No. 846,358. PATENTED MAR. 5, 1907.

H. F. SMITH.

PROCESS OF HANDLING ASH IN GAS PRODUCERS.

APPLICATION FILED NOV. 7, 1906.

2 SHEETS—SHEET 1.

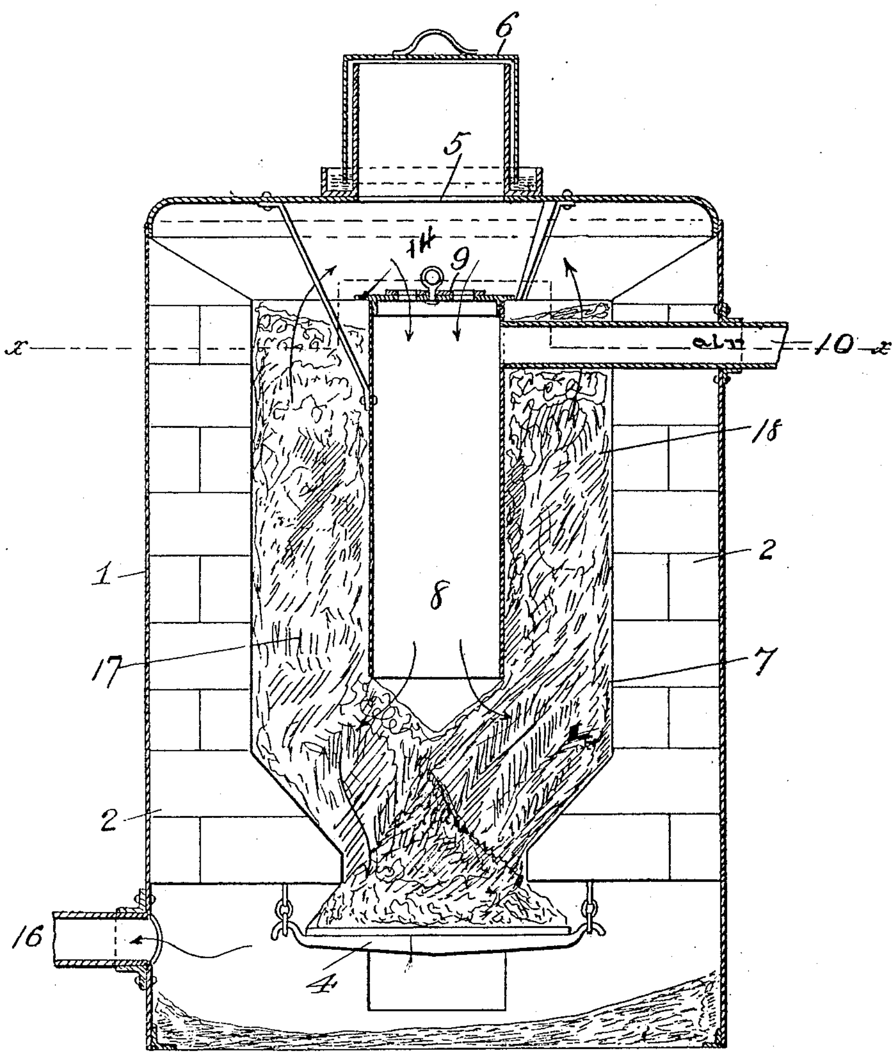

Fig. 1

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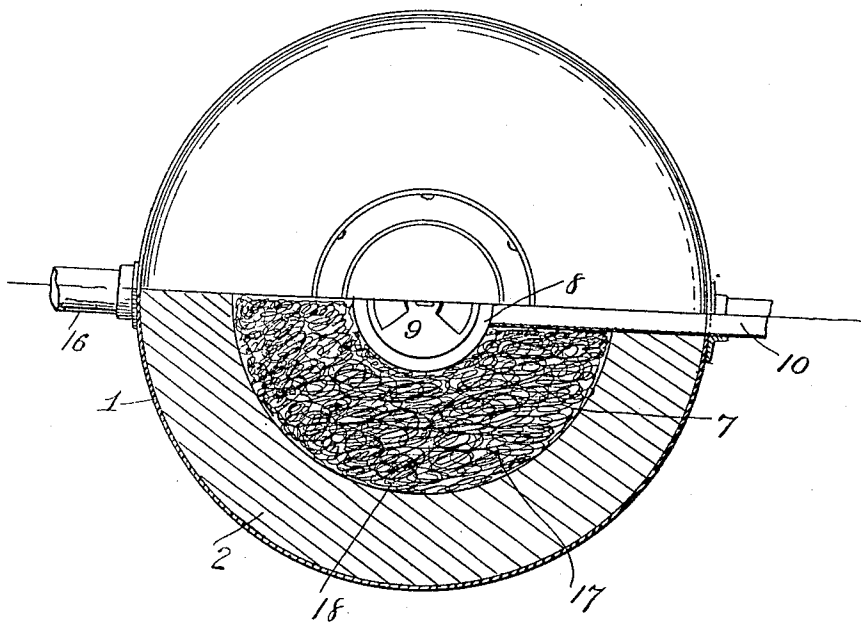

Fig. 2.

