

[54] METHOD FOR OPERATING A HOT BLAST STOVE 3,061,292 10/1962 Kinney..... 432/30

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[57] ABSTRACT

[21] Appl. No.: 478,499

A method for operating a hot blast stove in which a combustion gas of a sulfur-containing fuel is passed through a regenerator to heat up the regenerator and air subsequently is blown through the regenerator and is heated by heat-exchange with the heat built up in the regenerator, the improvement comprising preheating the air to a temperature above the acid dew point of the combustion gas whereby corrosion of the regenerator by sulfur is prevented.

[52] U.S. Cl..... 432/30; 432/214

[51] Int. Cl.²..... F24H 7/00

[58] Field of Search 432/30, 214, 217, 218

[56] References Cited
UNITED STATES PATENTS

1,880,229 10/1932 Andrews et al..... 432/30
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4 Claims, No Drawings

METHOD FOR OPERATING A HOT BLAST STOVE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method for operating a hot blast stove in which a sulfur-containing fuel is burned, with the heat of the combustion gas being stored in a regenerator, and with the air to be heated by the regenerator being brought into contact with the regenerator for heat exchange. More specifically, this invention relates to a method for operating a hot blast stove without causing corrosion of the regenerator structure.

2. Description of the Prior Art

It is customary to introduce a hot blast into a smelting furnace in order to smelt ores. Various methods are available to generate heat for the hot blast. Generally, however, prior techniques have employed a method in which an iron blast furnace gas is used, or a method in which a fuel is burned and the sensible heat of the exhaust gas is utilized. The sensible heat of the exhaust gas is stored generally in a heat-receiving device constructed of bricks, by passing the exhaust gas through the heat-receiving device. This heat-receiving device is generally called a regenerator. In operation, when the temperature of the regenerator has reached a fixed level, the flow of the combustion gas is stopped, and then air is blown in an opposite direction to the combustion gas flow, so that air is heated with the heat stored in the regenerator. As a result of this operation air is heated to a fixed temperature and usually, all of this equipment is called a hot blast stove.

Thus, in a hot blast stove operation, a fuel is burned in a combustion furnace which is separate from a regenerator, and then, the combustion gas is passed through the regenerator to transfer the heat of the combustion gas to the regenerator, with the combustion gas being passed through the regenerator for about 30 to 55 minutes to achieve a wall temperature of about 250° to 350°C. Then, in order to use the stored heat for a desired purpose, air at room temperature is introduced into the regenerator generally from the side of the outlet of the combustion gas from the regenerator and is brought into contact with the regenerator to recover the heat as hot blast. In this case, the temperature of the section of the regenerator near the air inlet of the regenerator drops to about 50°C.

However, in such a method for operating a hot blast stove, a sulfur free heat source is required. When the sulfur content of the fuel is less than 0.2 percent, SO₃ which is a main cause of corrosion is scarcely formed, and therefore, no consideration on the corrosion of the stove due to the sulfur is needed. However when the sulfur content is higher, corrosion of the regenerator in contact with the combustion gas occurs, and the regenerator can be damaged or destroyed.

It is said that when a heavy oil containing 2% of sulfur is used as a fuel, the amount of corrosion of a steel material in general, for example, is 10 to 50 mg/dm²Hr. If the lifetime of a hot blast stove can be calculated on this basis, a hot blast stove should be renewed every eight years when it is operated in the conventional method. This is about half of the inherent lifetime. Generally speaking, the inherent lifetime of a hot blast stove is about 15 years. In order to avoid this, fuels containing large quantities of sulfur have not been employed as a heat source.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to remove these defects of the conventional methods, and to provide a method for operating a hot blast stove which permits the use of a fuel having a high sulfur content which could not be used previously.

The present invention provides a method for operating a hot blast stove of the type in which a combustion gas of a sulfur-containing fuel is passed through a regenerator and the regenerator heated up, followed by the blowing of air through the regenerator to heat the air using the heat built up in the regenerator, comprising preheating the air to be blown through the regenerator to a temperature above the acid dew point of the combustion gas prior to blowing the air through the regenerator.

