A continuous miner has a number of specially located water sprays to form a curtain of water spray across at least a portion of the miner width and behind the cutting assembly of the miner to suppress dust that would otherwise be directed to the operator of the miner and cause the miner operation to be out of compliance with safety regulations.
WATER SPRAY SYSTEM FOR CONTINUOUS MINER AND METHOD OF USE

FIELD OF THE INVENTION

[0001] The present invention relates to an improvement in continuous miners, and more particularly, to the use of water sprays that are mounted on the miner and behind the cutter head, gathering pan, and parallel to the discharge conveyor used in the miner. The water sprays form a curtain of water spray that suppresses dust that would otherwise travel to the area that the operator occupies.

BACKGROUND ART

[0002] In the mining industry, continuous mining equipment, particularly coal mining equipment, (hereinafter miners) includes a cutting head, a conveyor, and coal loading arms for directing the coal removed by the cutting head to the conveyor. FIG. 1 shows one type of miner 10 that employs a cutting head assembly 1 and a conveyor assembly 3. The cutting head assembly includes a cutting head 5 and loading arms 7. The loading arms 7 collect the coal generated by the cutting heads and direct it to an entry end of a conveyor 11 of the conveyor assembly 3. The miner also includes rub rails 12 (one shown), which provide protection to the miner during its operation and/or movement, particularly for protection for electrical boxes and traction motors.

[0003] FIG. 2 is a schematic of the miner 10, which shows in better detail the spacing arrangement of the cutting head assembly 1, the conveyor assembly 3 and a typical area 13, wherein the miner operator would be located. The operator area 13 may vary depending on the particular miner, but it is spaced rearward from the cutting head assembly 1 as depicted in FIG. 2, and usually located on the air intake side of the miner. These miners are well known in the prior art and a more detailed description of all of the features thereof is not deemed necessary for understanding of the invention.

[0004] It is also well known in the prior art to employ water sprays for dust suppression during the mining operation. U.S. Pat. Nos. 7,614,705 and 6,540,304 to Southern, which are each herein incorporated by reference, disclose one type of water spray for dust suppression. Typically, these dust sprays are mounted in the vicinity of the cutting head and the conveyor to suppress dust. While some spray heads may be located behind the cutting heads, the spray nozzles of these heads direct water toward the front of the miner.

[0005] Dust suppression during miner operation is a mandatory requirement since the dust loadings are monitored for mine and worker safety purposes according to the Federal Coal Mine Health and Safety Act of 1996. One problem with miners is that the water sprays do not sufficiently suppress the coal dust generated during the mining operation with respect to the operator of the miner. Thus, the operator may see coal dust levels that are in violation of the standards set by federal regulation and this can cause problems for the operator safety and mine productivity. This problem is particularly prevalent during start up of the miner. When making an initial cut with the miner, dust can roll back over the miner, thus causing the operator to be exposed and the operation is out of compliance with mine dust regulations. Once the drums of the cutting head are sunken into the coal being extracted, the existing scrubber system of water sprays and collectors handle the generated coal dust. However, the existing scrubber is not configured to alleviate the dust entering the operator area during initial operation of the miner.

[0006] As such, a need exists to better suppress coal dust in the vicinity of the operator of a miner. The present invention addresses this need by the use of water sprays that are mounted to the miner to form a water spray curtain behind the cutting head assembly of the miner. The water spray curtain acts as a barrier to dust that would travel toward the operator area of the miner so that dust levels at the operator area are in compliance with Federal regulations.

SUMMARY OF THE INVENTION

[0007] One object of the invention is a miner water spray system, which has the capability to reduce the amount of dust that an operator would encounter during operation of the miner.

[0008] A second object is an improved method of mining material, wherein the dust loading is reduced in the area of the operator. Preferably, the material being mined is coal, but the inventive miner and method could be applied to mining of any materials that would generate dust in need of suppression.

[0009] In satisfaction of the objects and advantages of the invention, a miner is disclosed that comprises a cutting head assembly and a conveyor positioned along a length of the miner. A loading end of the conveyor is positioned near loading arms of the cutting head assembly. The operator area of the miner is located on the miner in a location removed from the loading end and cutting head assembly. Generally, the operator area is positioned on one side of the conveyor and towards the rear of the miner on the air intake side.

[0010] A plurality of water sprays are positioned behind the cutting head assembly with nozzles of the water sprays positioned to direct water in a direction that is generally transverse to a longitudinal axis of the miner. The water sprays can then form a curtain of water that crosses at least a portion of the width of the miner. This water spray curtain acts as a barrier to dust traveling from the front of the miner to the rear of the miner and to the operator area. The water spray can also be directed in other directions, upward against the roof of the mine, and away from the sides of the miner, e.g., at walls of the mine.

[0011] The invention also entails a method of controlling the dust loading at the operator area of a miner. The method entails creating a curtain of water that is between the operator area and the front end of the miner, with the curtain of water spray suppressing dust that would travel along the longitudinal axis of the miner and into the operator area.

