

May 13, 1930.

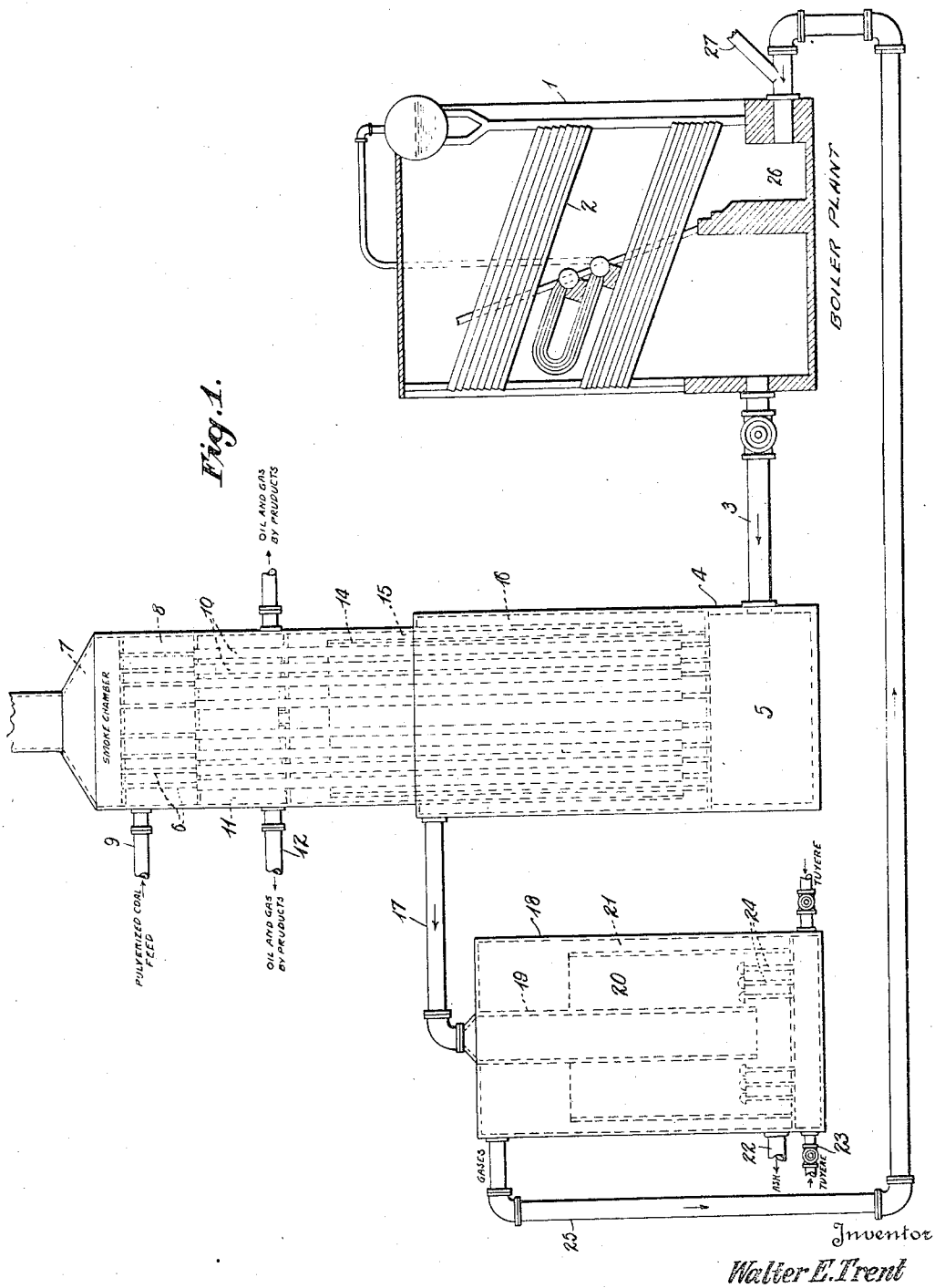
W. E. TRENT

1,758,630

PROCESS AND APPARATUS FOR GENERATING GASES FOR POWER DEVELOPMENT

Filed Oct. 25, 1926

2 Sheets-Sheet 1



By *Charles M. Shuman*

Attorney

May 13, 1930.

