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PROCESS OF GENERATING GAS.

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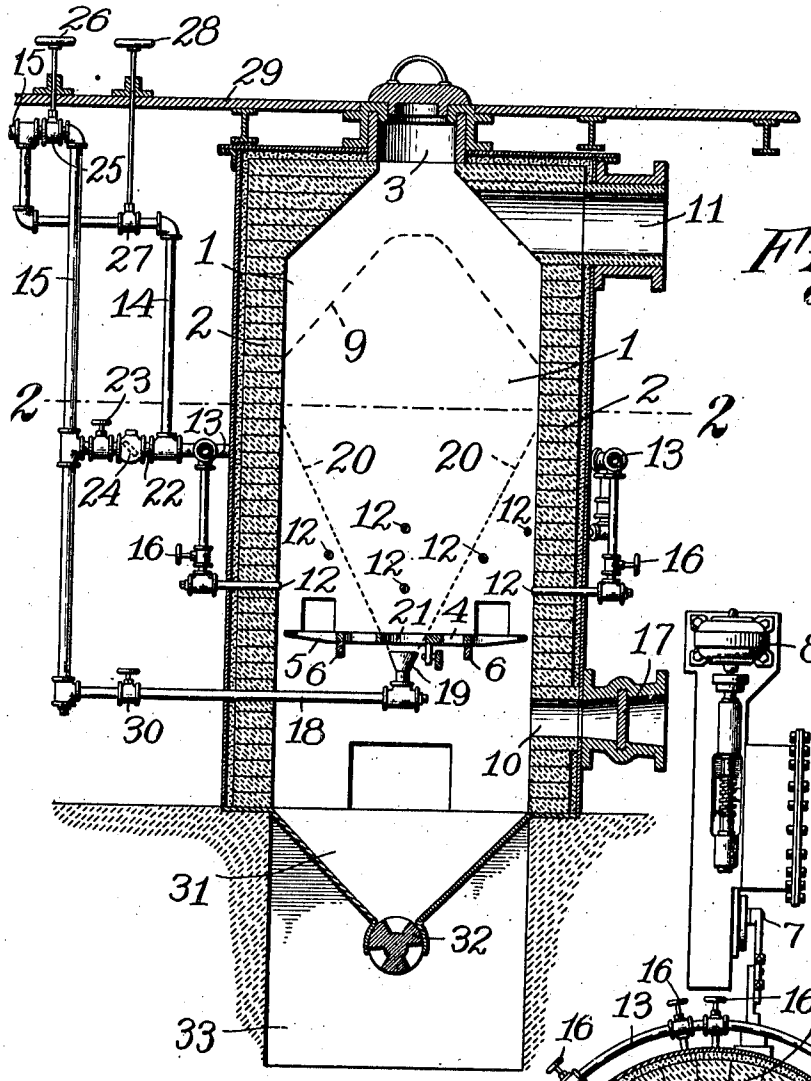

Fig. 1.

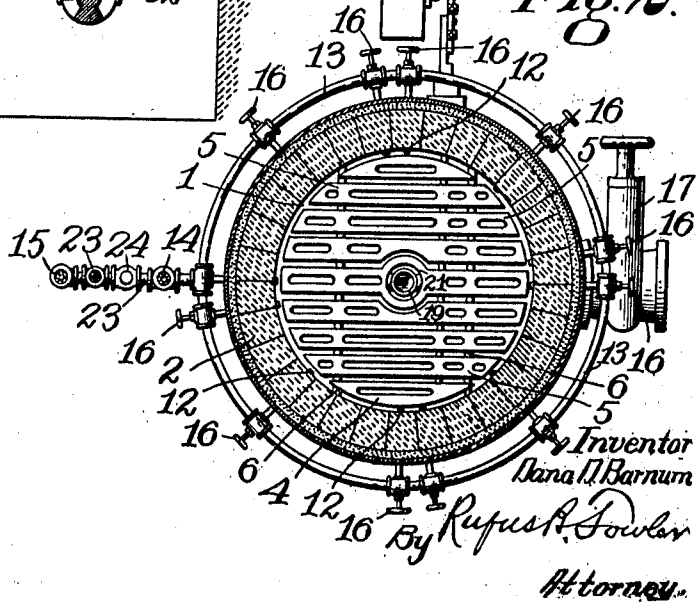

Fig. 2.

Witnesses

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PROCESS OF GENERATING GAS.

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To all whom it may concern:

Be it known that I, DANA D. BARNUM, a citizen of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented a new and useful Improvement in Processes of Generating Gas, of which the following is a specification.

My present invention relates to an improved process for generating gas from carbonaceous fuel contained in an inclosed fuel chamber and adapted to form the basis of a carbureted illuminating gas known as water gas.

My invention has for its objects to render the gas more uniform, to reduce its cost and improve its quality, and I accomplish these objects, among others, by means of an improved method of treating the fuel as herein described, the novel features being set forth in the annexed claims.

