

Nov. 20, 1962

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METHOD AND APPARATUS FOR INERTING FUEL
SEPARATION CYCLONE AGAINST
SPONTANEOUS COMBUSTION
Filed May 18, 1961

3,064,811

Fig. 2.

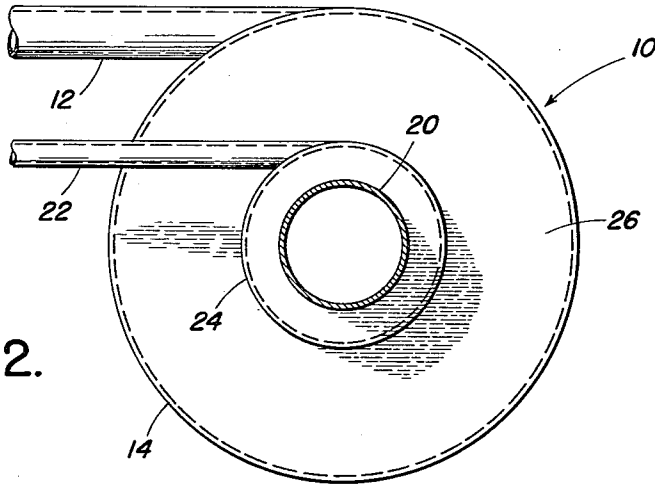
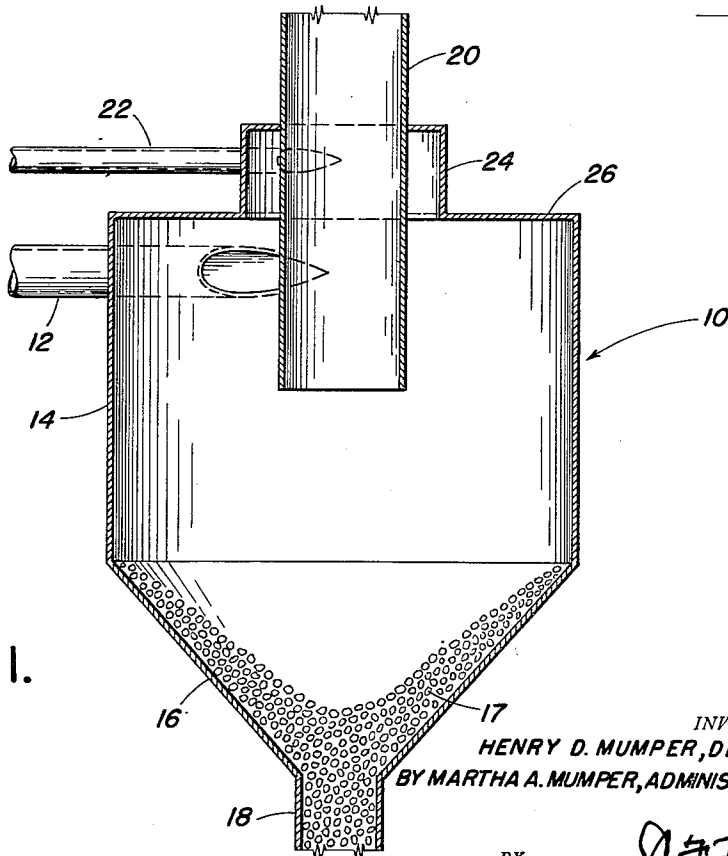


Fig. 1.



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3,064,811

METHOD AND APPARATUS FOR INERTING FUEL SEPARATION CYCLONE AGAINST SPONTANEOUS COMBUSTION

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Filed May 18, 1961, Ser. No. 112,170

1 Claim. (Cl. 209-144)

This invention relates to a new and novel method and apparatus for inerting a cyclone separator against spontaneous combustion.

In many present day boiler units, pulverized coal is used as the fuel in the furnaces. A suitable method of transporting this pulverized coal around the furnace structure is by entraining it in a stream of fluid flowing through ducts. Because of its abundance and ready accessibility, air is very often used as the transporting fluid or medium. Since the coal that arrives at the plant site usually contains a very high moisture content, it is desirable to heat the air to a relatively high temperature prior to utilizing it as a transporting medium, so that a substantial percentage of the moisture contained in the pulverized coal is evaporated while the coal is being conveyed by the hot air.

The mixture or stream of hot air and pulverized coal is fed into a cyclone separator after it has been moved to its point of use. The mixture is introduced into the cyclone separator tangential to the cylindrical wall in the upper portion thereof, so that the entering velocity of the mixture sets up a rotary motion within the separator. Centrifugal force throws the larger, heavier particles of coal towards the walls of the separator, and the air, along with the extremely fine, or small particles of coal flow out through an outlet centrally located in the top of the separator.

