United States Patent

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[54] **METHOD AND APPARATUS FOR PROVIDING COKE-OVEN GAS AS SUPPLEMENTARY FUEL FOR A STEAM GENERATOR ORGANIZATION**
6 Claims, 1 Drawing Fig.

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[50] **Field of Search** 122/5, 7; 110/31; 202/106

[56] **References Cited**

UNITED STATES PATENTS

1,523,414	1/1925	Gibson	122/5X
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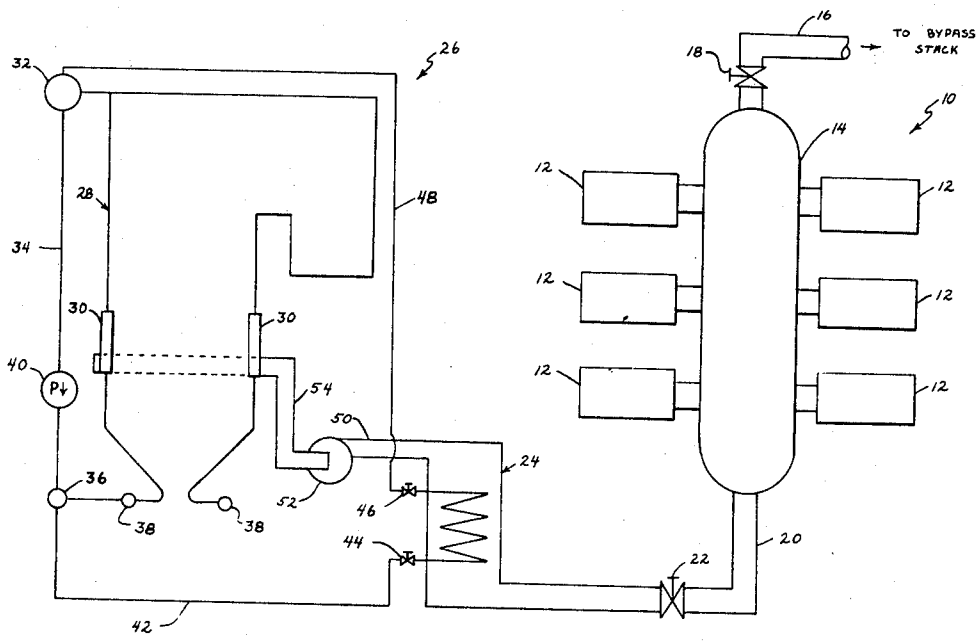
ABSTRACT: A method and apparatus for providing coke oven gas a supplementary fuel for a steam generator organization. The off-gas from an arrangement of coking stokers is collected in a manifold which is in communication with a steam generator organization of the fluid recirculating type. The gases are transported from the manifold to the steam generator, under the influence of a conventional gas-conveying induced draft fan located therebetween, to provide a supplementary fuel for the steam generator. Between the induced draft fan and the manifold is located a heat exchanger for the purpose of passing the coke oven gases in heat exchange relationship with a portion of the main boiler circulating fluid to substantially reduce the temperature of the gases to facilitate their handling by the fan and externally insulated ducting means.