DETAILED DESCRIPTION OF THE INVENTION

According to this process, the hot blast stove is operated so that the temperature of every part of the regenerator is not below the acid dew point of the combustion gas. In order to achieve this, the air to be blown for about 35 to 60 minutes through the regenerator, generally at 500 to 650 Nm³/min, for producing the hot blast is pre-heated to a temperature above the acid dew point, preferably at least about 50°C above the acid dew point, so that upon blowing the pre-heated air through the regenerator, the temperature of the regenerator is maintained always at a temperature above the acid dew point.

The range of acid dew point of the exhaust gas can not be unequivocally defined. The acid dew point is dependent upon the sulfur content of the fuel, and the water content in the exhaust gas. Therefore, the heating temperature for the blast air is determined by the fuel used. Generally, a pre-heating temperature of about 200°C to about 250°C is sufficient. The pre-heating of the air blast can be by any known method, but a method for heating using steam, or a method of heating by circulating a part of the high temperature hot blast is preferred.

The following example illustrates the method of this invention more specifically. Unless otherwise indicated all parts, and percents are by weight.

EXAMPLE

A hot blast stove which was used to provide a feed hot blast to a smelting furnace for smelting a copper ore and which had a regenerating capacity of 6,700,000 Kcal per hour was used. A heavy oil containing 2 percent of sulfur was burned at a rate of 1,000 liters per hour, and the burning was stopped when the temperature of the brick at the outlet of the combustion exhaust gas of the hot stove reached 350°C. After regeneration, using a heat exchanger separately provided, air was pre-heated to 200°C with superheated steam, and then fed to the hot blast stove at a rate of 500 Nm³ per minute. The supply of the blast was stopped when the hot blast temperature fed to the smelting furnace could not be maintained at 900°C, and the operation was switched over to one for regeneration. The time required for regeneration was about 55 minutes, and the time for supplying the hot blast was about 60 minutes. These operations were repeated alternately. After a lapse of about 6 months, scarcely any

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appreciable corrosion or damage of the stove was observed.

Since the damage of the regenerator by corrosion can be prevented by operating the hot blast stove in accordance with the method of this invention, fuels having a slightly higher sulfur content, e.g., up to about 3 percent and higher as desired, can also be utilized. Thus, use of such a higher sulfur content has not been possible with prior approaches as set forth above. The shortened lifetime of the stove, estimated at about 8 years in the conventional method, can be obviated. Rather, since the pre-heating of air to be supplied also causes a decrease in the periodical change in thermal expansion, it is expected that the brick collapsing of the hot blast stove due to thermal stresses on the brick can be prolonged.

Furthermore, because of the air pre-heating, the regenerator can be heated to the desired temperature even if the combustion time is shorter than in conventional method.

While the invention has been described in detail and with reference to specific embodiments thereof, it will be apparent to one skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope thereof.

What is claimed is:

1. A method of operating a hot blast stove of the type in which a combustion gas of a sulfur-containing fuel is

passed through a regenerator to transfer the heat of the combustion gas to the regenerator, and subsequently air is blown through the regenerator to heat the air and utilize the heat stored in the regenerator, the improvement comprising pre-heating the air to be passed through the regenerator to a temperature above the acid dew point of said combustion gas prior to blowing the air through the regenerator, said pre-heating taking place by recirculating a portion of the air passed through the regenerator.

2. The method of claim 1, wherein said pre-heating is to a temperature of at least about 200°C.

3. The method of claim 1, wherein the passing of combustion gas through the regenerator and the passing of air is conducted alternately.

4. A method for operating a hot blast stove of the type in which a combustion gas of a sulfur-containing fuel is passed through a regenerator to transfer the heat of the combustion gas to the regenerator and subsequently air is blown through the regenerator to heat the air and utilize the heat stored in the regenerator, the improvement comprising pre-heating the air to be passed through the regenerator to a temperature above the acid dew point of said combustion gas prior to blowing the air through the regenerator, said pre-heating taking place by using steam.

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3, 902, 844
DATED : September 2, 1975
INVENTOR(S) : Masaru HIGASHI

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

IN THE HEADING:

The Claimed Priority Data was omitted: Should read;
--June 12, 1973 Japan-----65363/73

Signed and Sealed this
twenty-fourth Day of February 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks