WATER GUN REMOTELY MOUNTED ON PLANER CUTTER GUIDE

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The present invention relates to the use of a water gun for the extraction of mineral from a mine face, and more particularly to a method of operation and mining arrangement for the extraction of mineral from the upper portion as well as the lower portion of a mine face, utilizing in addition to a mining planer, normally conducted back and forth along the lower portion of the mine face on longitudinally extending guide means, also more than one water gun spaced apart on the guide means for directing against the upper portion of the mine face high pressure water jets in slightly overlapping range to loosen the mineral sufficiently to cause the same to fall away from the upper mine face portion.

In accordance with the prior art techniques, mining planers for the extraction of coal or other minerals and angularly supported to a given angle to the mineral seam being worked, depending upon the positioning of the cutting means thereon. Especially with respect to coal planers, the same attack with their cutting tools only a portion of the height of the seam. Depending upon the thickness of the seam, a more or less large portion of the coal or other mineral in the seam is loosen and fall by its own weight. In the case of hard coal seams, and especially those hard coal seams containing baked-on coal, i.e. hard spots in the coal face of a dense consistency which will not normally loosen and break apart by their own weight, however, an overhang remains above the lower portion of the seam previously extracted with the mining planer, and such overhang or upper seam portion is usually extracted or won manually. Various proposals have been set forth previously in an attempt to extract the upper portion of the mine face, particularly where baked-on hard spots are present, by providing a combination of apparatus including a coal planer to extract the lower seam portion of the mine face in the normal manner and a coal auger or similar tool to extract or cut away the higher coal, i.e. the upper seam portion in the coal face. Especially designed coal planers have also been introduced in practice, in which cutting tools or chisels are provided which extend toward the coal face in such a manner that the mineral may be extracted from the seam all the way to the mine roof. The use of auxiliary equipment and supplementary techniques to achieve the extraction of the upper portion of the mine face being worked is encountered more often where the mine face represents a mineral seam or coal seam of an extra great height, i.e. a height which is too extensive to be efficiently worked by a normal mining planer under the conditions which must be expected in a mine.

It is an object of the present invention to overcome the drawbacks of previous arrangements and techniques for the mining or recovery of the upper portion of the mine seam being worked, and to provide a method of operation and arrangement of mining equipment sufficiently effective to achieve the extraction of mineral such as coal throughout the height of the mine seam, even where baked-on hard spots in the coal face of dense consistency are present.

It is another object of the present invention to provide a method in which the lower portion of the mine face is extractively engaged by a mining planer to provide an overhang of the upper portion of the mine face which is deprived of its undersupport, and thereafter to direct against such overhang, at spaced apart intervals thereof, high pressure water jets in slightly overlapping range to loosen the mineral sufficient to cause the same to fall away from the upper mine face portion.

It is another object of the present invention to provide in conjunction with a mining planer normally conducted along a mining conveyor in the long wall mining of material, a plurality of high pressure water guns artificiately mounted on the mining conveyor at the side thereof remote from the mine face, with such water guns being arranged for limited pivoting about both a horizontal and a vertical axis to achieve the direction of high pressure water jets against the upper portion of the mine face to loosen the mineral in the desired manner.

It is still another object of the present invention to provide a supply conduit or water pipe for the water guns in a convenient manner and without the requirement for additional constructional arrangements which would unduly occupy available space at the site of mining operations.

It is a further object of the present invention to provide for the extraction of mineral from a mine face throughout its entire height, especially where baked-on hard spots of dense consistency in the mineral seam are encountered, in a simpler manner than was possible heretofore, and without the significant expenditures necessitated by the provision for a combination mining planer and auger apparatus.

It is a still further object of the present invention to provide by hydraulic means the automatic completion of the extraction of mineral from the upper portion of the mine face after the lower portion thereof has been extracted by a mining planer in the normal way, with high pressure water jets being directed against such mine face upper portion in overlapping way, whereby a continuous loosening and removal of coal or other mineral will take place throughout the longitudinal extent of the upper portion overhang.

Other and further objects of the present invention will become apparent from the study of the within specification and accompanying drawings.

It has been found, in accordance with the present invention, that mining equipment for the extraction of mineral from the upper portion of a mine face may be provided in conjunction with a mining planer which is conducted back and forth along the lower portion of such mine face on longitudinally extending guide means adjacent the mine face being worked for the extraction of mineral from such lower portion of the mine face. The mining equipment comprises at least two longitudinally spaced apart high pressure water guns artificiately mounted on such guide means for limited pivoting about both a horizontal axis and a vertical axis to direct high water jets against the upper portion of the mine face to loosen the mineral sufficiently to cause such loosened mineral to fall away from such upper mine face portion. The water guns are spaced apart on the guide means a linear distance permitting at least slight overlap in the range of water jets of correspondingly adjacent water guns.