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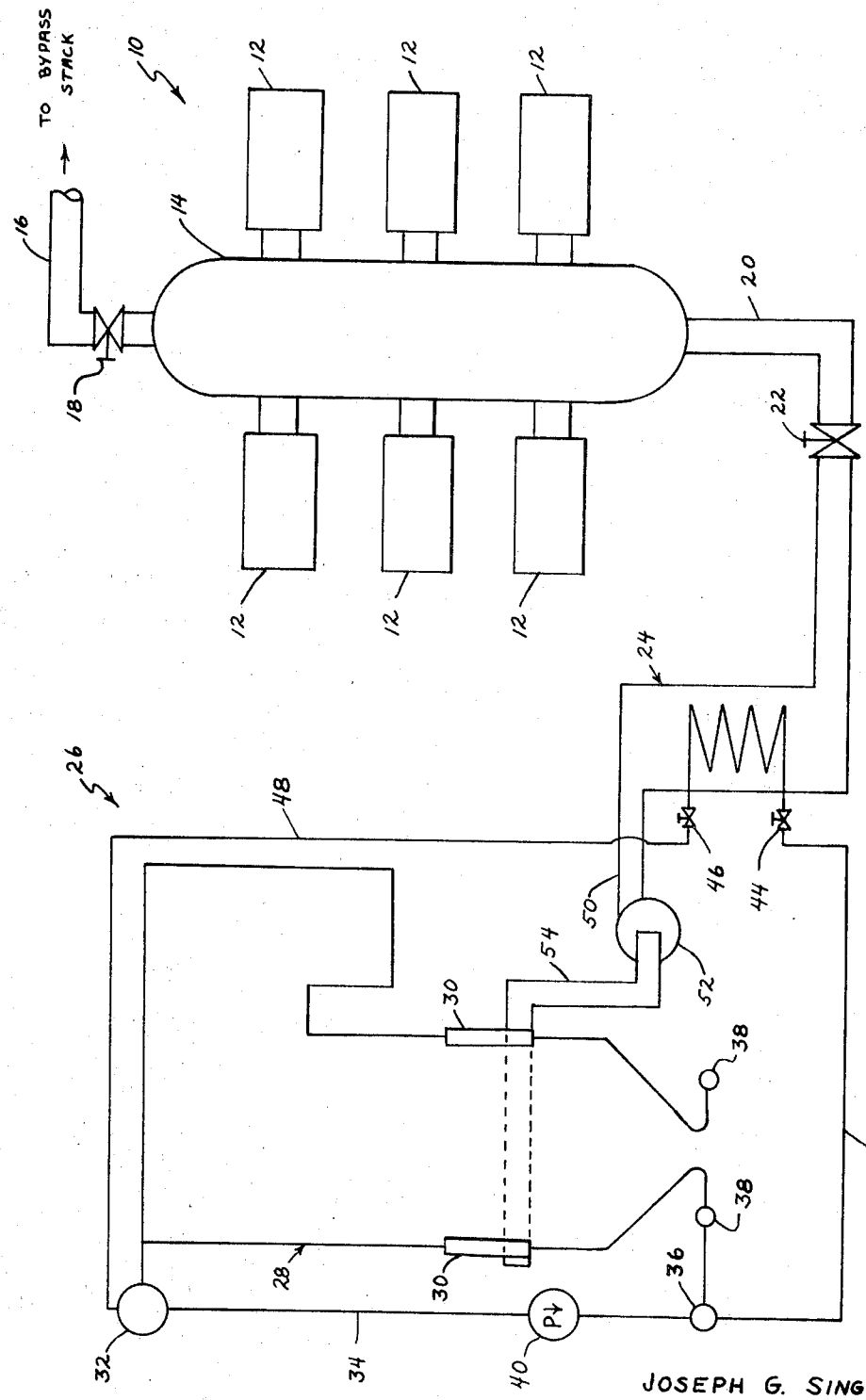

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METHOD AND APPARATUS FOR PROVIDING COKE-OVEN GAS AS SUPPLEMENTARY FUEL FOR A STEAM GENERATOR ORGANIZATION

BACKGROUND OF THE INVENTION

Calcium carbide is a basic compound found in a large number of many varying chemical compounds in common use today. The many tons of calcium carbide required daily for formation of these basic compounds are produced by reacting lime with coke. In turn, the large quantities of coke required for calcium carbide production are produced by high-temperature carbonization of bituminous coal.

One method of producing coke employs a traveling grate stoker and is described in detail in U.S. Pat. No. 2,380,930. A bed of carbonizable material such as bituminous coal is moved through a carbonizing chamber by means of the traveling grate stoker. Plural air compartments are provided along the length of the grate with the air supplied therebeneath. By controlling the air supply in each compartment, volatiles in the carbonizable material may be driven off at a maximum rate while maintaining the burning of fixed carbon at a minimum.