[0012] In a preferred embodiment, the water sprays are generated using one or more nozzle-containing manifolds in a water spray head. More preferably, a plurality of manifolds are used, with the connection between the manifolds being flexible so that the water spray head can take shocks or impacts without being damaged. The water sprays includes a removable mounting feature so that the manifolds and nozzles can be easily removed and either cleaned or replaced as necessary.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 is a perspective view of a prior art miner.

[0014] FIG. 2 is a schematic view of a miner showing the cutting head assembly, conveyor, and typical operator area.
FIG. 3 shows a view of FIG. 2 with a schematic representation of water sprays to form the curtain of water for dust suppression and the location of a miner operator.

FIG. 4 shows a transverse view of the FIG. 3.

FIG. 5 shows side view of an exemplary water spray assembly for creating the curtain of water.

FIG. 6 shows a side view of a miner with a water spray assembly mounted to a rub rail thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides significant improvements in the operation of miners in mining environments. By practicing the invention, the impermissible dust loading that can encountered by a miner operator is removed so that the miner, during its operation, is in compliance with all regulations concerning dust loadings from an operator's perspective. These improvements mean that the safety of the miner is improved and the risk to the mine operation of fines or shut-downs for non-compliance with dust loading regulations is reduced or eliminated.

Referring now to FIGS. 3 and 4, these schematic drawings show the water spray assembly of the invention as reference numeral 20. The assembly 20 comprises a number of spray heads 21, with one shown on either side of the miner 10. The spray heads 21 can have one or more spray nozzles thereon, with the spray pattern being any type that is typically used in mining applications for dust suppression. Preferable spray heads are those that produce a fan pattern. More preferably, the nozzles would have small orifices, as small as 0.036 inches so that the water supplied to the water spray assembly is atomized and produces a fog in the desired location. The fog would be three dimensional in its shape so that it would not only go across the width of the miner, but would also extend longitudinally along its length.

The spray heads 20 are configured to form a curtain of water spray 23 in at least a direction that is generally transverse to the longitudinal axis X of the miner and spans at least a portion of the width of the miner. Preferably, the sprays are sized/arranged so that the spray covers the entire width of the miner.

The spray heads can be numbered and/or placed in any fashion to form the water spray curtain, including directing the spray away from the miner as shown at 25, and even towards the ceiling of the mine at 27, see FIG. 4. By forming the curtain of water sprays, dust from the mining operation is caught up in the water spray curtain and the dust cannot reach the operator area 13 and cause the mining operation to be out of compliance with safety regulations.

While the spray heads are shown in FIGS. 3 and 4 as being located on the sides of the miner, other locations could be used as well, e.g., mounted across the width of the miner, spraying either up, down or both.

FIGS. 5 and 6 show a preferred embodiment of the miner of the invention. The miner 10 is depicted with a rub rail 12. Mounted to the rub rail is a water spray assembly 33. The assembly 33 is depicted in greater detail in FIG. 5.

The assembly 33 has a housing 34 that serves as a link between the spray head 35 and a source of water. The housing 34 is similar to that disclosed in the Southern patents described above in terms of how the spray head 35 removably attaches thereto. Thus, a further and more detailed description of this aspect of the water spray assembly 33 is not needed for understanding of the invention. The housing 34 allows the spray head 35 to be easily removed for cleaning or replacement with another spray head or cleaning or replacement of the filter 36.

The spray head 35, in this embodiment, comprises three manifolds 37, 39, and 41 and hoses 43 and 44. The manifold 37 is configured on one end to link to the housing 34 with the filter 36 as detailed in the Southern patents. The manifold 37 has six spray nozzles 45 (three shown), with the other three diametrically opposed to the illustrated three. The other end of the manifold 37 is connected to the hose 43, which is a flexible hose made of rubber or some other flexible material. The hoses 43 and 44 are made to be flexible since the water spray assembly extends from the miner in a precipitous fashion and will be subject to impact during the mining operation. The flexibility of the hoses 43 and 44 allow the water spray assembly to receive impact with minimal or no damage.

The other end of hose 43 attaches to manifold 39. The manifold 39 has two spray nozzles 47 (one shown), with the other one diametrically opposed. The manifold 39 is attached to one end of the hose 44. The other end of the hose 44 terminates in another manifold 41. Manifold 41 has three nozzles, one nozzle 49 at the end of the manifold 41 and two nozzles 51 (one shown) on the sides, with the two nozzles diametrically opposed.

The water spray assembly of FIG. 5 is designed to spray water in a fan pattern from both sides of all the manifolds and from the top of manifold 41. With this arrangement, the nozzles 45, 47, and 51 that are illustrated in FIG. 5 would form a water spray curtain. The spray emanating from the nozzles depicted in FIG. 5 would either span at least a portion of the width of the miner (see FIG. 4 reference numeral 23) or be directed away from the miner, e.g., toward a wall of the mine (see FIG. 4 reference numeral 25). The other side nozzles not shown in FIG. 5 would do the opposite of the function of the illustrated nozzles, either spray over the miner or away from it. In a preferred spray arrangement, the spray pattern from opposing nozzles would overlap so that when the spray assemblies are mounted on sides of the miner, spray from each assembly would extend beyond the midline of the miner to maximize the extent of the water spray curtain. Of course, the spray pattern of opposing nozzles could just touch each other or come close to touching each other so that at least a portion of miner width is covered by the spray pattern, with the remaining portion that may be left uncovered to be a minimal part of the width of the miner.