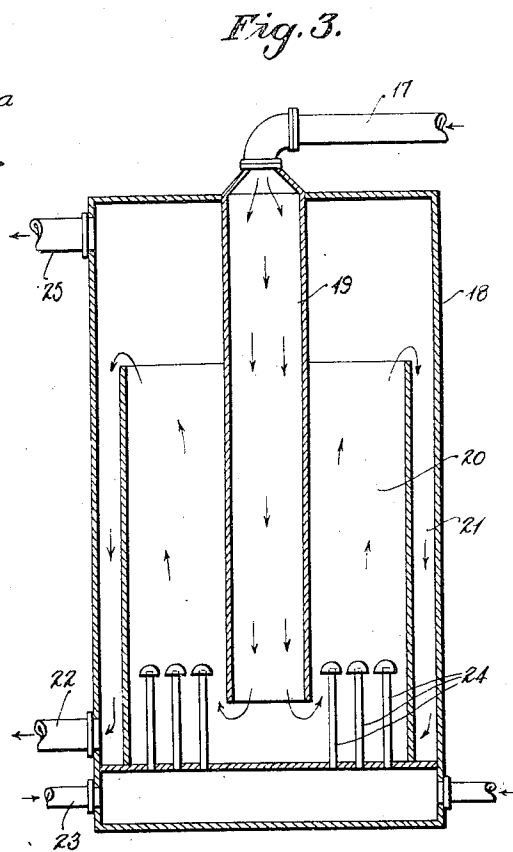
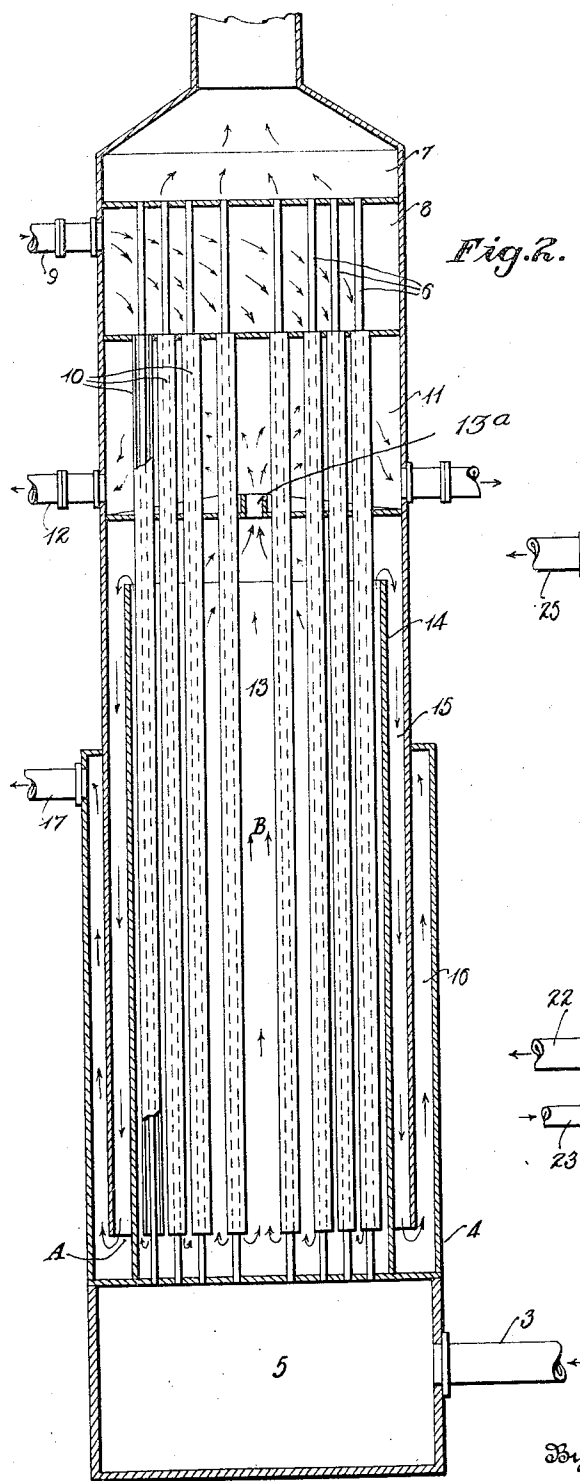
W. E. TRENT

1,758,630

PROCESS AND APPARATUS FOR GENERATING GASES FOR POWER DEVELOPMENT

Filed Oct. 25, 1926

2 Sheets-Sheet 2



Inventor

Walter E. Trent

By Charles M. Thomas

Attorney

UNITED STATES PATENT OFFICE

WALTER EDWIN TRENT, OF NEW YORK, N. Y., ASSIGNOR TO TRENT PROCESS CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

PROCESS AND APPARATUS FOR GENERATING GASES FOR POWER DEVELOPMENT

Application filed October 25, 1926. Serial No. 144,162.

The invention relates to a process for producing and feeding combustible gases to a boiler plant or other point of consumption.

Of recent years pulverized coal has been used to a large extent as a fuel in boiler plants and the like. While such material constitutes an excellent fuel, it has been found that the ash contained in the coal frequently constitutes a material part thereof and that a large part of this ash travels into the air with the products of combustion and another part has a decided tendency to adhere to and accumulate on the walls of the boiler tubes and other parts of the boiler. Both classes of ash are the source of considerable trouble and naturally are very objectionable.

