

[54] DUST SAMPLING SYSTEM

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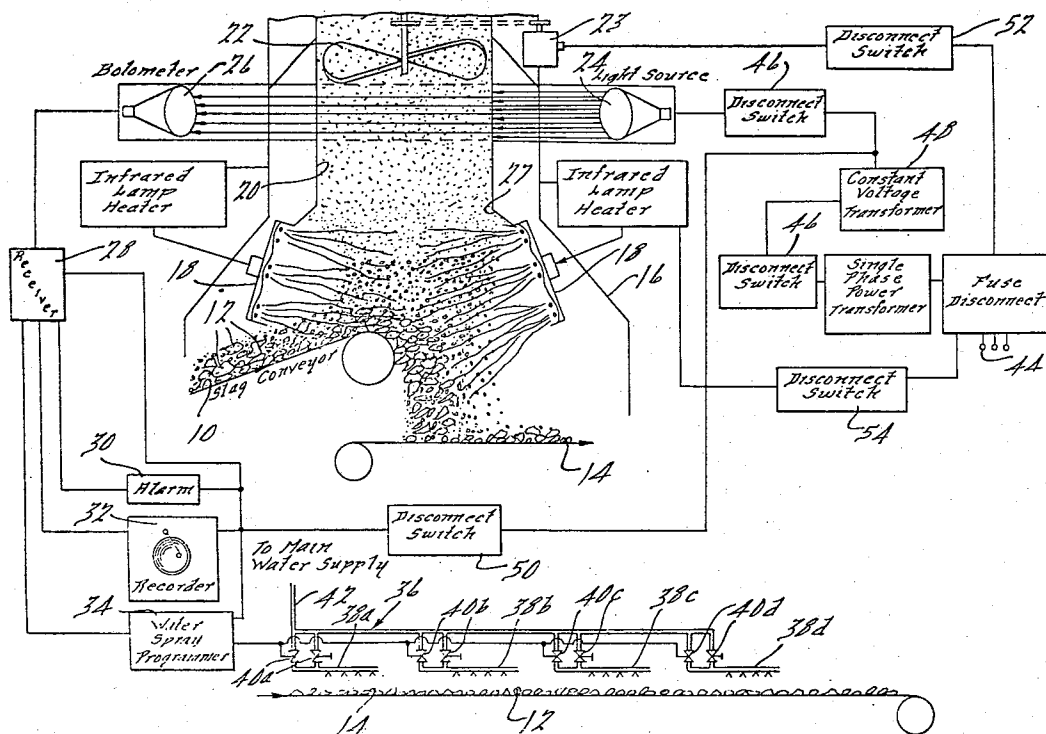
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ABSTRACT

A monitoring system for dusty, moist gases such as the ambient air near material handling equipment, exhaust fumes from cement or lime kilns, and the like. An infrared heater is used to vaporize moisture particles in the gases and thereby render such moisture invisible. The ability of light to penetrate the gas is then measured to determine the dust density thereof. The density measurement may be used for various purposes such as actuating an alarm or dust suppression apparatus.

8 Claims, 1 Drawing Figure



DUST SAMPLING SYSTEM

BACKGROUND AND BRIEF SUMMARY OF THE INVENTION

There are many situations in which air or other gases contain both dust and moisture. In the interest of minimizing air pollution, it is often desirable to monitor the dust density of such gases and take corrective action when such dust is excessive. In attempting to devise a method for monitoring the dust level of very moist gas it was found that the presence of suspended water vapor particles in the gases presented a serious obstacle to the correct measurement of dust density thereof. Measuring instrumentation frequently identified the moisture particles as dust and gave a false reading.

A typical environmental situation in the dust density which can be advantageously monitored relates to the handling of slag. Hot slag, after it is received from a steel or iron mill, is transported on conveyor belts between various crushing and screening operations. It is standard practice to spray water on the slag in order to minimize the dust released from the slag during its handling. It is desirable, however, to use the minimum amount of water necessary as the presence of excessive amounts of water impairs the effectiveness of the screening and crushing operations. As a result, an inadequate amount of water was frequently used for dust suppression purposes. It was, therefore, found to be desirable to monitor the amount of dust being released from the slag during its handling and to take corrective action by applying additional amounts of water on the slag when the dust being released from the slag is found to be excessive. The appropriate amount of additional water which should be sprayed on the slag has been found to be dependent upon the amount of dust being released therefrom during handling.

Slag, during the foregoing handling operations, is generally at a relatively hot temperature and if the air is relatively cold, a substantial amount of steam is liberated from the slag. Thus, the proper sensing of the density of the dust being released from the slag requires either that the sensing equipment differentiate between the steam and the dust or that the steam be eliminated.