This type of coking operation is a high temperature process giving off gases at a temperature of approximately 1800° F. These off-gases have been used in various industrial arrangements as fuel for auxiliary burners or to produce steam directly by heat transfer techniques in a waste heat steam generator. At such elevated temperatures, however, transportation and handling of the coke oven gases present distinct design problems.

SUMMARY OF THE INVENTION

It has been determined that by reducing the temperature of the coke oven gases to the 750° to 900° F. range, the gases may be handled by conventional induced draft equipment for injection into a fluid recirculating-type steam generator organization as supplementary fuel therefor with reasonable draft loss and without objectionable condensation of condensable gas constituents (e.g. carbon black). This gas temperature reduction is accomplished by passing the coke oven in heat exchange relationship with main boiler working fluid. A portion of the circulating main boiler working fluid from a fluid recirculation-type steam generator organization is diverted to a high-pressure extended surface heat exchanger. The heat exchanger is located between the coke oven gas supply valve from the collection manifold (which receives the off-gases from the coking stokers) and an induced draft fan in the steam generator organization. In passing through the heat exchanger, the temperature of the coke oven gases will be reduced to a temperature level at which they can be conveniently handled by externally insulated ductwork and moved by conventional induce draft equipment to provide supplementary fuel energy for the steam generating organization. At the same time, due to the heat transfer process, an enthalpy increase will be imparted to the main boiler working fluid to improve the efficiency thereof.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE shows a schematic arrangement of the coke oven gas supplementary fuel supply for a fluid recirculating-type steam generator organization according to this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The schematic drawing shows a conventional coal coking arrangement **10** having a series of coking means **12** which may be of the traveling grate stoker type as shown in the aforementioned U.S. Pat. No. 2,380,930. Off-gases from the coking means **12** are collected in a collection manifold **14**. The manifold **14** has a duct **16** communicating through a control valve **18** to a bypass stack and a duct **20** communicating

through control valve **22** to the coke oven gas heat exchanger **24**. Regulation of valves **18** and **22** according to the steam load demand determines whether the gases collected in the manifold **14** are to be exhausted through the bypass stack (not shown) or are to be used as supplementary fuel for a fluid recirculating-type steam generator organization **26** in the manner to be described hereinbelow. It is pointed out that while the off-gases are defined as a supplementary fuel, they are not necessarily always a secondary fuel. That is to say that under certain conditions, such as at low load demand on the steam generator organization, the coke oven gases may be the primary fuel (since they are continuously available as the coke process byproduct) with high grade fuel being used merely to maintain ignition and flame stability.

Since the coking process is carried on at elevated temperatures giving off gases at about 1800° F., it is highly desirable when these gases are used as supplementary fuel for a steam generator organization that the temperature of these gases be reduce. This is necessary in order that the gases may be handled in a conventional manner such as by commercially available fans and externally insulated ductwork so as to enable the arrangement to accept thermal expansion of the steam generator furnace. The heat exchanger **24** herein provided for the purpose of reducing the off-gas temperature may be of the high pressure, extended surface type and serves to pass the coke oven gas in heat exchange relationship with main boiler working fluid of the fluid recirculating-type steam generator organization **26**. The temperature of the gases passing through the heat exchanger **24** are herein reduced to a temperature in the 750° to 900° F. range. This range permits handling of the gases without precipitating condensable gas constituents such as carbon black.

The fluid recirculating-type steam generator organization **26** includes a furnace **28** having a plurality of corner fuel injection burner assemblies **30** preferably of the tangential firing type, for example, such as described in U.S. Pat. No. 2.363,875, which do not require premixing of fuel and air. This arrangement is preferred because high temperature coke oven gases are highly flammable when mixed with air and to use an arrangement requiring such premixing would yield a potentially explosive condition. A vapor separating drum **32** supplies working fluid to the walls of the furnace **28** by means of supply conduit **34** which communicates through a circulating fluid manifold **36** to wall supply headers **38**. The working fluid of the steam generating organization **26** may be recirculated by natural recirculation or by forced circulation in which case a pump **40** will positively recirculate the working fluid in the conduit **34**. The circulating fluid manifold **36** has a branch conduit extending therefrom to divert a portion of the working fluid through heat exchanger supply conduit **42** to the heat exchanger **24**. If the steam generator organization depends upon natural circulation of working fluid, a pump (not shown) must be provided in conduit **42** to supply heat exhanger **24** with its necessary portion of working fluid. The working fluid is returned to the vapor-separating drum **32** through heat exchanger outlet conduit **48**. The inlet and outlet conduits **42** and **48** are controlled respectively by valves **44** and **46**.