It is an object of my invention to provide a process wherein the waste heat from the boiler plant assists most materially in converting a charge of pulverized coal into a combustible gas which in turn may be directly introduced to the boiler plant and there consumed without causing the adherence of deposits on the walls or tubes thereof.

In carrying out my invention, I first pass the hot waste products of combustion from a boiler plant through a coal distilling apparatus wherein finely pulverized coal is passed in heat interchanging relationship with said gases to effect the removal of the volatiles therefrom and to provide a hot carbonized residue, preferably in the form of particles, which is thereafter introduced with its contained heat to a gas generator. In this generator producer gas is manufactured from the hot carbonized particles and this producer gas continuously flows to the boiler plant leaving, of course, in the gas generator, ash and other foreign substances which would be detrimental to the operation of a boiler plant.

The coal distilling method utilized in this process is of the type described, and claimed per se in my co-pending application, Serial No. 135,471, filed Sept. 14, 1926, wherein I have pointed out the advantages of treating pulverized coal in an exceedingly fine state of sub-division of say 300 meshes or finer, as such coal is so mobile that it will actually flow in a descending and ascending stream

through the coal distilling apparatus, and there, by reason of the heat transfer relationship existing between the hot gases and the coal will be substantially removed of its volatiles without causing a substantial carbonization of the fine particles.

In the accompanying drawing,

Figure 1 designates substantially a diagrammatic view of the apparatus I utilize for carrying out my process;

Figure 2 is a sectional view of the coal distilling apparatus shown in Figure 1; and

Figure 3 is a sectional view of the gas generator shown in Figure 1.

Referring now more particularly to the drawings wherein like reference characters indicate corresponding parts, the numeral 1 designates a boiler plant. Obviously any well known plant may be used or in fact, any apparatus where fuel is needed for the generation of steam or power. As shown, this plant has a series of tubes 2 of conventional structure.

Leading from the boiler plant is a conduit 3. Through this conduit stack gases of a rather high temperature, in fact, considerably higher than the usual temperature of such gases, are conducted to the coal distilling apparatus 4. These gases are preferably of a temperature of from 500° C. to 600° C.

The coal distilling zone has a suitable pocket 5 in the base thereof, and leading from this pocket there are a plurality of hollow tubes 6 extending to the smoke and gas discharge chamber 7 at the top of the apparatus. Immediately below this chamber 7 there is a chamber 8 having an inlet 9 by means of which very finely pulverized coal of say 300 meshes per inch or finer is introduced to the chamber 8. Communicating with the chamber 8 through the bottom wall thereof is a series of vertical tubes 10 concentric with the tubes 6 and extending downwardly through the apparatus to the point A or near the bottom wall of the distilling apparatus. An intermediate gas chamber 11 is provided from which volatiles in the form of vapors and gases are withdrawn through the lines 12.

The very fine coal enters the chamber 8, flows downwardly through the tubes 10 in

a slow continuously moving stream, discharges from said tubes at the point A and then ascends as indicated by the arrows designated by the reference character B upwardly through the chamber 13 surrounding the tubes 10, around the upper end of an annular wall 14, thence down through a passage 15 and thence up through an annular passage 16 from whence the finely carbonized particles are withdrawn by a pipe 17 to the gas generator 18. In descending in the tubes 10 which surround the heating flues or tubes 6 the coal is heated by heat absorbed from the gases rising through these tubes to a distilling temperature. The temperature maintained is sufficient to drive out the volatiles which, of course, must move downwardly with the coal particles and thence upwardly with the carbonized particles as indicated by the reference character B applied to the arrows, these gases finally rising through the gas outlet 13^a into the chamber 11 from whence they are withdrawn by the pipes 12. As pointed out in my co-pending application Serial No. 135,471, the heating of the pulverized particles may be effected without causing a substantial agglomeration or fusing of these particles. This is in part due to the fineness of the material, the rate at which the heat is applied to the material and the fact that the gases are compelled to travel along with the fine particles undergoing treatment.

The gas generator 18 may be of any conventional form that will separate ash. The fine particles pass downwardly through the tube 19 and then ascend through the gas generating chamber 20 while subjected to the desired gas producing treatment, any unconsumed material such as ash, etc., flowing downwardly through the annular space 21 from whence such material is withdrawn through a line 22. To convert the finely pulverized particles into producer gas, air may be introduced through the air line 23, passing through the tuyères 24 into the bed of hot carbonaceous particles to effect incomplete combustion thereof, generating producer gas which discharges through the line 25 and is conveyed to the fire box 26 of the boiler, where such gas mixes with additional air introduced through the line 27 in sufficient quantities to form a highly combustible mixture. The temperature of the material in the generator 18 is preferably raised from 700° to 1000° C. by this incomplete combustion in order to manufacture the most desirable producer gas. If preferable, steam can also be admitted with the air through the line 23 for the production of producer gas and/or water gas, in which event, of course, the temperature of the finely carbonized particles will be lower than if air is introduced alone. It will be appreciated that as occurs in the ordinary producer gas operation sub-

stantially the entire combustible content of the very hot carbonized particles is converted into gas while the ash and other substances that cannot be gasified flow into the annular chamber 21 and are withdrawn by the line 22.