Another possibility would be to have nozzles only on one side of the miner. If desired, these nozzles be configured so that the spray would cross at least most of the width of the miner for dust suppression or the entire width. With the operator area on one side of the conveyor, a water spray curtain emanating from only one side of the miner covering only a portion of the width of the miner may be sufficient to suppress dust to meet safety regulations.

Each water spray assembly can also have an on-off valve, which can be controlled by the operator of the miner. With this capability, the operator can control the extent of spray for any given water spray assembly.

The number of manifolds and number of spray nozzles/hoses shown in the embodiments above are exemplary only. That is, more or less manifolds could be used and a different number, arrangement, or type of nozzle could be employed. In fact, the entire water spray assembly 35 of FIG. 5 is exemplary only and other arrangements can be employed.
in various locations to achieve the dust suppression of dust traveling beyond the cutting head assembly and towards the operator area of the miner.

According to the method of controlling the dust suppression in the area of the operator, water is supplied to the various located water spray assemblies 35 so that at least a curtain of water spray is formed across at least a portion of the width of the miner. The spray can also be directed so that it covers the entire width of the miner to form a complete wall or curtain of spray for dust suppression. The water spray can also be directed away from the miner (opposite to that directed across the miner) and/or towards the ceiling of the mine (in a vertical direction) for enhanced dust suppression.

While the spray in FIG. 3 is shown to travel in a direction that is generally perpendicular to the longitudinal axis X of the miner 10, the spray could be angled from the perpendicular direction. In addition, when using a number of nozzles from a water spray assembly, the nozzles can be directed in slightly different directions. For example, some could direct the spray generally perpendicular to the longitudinal axis X and others could be directed at an angle more toward the operator area or the front of the miner. Arranging the nozzles with different directions of spray can expand the width of the curtain along the miner longitudinal axis. Thus, rather than have a two dimensional type of curtain as depicted in FIGS. 3 and 4, the curtain would take on a more three dimensional configuration, thus adding depth to the curtain and causing the dust to travel through more water spray when directed towards the operator area. This angular orientation of the nozzles that creates a curtain of water with more depth would be encompassed by the description that the spray pattern is generally transverse to the longitudinal axis X of the miner.

As such, an invention has been disclosed in terms of preferred embodiments thereof which fulfills each and every one of the objects of the present invention as set forth above and provides a new and improved continuous miner and method of use.

Of course, various changes, modifications and alterations from the teachings of the present invention may be contemplated by those skilled in the art without departing from the intended spirit and scope thereof. It is intended that the present invention only be limited by the terms of the appended claims.

1. In a miner having a cutting head assembly, a conveyor assembly for removing a material mined by the cutting head, and an operator area located behind the cutting head assembly, the improvement comprising a plurality of water spray assemblies, each assembly adapted to connect to a source of water, with the water spray assemblies located on the miner to form a curtain of water spray across at least a portion of the width of the miner, in a direction generally transverse to a longitudinal axis of the miner and between the operator area and the cutting head assembly.

2. The miner of claim 1, wherein the miner has rub rails along sides of the miner and at least one water spray assembly is mounted on each rub rail.

3. The miner of claim 1, wherein the water spray assembly includes a plurality of manifolds, each with at least one spray nozzle to form the water spray curtain.

4. The miner of claim 2, wherein the water spray assembly includes a plurality of manifolds, each with at least one spray nozzle to form the water spray curtain.

5. The miner of claim 1, wherein each manifold has at least one spray nozzle to form the water spray curtain and at least one other spray nozzle to spray water away from the miner.

6. The miner of claim 5, wherein the at least one other spray nozzle directs water spray in a direction opposite to the at least one spray nozzle or in a vertical direction.

7. The miner of claim 1, wherein the water spray assemblies are configured such that the water spray curtain extends across the entire width of the miner.

8. In a method of mining a material using a miner having a cutting head assembly, a conveyor assembly for removing a material mined by the cutting head, and an operator area located behind the cutting head assembly, the improvement comprising forming a curtain of water spray in a direction generally transverse to a longitudinal axis of the miner and across at least a portion of the width of the miner and between the operator area and the cutting head assembly.

9. The method of claim 8, wherein the water spray curtain extends across an entire width of the miner.

10. The method of claim 8, further comprising also spraying water behind the cutting head assembly in a direction opposite the direction of the formed water spray curtain or a vertical direction.

11. The method of claim 9, further comprising also spraying water behind the cutting head assembly in a direction opposite the direction of the formed water spray curtain or a vertical direction.

12. The method of claim 8, wherein the curtain of water spray is formed by at least one water spray assembly mounted to each side of the miner.

13. The method of claim 8, wherein the at least one water spray assembly is mounted to a rub rail on each side of the miner.

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