After the coke oven gases pass through the heat exchanger **24** and their temperature is reduced, they are transported through duct **50** under the influence of an induce draft fan **52** to the duct **54**. This duct communicates with the plurality of fuel-injection burner assemblies **30** of the steam generator furnace **28** so as to permit the introduction of the coke oven gas thereinto to be used as a supplementary fuel. At the reduced temperature level, ducts **50** and **54** may be of the externally insulated type and induced draft fan **52** may be of conventional commercially available construction. Externally insulated ductwork permits the use of toggle action lever supports to accommodate downward thermal expansion of the steam generator organization.

From the foregoing it can be seen that there is herein provided an efficient means for utilizing coke oven off-gases as supplementary fuel in a fluid recirculating-type steam genera-

tor organization having tangential firing corner burners. The reduction of the coke oven gas temperature in the heat exchanger **24** serves to directly increase the enthalpy of the diverted portion of the boiler working fluid. At this particular reduced temperature level (750° to 900° F.), ducts **50** and **54** and the induced draft fan **52** of the steam generator organization may be of conventional construction (need not be designed to sustain ultra-high temperature conditions) without being subjected to condensation of condensable gas constituents (e.g. carbon black). The ducts **50** and **54** may be of the externally insulated type so as to enable the ducting system to incorporate a toggle action support mechanism to permit the ducting to go to the corner fuel-injection burner assemblies **30** and withstand downward expansion of the furnace **28**. This ducting arrangement, in coordination with tangential firing techniques, has the additional advantage of permitting the coke oven gases to be injected into the furnace and properly mixed with air therein as opposed to prior fuel-air premixing. This is important since, as pointed out, the coke oven gas and air mixture would be extremely flammable at the 1800° F. temperature level.

While this preferred embodiment of the invention has been shown and described, it will be understood that it is merely illustrative and that changes may be made without departing from the scope of the invention as claimed.

I claim:

1. A fluid recirculating-type steam generator organization utilizing coke oven gas as a supplementary fuel, the arrangement comprising: a recirculating-type steam generator having a working fluid recirculating loop and fuel-injection burner means; coking means yielding a supply of coke oven gas; means for transporting said coke oven gas from said coking means to said fuel-injection burner means to serve as a supplemental fuel therefor; and heat exchange means located between said coking means and said fuel-injection burner means having flow passages therethrough for passing at least a portion of said working fluid in heat exchange relationship with said coke oven gas.

2. The apparatus of claim **1** wherein said means for yielding the supply of coke oven gas comprises a plurality of traveling grate coking stokers and a collection manifold for receiving the coke oven gases given off by each.

3. The apparatus of claim **1** wherein said means for transporting said coke oven gas from said coking means to said burner means includes an induced draft fan, said fan located between said burner means and said heat exchange means.

4. The apparatus of claim **1** wherein said working fluid recirculating loop includes a main loop for primary working fluid recirculation and a branch loop for circulating a portion of said working fluid through said heat exchange means.

5. The apparatus of claim **4** wherein said heat exchange means is of the high pressure, extended surface type.

6. A method for supplying coke oven gas to a fluid recirculating type steam generator organization as a supplementary fuel therefor, the steps comprising: collecting coke oven gas; diverting a portion of the steam generator working fluid; passing said portion of working fluid in heat exchange relationship with said coke oven to remove heat there from; and transporting the relatively cooled coke oven gas to the steam generator as a supplementary fuel therefor.