By the foregoing operation I am enabled to continuously produce gas for generation in a boiler plant by waste heat from said plant. This permits the boiler plant to be operated at a high efficiency without the danger of the formation of foreign deposits on the walls thereof. By utilizing very finely pulverized coal and by flowing this coal in the manner specified, a most effective heat transfer may be obtained which enables this coal to be devolatilized, forming hot carbonized particles which are thereafter readily converted into gas in the gas generator 18.

Having thus described the invention, what I claim is:

1. The herein described process consisting in passing waste gases from a zone of combustion in heat transferring relation with finely pulverized coal to remove the volatiles therefrom and form a carbonized residue, in introducing such residue with its contained heat to a gas generator, in producing from the carbonaceous content of the residue gas in said generator, in conveying said gas to the zone of combustion, and in removing foreign substances from the generator.

2. The herein described process consisting in passing waste gases from a zone of combustion in heat transferring relation with finely pulverized coal to remove the volatiles therefrom and form a carbonized residue, in introducing such residue with its contained heat to a gas generator, in producing from the carbonaceous content of the residue gas in said generator, in conveying said gas as produced to the zone of combustion, and in removing foreign substances from the generator.

3. The herein described process comprising continuously passing waste gases from a zone of combustion into heat transferring relationship with a continuously moving body of finely pulverized coal, in removing the volatiles from said coal and in providing a carbonized residue substantially in the form of carbonized particles, in transferring such particles with their contained heat to a gasifying zone, in there effecting a gasification of the carbonaceous particles by causing an incomplete combustion of said particles by the introduction of air, in conveying such gas continuously to the combustion zone to be consumed for the development of power, and in withdrawing from the gas generating zone ash forming incombustible substances.

4. The combination with a steam boiler plant, of a coal distilling apparatus, means for feeding pulverized coal continuously to said apparatus, means for continuously passing waste gases from said boiler plant to the

coal distilling apparatus to remove volatiles from said pulverized coal and to form a carbonized residue, a gas generator, means for discharging such residue to said gas generator, an air inlet to said generator, whereby air is admitted to effect partial combustion of carbonized particles therein, means for withdrawing ash forming substances from the generator, and means for continuously returning gases to the steam boiler plant to be consumed therein.

5. The combination with a boiler plant having a fire box, of a coal distilling compartment, means for conducting flue gases from the boiler plant to said coal distilling compartment, means for feeding finely pulverized coal to said compartment to travel in indirect heat transfer relation with said flue gases to effect the distillation of said coal and the production of a residue in the form of carbonized particles, a gasifier, means for discharging said heated particles to the gasifier, means for introducing air to the gasifier to make producer gas from the hot carbonaceous material, means for conveying said producer gas to said fire box, and means for discharging ash forming materials from said gasifier.

6. A method for generating power comprising passing waste gases from a power generating zone in heat transferring relationship with an advancing body of finely pulverized coal, removing the volatiles liberated by the heat from the coal, separately removing the carbonized residue, introducing said residue to a gas generating zone, subjecting said residue to gas generating conditions, whereby the carbonaceous portion of said residue is completely gasified, and introducing the resulting gas to said power generating zone for combustion therein.

7. A continuous process for converting carbonized material into gas and for utilizing said gas, comprising passing finely pulverized coal continuously in heat transferring relationship with an advancing stream of highly heated waste gases, controlling the temperature of said gases to effect a removal of the volatiles from said coal, and to produce a highly heated carbonized residue, continuously advancing said residue with its contained heat to a separate gasifying zone, introducing to said zone air in quantity sufficient to make producer gas, and continuously feeding said producer gas to a zone of combustion where said gas is consumed.

8. A continuous process for converting carbonized material into gas and for utilizing said gas, comprising passing finely pulverized coal continuously in heat transferring relationship with an advancing stream of highly heated waste gases, controlling the temperature of said gases to effect a removal of the volatiles from said coal, and to produce a highly heated carbonized residue, continuously advancing said residue with its con-

tained heat to a separate gasifying zone, introducing to said zone air in quantity sufficient to make producer gas, and continuously feeding said producer gas to a zone of combustion where said gas is consumed and withdrawing the ash forming substances from said gasifying zone.

In testimony whereof I affix my signature.
WALTER EDWIN TRENT.