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[54] **PROCESS FOR DRYING AND STABILIZING COAL**

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[52] **U.S. Cl.** **34/10**; 34/12

[51] **Int. Cl.** **F26b 3/08**; F26b 7/00

[58] **Field of Search** 34/10, 12; 432/14; 432/15

[56] **References Cited**

UNITED STATES PATENTS

3,755,912 9/1973 Hamada et al. 34/10

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[57] **ABSTRACT**

A process for drying lignitic and subbituminous coal containing from about 25 to about 40% by weight water which comprises heating said coal with a fluidizing combustion gas stream containing from about 7 to about 9% by volume of oxygen to reduce the moisture content to a level of from about 8 to about 12% whereby said coal is also stabilized against spontaneous combustion.

5 Claims, No Drawings

PROCESS FOR DRYING AND STABILIZING COAL

Lignitic and subbituminous coals are received from the mine containing from about 25 to about 40% internal moisture and such coals are usually subjected to a drying procedure before shipment and use. Numerous types of equipment and techniques for such coal drying are available and have been used for some time. In general, a hot combustion gas is used to drive moisture from the coal and this is done either by passing such gases through a bed of the coal, often a fluidized bed, or by passing the coal through a kiln or other rotary device while the gases are passed through. A particularly useful commercial device for such coal drying is the Parry Dryer (see U.S. Pat. No. 2,666,269) which employs the hot combustion drying gases to fluidize the coal. In commercial use the combustion gases are usually obtained from coal or fuel oil and the fuel-air ratio is maintained so that the combustion gases contain about 5 percent by volume of oxygen. The dried coal emerging from the dryer generally contains from 0.5 to about 10% by weight, and might even be somewhat higher.

One of the characteristics of dried coal is its tendency toward spontaneous combustion and this becomes a serious problem during the shipment and storage of such coal. Coal subjected to the above described drying process is somewhat improved in its spontaneous combustion character, but additional stability is still desired in order to further mitigate or eliminate the fire hazard present in shipping and storing dried coal.

It has now been found that a significant improvement in increasing the stability of coal dried by the above described process can be obtained by carefully controlling the oxygen content of the drying gases and by controlling the moisture content of the dried coal. In accord with the invention, lignitic or subbituminous coal containing from about 25 to about 40% by weight of water is dired and increased stabilization to spontaneous combustion is obtained by heating said coal in a fluidized bed dryer with fluidizing combustion gases containing from about 7 to about 9% by volume of oxygen until the moisture content of said coal is from about 8 to about 12% by weight. It is quite unexpected that by exercising initial control of the oxygen content of the drying gases and the moisture content of the dried coal as defined above that a coal of superior stability is obtained.

The coals used in the process of the invention will be, as indicated, lignitic and subbituminous coals and will include North Dakota lignite, Powder River subbituminous coal, Wyodak coal, and the like. Such coals usually contain from about 20 to 40 percent water as they come from the mine.

The drying procedure will be carried out with a fluidized bed type dryer where the drying gas is used to fluidize the bed. A preferred type of dryer is the Parry Dryer referred to above and the process of the invention will be illustrated with such equipment.

In operation, the raw coal is fed to the dryer column through a screw feeder. The coal particles are entrained in a stream of high velocity gases from a combustion furnace and carried through the column to a primary separator. The drying is accomplished almost instantaneously due to the intimate mixing of coal with the turbulent gases in the dryer column. Coal and gases leaving the dryer column expand into the primary separator where the velocity is decreased to allow the main product to drop out and the gases continue to move slowly to the entrance of cyclones, or secondary separators. This action drops out up to 98 percent of the coal, or all but the fine dust. The coal is discharged from a conical bottom of the primary separator through a rotary valve to be carried away on a dry product conveyor. The gases flow through high efficiency cyclones to a common stack and are discharged to the atmosphere.