Because of the lean fuel-air ratios which exist in the region surrounding the centrally located air outlet duct, and because of the heat still contained in the air at this point, spontaneous combustion is quite likely to occur in this area. Spontaneous combustion results in economic losses, both in repair of the separator, and in the loss of fuel, and can also cause injury to personnel working nearby.

It is an object of this invention to overcome the above-mentioned problem and to prevent spontaneous combustion from taking place within the cyclone separator. This is accomplished by introducing an inert gas, preferably nitrogen, into the separator within the vicinity of the air outlet duct. The inert gas is so introduced into the cyclone separator that physical diffusion of the inert gas through the lean fuel-air ratio regions takes place, thus eliminating any possibility of spontaneous combustion within the separator.

The foregoing will be more readily understood after reading the following description of a preferred embodiment when considered in conjunction with the accompanying drawings wherein:

FIGURE 1 is a cross sectional side view of a cyclone separator embodying my invention;

FIGURE 2 is a top plan view of the cyclone separator shown in FIGURE 1.

Referring now to the drawings, 10 designates a cyclone separator. Pulverized coal entrained in hot air is introduced into the separator through duct 12. Duct 12 introduces the fuel-laden air into the separator tangential to the cylindrical wall 14 in the upper portion thereof, causing it to whirl downwardly therethrough in helical or vortical flow. Centrifugal force causes the coarser, or heavier particles of coal to move outwardly towards the wall

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14, thereby separating it from the air and lighter or smaller particles of coal. This separated coal falls to the bottom of the frustoconical portion 16 of the separator. The accumulated coal 17 can be withdrawn from the separator through outlet 18.

The air, which still contains some heat, along with the lighter particles of coal, whirls centrally upwardly through the separator and out through duct or conduit 20, which extends down through the top wall 26. The central zone of the separator and the exhaust stack 20 constitute the normal trouble spots for spontaneous combustion. Because of the lean fuel-air ratios in these regions, plus the fact that the air still contains some heat, makes it possible that spontaneous combustion will occur.

To prevent the above from happening, an inert gas, such as nitrogen, is introduced into the center of the separator, through duct 22. The inert gas flows into the separator chamber through the wall of a reduced diameter cylindrical portion 24, which surrounds duct 20. The inert gas is introduced tangential to the cylindrical wall, as seen in FIGURE 2, so that the gas flows downward into the separator in a whirling, rotating manner, about the outer wall of duct 20. The inert gas is introduced so that it will rotate in the same direction as the mixture of air and pulverized coal, so as not to detract from or counteract the centrifugal forces created by the whirling flow of the mixture. Physical diffusion of the inert gas with the coal dust-laden hot air takes place in and around the location of duct 20, and the diffused inert gas passes out through duct 20 along with the air and entrained particles of coal, thereby eliminating the possibility of spontaneous combustion.

On pages 6 and 7 of the Bureau of Mines Report of Investigations 5052 it is stated that the minimum amount of oxygen required for ignition of coal dust in an environment at atmospheric temperature is 15%, and in a furnace at 850° C. it is 7.5%. Since the air used for transporting the coal to the separator in accordance with my invention still will have some heat left in it upon reaching the separator, the area surrounding the central outlet should be inerted to such an extent that the resulting mixture will have an oxygen content somewhere between 10-15%, depending on the temperature prevailing in this area. It can be seen that if the inert gas were introduced along with the air through duct 12, it would require as much inert gas as there is air to get a mixture having approximately 10% oxygen. By introducing the inert gas tangentially through duct 22 so that it flows downwardly along the outer wall of duct 20 thereby mixing with the air adjacent to and surrounding the central opening, a much smaller amount of inert gas is required than if the entire separator 10 were inert. The exact amount of inert gas required will vary, depending on such factors as the size of the separator, the fineness and amount of coal dust present, the type of coal being conveyed, and the velocity and temperature of the conveying air.

In accordance with the invention, the possibility of spontaneous combustion taking place within a cyclone separator is simply, efficiently, and economically eliminated.

It will be understood that the above description is intended for the purpose of illustration only and that modifications such as will occur to those skilled in the art are possible and are embraced within the scope and spirit of the invention.

What is claimed is:

The method of inerting a separator comprising the steps of introducing a mixture of pulverized coal and air into a cylindrical chamber tangential to the cylindrical wall such that the heavier particles of coal will be centrifugal-

ly separated and fall to the bottom of the chamber, removing the air along with the fine, or smaller particles of coal which are not centrifugally separated out from the chamber through a central opening in the top of the chamber, and introducing an inert gas into the chamber in the upper portion thereof tangential to a cylindrical wall adjacent the central opening, which cylindrical wall is of reduced diameter as compared to the wall of the cylindrical chamber, such that the inert gas thus mixes with the air surrounding the central opening so as to prevent spontaneous combustion of the air containing the fine particles of coal.

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