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UNITED STATES PATENT OFFICE.

HARRY F. SMITH, OF LEXINGTON, OHIO.

PROCESS OF HANDLING ASH IN GAS-PRODUCERS.

No. 846,358. Specification of Letters Patent. Patented March 5, 1907.

Application filed November 7, 1906. Serial No. 342,372.

To all whom it may concern:

Be it known that I, HARRY F. SMITH, a citizen of the United States, residing at Lexington, in the county of Richland and State of Ohio, have invented certain new and useful Improvements in Processes of Handling Ash in Gas-Producers, of which the following is a specification.

My invention relates to improvements in processes for handling what is termed in this art as "ash," particularly in connection with downdraft gas-producers.

The principal objects of my invention are to provide for converting the ash or residue of the gas-forming fuel into a clinker or agglomerated mass in lieu of reducing the same to a powder or small pieces, as heretofore practiced, and to effect the advantageous removal of said clinker and whereby waste of carbon is obviated attending the general method now adopted in accomplishing that end, besides avoiding certain inconveniences and objections or disadvantages accompanying said method.

One of the principal difficulties in handling downdraft-producers is to provide for the proper disposition of the ash. In producers of this type the fuel and the air supporting combustion are both fed into the producer from the same direction, while the gas discharged from the apparatus and the ash resulting from the action of combustion are withdrawn at a point remote from the introduction of the air and fuel. If an effort be made to remove the ash at that part of the fuel-bed from which the gas is to be discharged, two principal difficulties would be encountered: First, the ash-pit must be kept tightly closed at all times in order to avoid admixture of air with the outgoing gas or, in the case of pressure-producer, the escape of gas into the surrounding atmosphere. Under these circumstances it is a matter of considerable difficulty to remove the ash, and it is usually necessary to "shut down" the apparatus periodically for that purpose. Second, furthermore, the ash being removed from a point remote from the entrance of the air the combustion is necessarily very incomplete and a great amount of unburned carbon is taken from the apparatus.

By the practice of my process both of these difficulties are obviated, it being designed to feed the fuel always in the direction of some particular portion of the apparatus, preferably the center, in such a manner that the ash resulting from combustion will be carried along with the fuel and delivered to this point.

In the accompanying drawing illustrating an apparatus suitable for carrying out my process or invention, Figure 1 is a sectional elevation thereof, and Fig. 2 is a horizontal or transverse section produced on the line $x\,x$ of Fig. 1.

The casing or shell 1 has a suitable refractory lining 2, and suitably suspended or supported from the base of said lining by chains or otherwise is a grate 4 for the support of the fuel. Said casing has applied or fitted upon its upper end a charging-opening 5, which is closed by a cover 6.

Arranged within the casing or shell 1, about centrally of the combustion or fuel chamber 7, is a vertical metal tube or cylinder 8 of relatively large dimensions, fixed in suspended position in any suitable way, preferably as shown, with its upper end extending somewhat above the combustion-chamber and its lower end terminating directly above the grate and at a suitable distance from it, which distance is determined by the particular character of fuel used. Said tube or cylinder 8 has a removable and valve-equipped cover 9.

A pipe 10 has its inner delivery end secured to and communicating with the cylinder or tube 8 at its extreme upper end and extends therefrom out through the casing 1 for introducing air or a mixture of air and steam via said cylinder or tube into the producer or apparatus.

The operation of this apparatus may be stated briefly as follows: It having been filled with fuel, suitable "kindling" is dropped through the cylinder or tube 8, so as to lodge or rest upon the fuel just below said tube or cylinder, which kindling is then fired or ignited. The cover 9, previously removed from the upper end of the cylinder or tube 8, is replaced, and the valve thereof is closed. A blast of air is now suitably generated in a well-known way for delivery into and through the pipe 9, which air-blast also passing through the cylinder or tube 8 and through the fuel after leaving the latter continues its passage out through the grate 4, being finally delivered through the pipe 16, constituting an outlet of the casing or shell 1, at a point about in alinement with the grate. The combustion thus created rapidly generates sufficient heat in the mass of fuel 17 below the discharge end of the cylinder or tube 8 to

completely drive off or eliminate from this part of the fuel charge all the volatile hydrocarbons which it may contain. After these hydrocarbons have been thus freed from the fuel in the bottom of the producer the cover 6 is removed, and the opening thus produced in the top of the producer results in inducing the passage or delivery of a part of the aforesaid blast downward through the tube or cylinder 8 and thence upward through the fresh fuel 18. After this blast has continued for a short time the parts of the fuel 17 and 18 will have been thoroughly coked and the fuel intermediate of 17 and 18 will have become well fired or ignited, when the apparatus will be in condition to begin the operation of manufacturing the gas.