The apparatus employed in carrying my invention into effect is illustrated in the accompanying drawings, in which—

Figure 1 represents a gas generator, of the class described, in central vertical sectional view. Fig. 2 is a plan view, shown in section, on the plane of the broken line 2—2, Fig. 1.

Similar reference characters refer to similar parts in both figures.

In carrying my improved process into effect, I employ a fuel chamber 1 inclosed by a wall 2, circular in cross section, and provided with a concentric opening 3 at its top for the admission of fuel. Near the bottom of the chamber inclosed by the circular wall 2 is a grate 4, consisting of a series of rocking grate bars 5 supported upon transverse girders 6. The movable grate bars 5 are continuously rocked upon the girders 6 during the operation of the generator by their connection with a rotating crank 7 of a motor 8, in order to automatically remove the ashes as they accumulate upon the grate 4 and provide for the constant and uniform admission of air and steam through the grate to the fuel chamber. This grate, the action of which may be adjustably regulated as described, makes it possible to maintain a more uniform temperature in a vertical direction, the regulation of the flow of steam through the different supply nozzles acting at the same time to make the temperature more uniform throughout each horizontal plane. Any accumulation of ashes on the grate will cause the base of the incandescent fuel to rise above its proper level with relation to the radial nozzles supplying steam through the wall of the fuel chamber. By properly adjusting the action of the grate, it is kept at all times free and clear of ashes and the base of the incandescent portion of the fuel is kept in proper position vertically with relation to the radial nozzles. This allows the steam supplied from these radial nozzles to act much more effectively toward maintaining a uniform temperature in the fuel than would be possible with a common form of grate which would allow the ashes to accumulate thereon.

In the operation of the generator according to my improved method, I first place suitable kindlings upon the grate 4 and then supply carbonaceous fuel, such as coke or coal, through the opening 3 until the fuel chamber is filled to the broken line 9. The kindlings are ignited and a current of air under pressure is supplied through an opening 10 at the bottom of the generator, the products of combustion escaping through a flue 11 at the top of the generator. Combustion is maintained until the entire mass of fuel has been brought to a state of incandescence. During this heating of the fuel and simultaneously with the admission of air to the bottom of the fuel chamber, I introduce a series of steam jets into an annular section of the fuel lying adjacent to the wall 2 of the fuel chamber, in order to maintain a uniform temperature in said annular section corresponding with the temperature existing at the center of the fuel chamber. These steam jets are admitted to the annular section of the fuel through a series of radially disposed steam nozzles 12 entering the fuel chamber above the grate 4, but preferably in different horizontal planes and in staggered relation to each other. The nozzles 12 are supplied with steam from an annular steam pipe 13 surrounding the generator and connected through a pipe 14 with a supply pipe 15 leading from a boiler or other source of steam supply under pressure. Each of the nozzles 12 is controlled by a hand valve 16, enabling the operator to regulate the flow of steam into different sections of the fuel chamber as the existing temperature may demand, which is ascertained by the color of the fuel at the top of the fuel chamber. If the tempera-

ture were not controlled by the introduction of a temperature reducing medium, such as steam, into the annular section adjacent to the outer wall of the generator, a supply of air sufficient to bring the central mass of fuel to an incandescent state would produce an intense heat at the outer portion of the fuel, resulting in a waste of fuel and in the formation of clinkers. For the economical operation of the generator, it is desirable that the temperature be nearly uniform in different sections of the fuel chamber. I am able to secure this by the application of steam distributed through the outer annular portion of the fuel next the wall of the generator simultaneously with the admission of an air current at the bottom of the fuel chamber, thereby preventing an undue increase in temperature adjacent to the outer wall of the generator, which would otherwise be caused due to the fact that the interstices in the outer annular section of the fuel are greater than at the center of the fuel chamber, thereby allowing greater freedom for the movement of air therethrough.

As fuel is fed to the chamber 1 through the concentric opening 3, a conical heap of fuel is formed at the center of the chamber, as indicated by the broken line 9, Fig. 1, causing the smaller pieces and dust to cling to the conical heap, making a comparatively solid mass in the center of the chamber, while the larger pieces of fuel roll down the sides of the cone and fill the outer annular space next the wall 2, allowing greater freedom here than at the center for the movement of air. The formation of clinkers in the outer annular section of the fuel not only causes a waste of fuel as they are impermeable to steam during the gas producing period, but they also cling to the outer wall of the generator necessitating frequent removal.

By my improved process, comprising the introduction into a portion of the mass of fuel of a temperature reducing medium during the period of bringing the fuel to a state of incandescence, I secure greater economy in the use of fuel and avoid the loss incident to the frequent cleaning of the fuel chamber and the suspension of its operation for the removal of clinkers. I am also able to bring the entire mass of fuel to a uniform state of incandescence and render the final gaseous products uniform in quality, and to increase the quantity from a given weight of fuel.