The present invention utilizes a radiant heat source such as infrared heaters in order to transform the steam to an invisible vapor. Thus, the dust containing air or other gas may be sampled by equipment which will respond to any light reflecting particles in the air and only the dust will comprise such particles. The present invention further comprehends the use of a constant intensity light source for sampling the gases downstream from the radiant heat source and a sensor arranged to receive light from the source with the dust containing gases passing between the two. The magnitude in interference of light transmission from the source to the sensor is indicative of the density of dust contained in the air. Thus a reduction in the light being sensed may be utilized to actuate an alarm, to actuate dust suppression equipment to a degree dependent on the dust density, or for any other desired purpose.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is a schematic view of a material handling and treating system embodying a dust monitoring device incorporating the principles of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The drawing discloses a conveyor 10 designed to transport slag 12 in a linear and upward direction. From one end of the conveyor 10 the slag is deposited on a second conveyor 14. Arranged generally over the transfer location from the conveyor 10 to the conveyor 14 is a collecting hood 16. Mounted in the interior of the collecting hood 16 are a pair of radiant heaters in the form of infrared lamps 18. The heaters 18 are positioned to heat and thereby vaporize the moisture particles suspended in the air entering the hood 16. The dusty air in this location is drawn upwardly through the hood 16 to a conduit 20 by means of an exhaust fan 22 driven by a fan motor 23. Mounted on diametrically opposite sides of the conduit 20 are a light source 24 and a light sensor in the form of a bolometer 26. The light source 24 is focused precisely at the bolometer 26. Air flowing upwardly through the conduit 20 moves through the path of the light from the source 24 and dust particles contained in this air will reflect a portion of this light, diminishing the magnitude of the light sensed by the bolometer 26. The flow of air is from an inlet 27 formed in the conduit 20 adjacent the hood 16 to an outlet (not shown) disposed at the upper end of the conduit 20 above the fan 22.

The output of the bolometer 26 is transmitted to a receiver 28 which, in turn, delivers an electrical signal either alternatively or simultaneously to an alarm 30, a dust density recorder 32 and a water programmer 34. The alarm 30 may give either a visual or audible signal and is actuated when the dust density reaches an excessive level. The water programmer 34 is connected to an automatic water spray system 36 having a plurality of spray nozzles 38a, 38b, 38c and 38d. The nozzles 38a, etc. are connected to a water supply pipe 42 through solenoid operated valves 40a, 40b, 40c and 40d. When the dust density reaches a first predetermined level, the valves 40a will be opened to cause the nozzles 38a to spray a first quantity of water on the slag 12 passing beneath them on the conveyor 14. When a second greater level of dust density is sensed by the bolometer 26, both the valves 40a and 40b will be actuated to spray a greater amount of water on the slag 12 through the nozzles 38a and 38b. Similarly, additional levels of water spray are applied to the slag 12 by also spraying from the nozzles 38c and/or the nozzles 38d when third and fourth levels of dust density are sensed by the bolometer 26.

Power for operating the electrical apparatus shown in the drawing is supplied through power terminals 44 connected to a constant voltage transformer 48 through a manual switch 46. The transformer 48 is connected to the light source 24 through a switch 46 and to the receiver 28, the alarm 30, recorder 32 and water spray programmer 34 through a switch 50. Electrical power is also supplied to the fan motor 23 through a switch 52 and to the heaters 18 through a disconnect switch 54.

As will be apparent to those working in the area of air pollution, a dust sampling and control system incorporating the principles of the present invention will find use in a wide variety of applications. Where dust suppression systems are already in operation, the device of the present invention may be utilized to detect malfunction of the suppression equipment. Also, and as

shown herein, the device may be used as a means for programming the suppression equipment. Of course the recorder 32 can be utilized to provide a permanent record of the proper functioning of pollution control equipment.

It will be apparent that the use of a radiant heat source such as the infrared lamps 16 enables the dissipation, dissolution or gasifying of visible water vapor mist or steam without impeding or in any way interfering with the flow of air through the conduit 20. The radiant heat energy is readily absorbed by the water particles suspended in the air entering the conduit 20, dispensing or gasifying such particles into an invisible vapor which will not be detected or sensed by the bolometer 26.

In the appended claims the expression "gas" or "gases" is used in its broadest sense as intended to include atmospheric air, smoke, various gaseous effluents and any other gaseous medium containing both dust and suspended fluid particles.

What is claimed is:

1. A dust sampling system for monitoring the dust content of moist gases including an open conduit having a gas inlet and outlet, a radiant heat source associated with said inlet and operable to vaporize moisture

particles suspended in moving gases entering said inlet, a constant intensity light source directing a beam of light across said conduit downstream from said heat source, a light sensor arranged to receive light from said source and means controlled by said sensor responsive to a reduction in the amount of light received by said detector from said source resulting from an increase in the dust particles suspended in said gases.

2. The structure set forth in claim 1 in which said means comprises a recorder.

3. The structure set forth in claim 1 in which said means comprises an alarm.

4. The structure set forth in claim 1 in which said radiant heat source comprises an infrared lamp.

5. The structure set forth in claim 1 in which said sensor comprises a bolometer.

6. The structure set forth in claim 1 including a fan for inducing the flow of gases through said conduit.

7. The structure set forth in claim 1 including a hood mounted at the inlet end of said conduit.

8. The structure set forth in claim 1 including an air collecting hood at said inlet arranged adjacent a conveyor for dusty particulate materials.

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