber, greater in diameter than the orifice, substantially as described.

5. The combination in a gas generating apparatus of a chamber for containing the gas-producing solid material, of another chamber for containing water connecting with said first chamber by a constricted orifice having an independent overflow chamber, and a perforated support for the solid material below said orifice located in a chamber greater in diameter than the orifice, substantially as described.

6. The combination of a chamber for containing a solid gas-producing body, an independent chamber beneath containing a liquid which combines with said solid material to form a gas, a fixed grating or equivalent support for supporting the solid material, and a gas-escape pipe permanently fixed at the level of the grating for removing the gas, substantially as described.

7. The combination of a chamber for containing a solid gas-producing body, an independent chamber beneath containing a liquid which combines with said solid material to form a gas, a grating or equivalent support for supporting the solid material, a gas-escape pipe at the level of the grating for removing the gas, and a constricted opening between said upper and lower chambers and above the gas-escape pipe, substantially as described.

8. In a gas producing apparatus, the combination of the chamber A, having a constricted

lower opening, the chamber B, greater in diameter than the constricted lower opening A, the grating O located in the chamber B at a point greater in diameter than the constricted opening, and the surrounding water-jacket C, surrounding said constricted chamber and serving as an overflow chamber, substantially as described.

9. In a gas producing apparatus, the combination of the chamber A, having a constricted lower opening, the chamber B, greater in diameter than the constricted lower opening A, the grating O located in the chamber B at a point greater in diameter than the constricted opening, the surrounding water-jacket C, surrounding said constricted chamber and serving as an overflow chamber, and the gas escape pipe M connected with the chamber B below the level of the constricted opening of chamber, and itself passing through the surrounding water-jacket, substantially as described.

10. The combination of the chamber A having lower converging sides with the chamber B having upper converging sides uniting with the chamber A to form a constricted orifice, and the perforated support O for the solid material beneath the constricted orifice, and a chamber below the perforated support O, substantially as described.

11. The combination of the chamber A provided with gate valve F, the water-seal J connecting with flexible pipe H, thereby allowing the chamber A to be emptied of gas, and likewise carrying off any escape past the valve F, substantially as described.

12. The combination of the generating chamber A, the water chamber B, the grating O, and overflow water chamber C, and the gas delivery pipe M provided with gas regulator T controlling the height of the water in the chamber B and the overflow chamber C, substantially as described.

13. The combination of the gas generator A, the water chamber B, the grating O, the surrounding water chamber C provided with automatic water supply arranged to deliver water obtained from a source exterior to the mechanism above the level of the grating O, and the overflow Q above the level of the water supply, substantially as described.

14. The combination of the chamber A, the water chamber B, the grating O, and the escape pipe G connecting with the lower portion of the chamber B, normally beneath the water level in said chamber thereby serving as an automatic escape, substantially as described.

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

E. N. DICKERSON.

Witnesses:
H. COUTANT,
ANTHONY GREF.