When the fuel has been brought to a uniform state of incandescence at a uniform temperature throughout the same horizontal planes, the supply of air is cut off by closing a gate valve 17 and a jet of steam under pressure is conducted through a pipe 18 in an upwardly directed current through the center of the grate into the bottom of the fuel chamber. The pipe 18 is provided with a vertical nozzle 19 preferably flaring, causing the jet of steam to be forcibly driven through the mass of fuel in the center of the fuel chamber in the form of an inverted cone, as indicated by the lines 20, 20. The grate 4 is provided with a central opening 21 directly over the nozzle 19, in order that the full force of the jet of steam may be applied to the fuel at the center of the fuel chamber. The annular mass of fuel resting upon the grate 4, triangular in cross section and inclosed between the lines 20, 20 and the outer wall of the generator, is furnished with an additional supply of steam through the nozzles 12. This additional supply of steam is taken from the supply pipe 15 through a pipe 22 by opening a hand valve 23. The pipe 22 is also provided with a check valve 24, which will prevent the passage of steam from the pipe 14 through the pipe 22 into the pipe 15 in case the hand valve 23 should be left open during the preliminary heating of the fuel. As the annular mass of fuel, triangular in cross section, which is supplied with steam through the nozzles 12 is gradually reduced in thickness from the grate 4 upward, the proper regulation of steam in different horizontal planes in order to secure uniform results in the generation of gas may be accomplished by means of the hand valves 16. Inasmuch as the steam may pass more easily through the cellular mass of coal near the wall of the fuel chamber than through the compact central core of the fuel, it is obvious that the outside cellular fuel would receive more than its share of steam in case the steam were admitted uniformly throughout the space under the grate. This would result in serious unevenness in action in the central core and in the outside cellular portion of the fuel, the action in this cellular portion being most rapid and being completed first. I overcome this difficulty, as has been described, by directing steam upwardly through the center of the grate with sufficient force to drive it into and through the compact central core of the fuel. I then supply a proper quantity of steam to the outer cellular portion of the fuel by means of the radial nozzles extending inwardly through the wall of the fuel chamber. It is obvious that as the character of the coal used varies, the relation between the compactness of the central core and the porosity of the cellular portion of the fuel will vary. This makes necessary a different adjustment of the relative forces with which the steam is blown into the central core and into the cellular portion of the fuel. Therefore, as has been described, I provide independent adjustment to regulate the flow of steam into these two portions of the fuel

with the important result that I am enabled to maintain the fuel at a substantially uniform temperature throughout each horizontal plane.

The steam supply pipe 15 is provided with a valve 25 having an extended valve stem terminating in a hand wheel 26, and the pipe 14 is provided with a valve 27 having an extended valve stem terminating in a hand wheel 28 above a floor 29 extending over the top of the generator. The pipe 18 is also provided with a hand valve 30. The hand wheels 26 and 28 enable the supply of steam to be controlled by an attendant above the floor 29, allowing the valves 23 and 30 to be permanently open and used only for the purpose of throttling the flow of steam through the pipe 18 and the nozzles 12. Regulation by means of the valves 23 and 30 will become necessary when different varieties of fuel are used forming clinkers at different temperatures. When the valves 23 and 30 have been adjusted for the variety of fuel being used, the valves 23, 30 and 27 may be left without further attention and the entire control of steam through the supply pipe 15 be effected by means of the valve 25.

During the operation of producing gas a moderate shaking movement is imparted to the grate 4 by the motor 8 to prevent the accumulation of ashes on the grate and permit the free access of steam through the pipe 18 to the central mass of fuel. The ashes removed from the grate fall by gravity into a hopper shaped receptacle 31 from which they are periodically removed by the rotation of a rotary valve 32 which allows the ashes to fall into a lower chamber 33.

I claim—

1. The within described process of producing gas from carbonaceous fuel inclosed in a fuel chamber, comprising igniting the fuel, supplying an air current to the bottom of the chamber to bring the fuel to a state of incandescence, simultaneously supplying a temperature reducing medium to the outer mass of fuel adjacent to the wall of the fuel chamber, substituting an upwardly directed steam jet under the central portion of the fuel for the air current at the bottom of the fuel chamber, and simultaneously introducing a series of steam jets to the mass of fuel adjacent to the wall of the fuel chamber.

2. The within described process of producing gas from carbonaceous fuel inclosed in a fuel chamber, consisting in igniting the fuel, bringing the fuel to a state of incandescence by the introduction of an air current at the bottom of the fuel chamber, simultaneously introducing a temperature reducing medium to the outer mass of fuel adjacent to the wall of the fuel chamber, substituting an upwardly directed steam jet for the air current at the bottom of the fuel chamber, simultaneously introducing with said steam jet a series of radially disposed steam jets through the wall of the fuel chamber, and automatically removing the accumulation of ash.

3. The within described process of producing gas from carbonaceous fuel contained in an inclosed fuel chamber, comprising bringing the fuel to a state of incandescence by supplying a current of air to the fuel chamber, blowing steam upwardly into the central portion of the mass of fuel, supplying steam to the fuel near the wall of the fuel chamber, and regulating independently the flow of steam to the central portion of the mass of fuel and the flow of steam to the fuel near the wall of the fuel chamber to maintain a substantially uniform temperature throughout each thin horizontal layer of the fuel.

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Witnesses:
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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."