The fine dust is separated from the gas stream in the cyclones, collected in a hopper and discharged to a conveyor. The major part of the dust collected is introduced into the primary combustion air at controlled rates, conveyed to the furnace, and burned. The particle size of about 80 percent minus 200 mesh makes it ideal for use as a pulverized fuel for the combustion furnace which furnishes the fluidizing drying gases. However, materials other than coal, such as gas or oil may be used for fuel.

A portion of the stack gas may be recycled to the furnace for tempering the drying gases. This eliminates the use of excess air for tempering and allows accurate control of the oxygen content in the drying system.

The dryer operates under a positive pressure to prevent air leakage into the system. Before feeding coal to the dryer, the system is preferably purged with inert gas obtained from an oil fire in the furnace. The primary air blower is a positive displacement type and supplies air to the oil fire at a constant rate. The fuel oil is maintained at a controlled pressure and metered by the atomizing nozzle in the burner. This maintains the desired fuel-air ratio, so that the products of combustion are essentially inert. The oil fire is continued for a predetermined interval, normally about 5 minutes, until the system is completely purged. The recycle blower, fuel dust feeder, and forced draft blower are then started after the system is purged. The fuel oil is no longer required and may be turned off a few minutes after the coal dust feed is started.

The drying gases rise to operating temperatures of from about 1000° to about 2200°F. about 5 minutes after the dust is started, and then the raw coal feeder is started. The moisture in the dried product is held at the desired value of from about 8 to about 12%, preferably about 9 to about 10% by a temperature controller that regulates the heat liberated in the furnace. This is accomplished by controlling the forced draft damper and the fuel dust feeder to maintain a constant temperature of from about 150° to 250°F. (preferably about 180° to about 230 °F.) at the top of the drying column. This temperature is recorded on the controller.

The temperature control system is designed to vary the fuel dust fed to the furnace as required to hold the drying column top temperature constant. An oxygen recorder is used to make a continuous record of the oxygen content of the stack gases which will be from about 0 to about 10%. Forced draft air is varied as necessary to hold the desired oxygen content of the input gases from about 7 to about 9% by volume oxygen content as required by the process of the invention.

In order to more fully exemplify the process of the invention the following examples are given:

Wyodak coal of one-fourth inch to 0 mesh containing about 30% moisture (inherent) was dried in a Parry Dryer. The temperature of the input gases was from

about 1900° to about 2100°F. and other conditons of the various runs are shown in the following table:

Example No.	Percent Oxygen Content Of Drying Gases	Percent Moisture Content Of Dried Coal
A	4.5	5
B	8.6	5
C	4.2	5
D	8.4	5
E	3.5	10
F	7.5	9.4

Each of the above samples of dried coal was subjected to a stability test carried out by placing the coal in a Dewar flask fitted at the bottom with a sparging tube to pass oxygen through the coal and equipped with a temperature measuring device. The coal (450g.) in Dewar flask (70 mm.I.D.) is about 200 mm. in depth and oxygen saturated with water is passed through it at 62°C. at a rate of 200 ml/min. The time for combustion of the coal to occur is noted as shown by the sudden temperature increase and is taken as a measure of stability. The results are shown in the following table:

Example No.	Hours To Combustion
A	2.5
B	2.7
C	1.6
D	2.0
E	9.2
F	Did not combust

The invention claimed is:

1. A process for drying lignitic and subbituminous coal containing from about 25 percent to about 40% by weight water which comprises heating said coal with a fluidizing combustion gas stream containing from about 7 percent to about 9% by volume of oxygen to reduce the moisture content to a level of from about 8 to about 12% whereby said coal is also stabilized against spontaneous combustion.

2. The process of claim 1 where the coal is dried to a moisture level of from about 9 to about 10%.

3. The process of claim 1 where the coal is a subbituminous coal.

4. The process of claim 3 where the coal is Wyodak coal.

5. The process of claim 1 where the coal is lignite.

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