When the producer is operated by suction, the means for producing such suction (which may be either a gas-engine supplied from the producer or a gas-exhauster of suitable construction) is put in operation and air and steam supplied in suitable proportions through the pipe 10, the valve in the cover 2 being opened at this time. The air and steam entering the apparatus through the pipe 10 are impelled by the suction created at 16 to pass into and down through the cylinder or tube 8, whence a part of said commingled steam and air will be drawn directly through the incandescent fuel or mass 17 18, converting the latter into gas in accordance with the well-known laws governing such operations.

In the apparatus shown the fuel-bed is so arranged that the fuel and ash are delivered to the central part of the fuel-bed, the fuel being passed radially inward and downward toward the center. The apparatus is also so devised that that part of the fuel-bed to which the ash is delivered, which is in this case the central portion, is the thinnest, and therefore the most active part of the fire. It is not absolutely essential, however, for the carrying out of my process that said point should be the most active part of the fuel-bed, it being only necessary that the combustion at this point be sufficiently active to raise the temperature of this fuel-bed so as to cause a partial fusion of the ash and its agglomeration into comparatively large semisolid masses or clinkers. In case the nature of the fuel is such as to require an abnormally high temperature for the proper clinkering of the ash, provision may be made for sufficiently lowering this temperature of fusion by the admixture of appropriate fluxing material with the fuel before it is charged into the producer, the nature and amount of such material being determined from the character of the ash resulting from the combustion of the fuel treated. The ash resulting from combustion will be delivered toward the designated portion of the fuel-bed, which, as previously noted, is in this case the central portion, and will there become attached to and agglomerated with other similar particles, thus forming a solid or semisolid mass or clinker of continually-increasing dimensions. Since the combustion is always most rapid nearest to the air, the most rapid production of ash will occur at or near the upper surface of the fuel in the downdraft form of producer, and the resulting clinker or semisolid mass of ash will be found to lie comparatively near to this upper surface. It is very evident from the character of this process that the ash in this form—*i. e.*, clinkered—will contain a comparatively small amount of unburned carbon for two reasons: first, because the temperature and rate of combustion at the point where the clinker is formed is necessarily high and any carbon associated with the ash would be rapidly consumed; second, the carbon of the fuel being infusible there would be comparatively little tendency to associate itself with a semifused ash and would not therefore become a part of the clinker.

After the ash has accumulated in comparatively large masses in the form of clinker it may be removed from the fire very readily. This operation is most easily performed from that part of the fuel-bed to which the air for combustion is delivered, which in the case of down draft-producers would be the upper part of the fuel-bed. For facilitating the removal of this clinker it is of advantage to arrange the apparatus in such a way as to allow free access from above to that portion of the fuel-bed in which the clinker is formed, as illustrated by the particular type of apparatus herein shown, and resulting from arranging the relatively large tube 8 within the fuel-magazine and terminating this tube immediately above the central portion of the fire, as described, which, as previously noted, is that part to which the ash is delivered. This central tube not only serves the purpose of admitting air to the fuel-bed for the proper combustion of the fuel, but is of large dimensions and adapted, as above disclosed, to allow ready access to the active portion of the fire at any time therethrough from above. The ash being continually delivered to this portion of the fire during the operation of the apparatus, and there partially fused and agglomerated into comparatively large masses can be readily removed through the tube 8 by the use of a hooked poker or suitably-constructed tongs. The disengaging of the clinker from the fire involves no especial difficulty, and it is found in practice to be a comparatively simple matter to remove all the ash from the apparatus in this way. It is not essential for carrying out this process that the tube 8 be provided, since this is of convenience only when a large amount of fuel is carried in the magazine. The producer could be operated quite as well, so far

as the removal of the ash is concerned, with the tube 8 omitted, provided only the fuel be fed to the fire in comparatively small amounts, whereby the active portion of the fuel-bed would be open to inspection through the opening 5.

It is understood that I do not confine myself to the particular construction of apparatus shown, but would expect to use whatever construction would be found most desirable for carrying out this process.

I claim—

1. The described process of removing ash from downdraft gas-producers, which consists in agglomerating the ash in relatively large masses or clinkers; and in removing said clinkers from above the fuel-bed, out through the upper end of the producer.

2. The described process of removing ash from downdraft gas-producers, which consists in delivering the forming ash at a readily-accessible point in the fuel-bed; in agglomerating the ash in relatively large masses or clinkers; and in removing said clinkers from above the fuel-bed, out through the upper end of the producer.

In testimony whereof I affix my signature in presence of two witnesses.

HARRY F. SMITH.

Witnesses:

GEO. H. TROUT,

WM. H. EARHART.