Preferably, the guide means in accordance with one embodiment of the present invention takes the form of a mining conveyor, such as a double chain scraper conveyor of the conventional type, and the water guns are mounted on the longitudinal side of the mining conveyor remote from the mine face, the mining planer on the other hand being mounted for movement on the conveyor on the side thereof adjacent the mine face. Advantageously, a substantially horizontally extending water pipe is attached to the conveyor on the side thereof remote
from the mine face in order to supply water under high pressure for the water guns. In particular, each water gun has a collar at one end outwardly enclosing the water pipe and movable about the axis of such pipe, and a nozzle at the other end pivotable about a vertical axis, such collar flow communicating the water pipe with the gun and in turn said gun flow-communicating said collar with the nozzle. The nozzle is preferably pivotable about said vertical axis through a limited angle of pivot, while the gun including such nozzle is pivotable horizontally about the pipe axis through a limited angle of pivot, such that the extent of the limited pivoting is sufficient for the water jets to be played upon at least the upper portion of the mine face, and to a lateral degree at least slightly more than half the distance of the mine face portion extending between adjacent water guns.

In the accompanying drawing:

FIG. 1 is a schematic longitudinal end view of a mining arrangement in accordance with the present invention particularly.

FIG. 2 is a schematic plan view of the mining arrangement of FIG. 1, illustrating the positional relationship between the water guns on the one hand and the mining planer on the other hand, as well as the lateral range of the water jets of the water guns of the present invention.

Referring to the drawing, FIG. 1 shows a mining conveyor 1 having a central plate 2, a side wall 3 adjacent the mine face, and a side wall 4 remote from the mine face, the central plate 2 being connected to the side walls 3, 4 intermediate their height such that the same is spaced from the mine floor 5. The conveyor 1 may be of the double chain scraper conveyor type as is disclosed fully in U.S. Patent 2,745,651. On the mine face side of the conveyor a ramp 6 is positioned which is fixedly attached to the side wall 3 so that the bottom portion of ramp 6 will rest upon mine floor 5. Ramp 6 is provided with a lower groove 7 longitudinally therealong and an upper crest 8 attached to the upper portion of side wall 3 whereby to provide an upper groove 9. A mining planer 10 of the conventional type having a lower extension 11 and an upper extension 12 is positioned on ramp 6 with lower extension 11 slidably received in lower groove 7 and with upper extension 12 slidably received in upper groove 9. Accordingly, a traction cable means such as a chain 13 may be attached at its ends to the upper extension 12 such that an endless chain arrangement is provided with the forward chain portion 13 riding along the upper groove 9 coincident with the return chain portion 14 riding along the return groove 15 located in the hollow central section of the ramp 6. The drive chain is looped at the longitudinal ends of the mine face over appropriate drive wheels such as sprocket wheels so that the planer 10 may be conducted in the desired longitudinal manner back and forth along the mine face with the cutting tools 16 thereof in extractive engagement with the lower portion 17 of the mine face. Such drive means for the traction cable or chain are indeed well known and a particular drive chain arrangement, including sprocket wheel assemblies is shown in U.S. Patent 2,691,514.

Nevertheless, the upper portion 18 of the mine face being worked is not reached by the highest projections of the cutting tools 16 and an overhang of the upper portion of the mine seam between the mine floor 5 and the mine roof 19 remains. Such upper portion will often contain bordered hard spots of dense consistency in the coal face or mine face and these portions of the overhanging coal or other mineral will not break up and fall of their own weight. Accordingly, another manner of extracting this portion of the mine seam must be utilized. Systems heretofore employed included the use of a roof cutting machine mounted on a mining planer similar to the type shown in FIG. 1, or on a base means movable back and forth along the ramp 6, or on the top inwardly directed flange portions of the conveyor side walls 3, 4. In accordance with the present invention on the other hand, an entirely different manner of extracting the overhanging roof coal or roof mineral making up the upper portion of the mine face 18, which involves the use of water guns is provided.

In this connection, as the planer 10 exposes a new part of lower portion 17 of the mine face, the entire arrangement of the conveyor including the ramp guide means and the planer must be urged transversely in order to clear the newly exposed other face part in order to maintain the cutting tools 16 in extractive operative engagement with such mine face. To accomplish this end, an urging means is employed which includes the bracing pit prop 20 (partially shown in FIG. 1) which is adapted to extend between the mine floor 5 and the conveyor 1 and the piston 22 operating therewith against rearward displacement in a direction away from the mine face 17. The free end of the piston 22 in the form of a rod is pivotally linked by pin 32 to a lug 33 attached to the side wall 4, i.e. remote from the mine face. Accordingly, as the piston rod 22 extends outwardly from cylinder 21, the conveyor 1 including the ramp 6 is urged toward the mine face in the desired manner. This may be seen more clearly in FIG. 2 wherein spaced apart bracing props and urging piston cylinder means are situated so as to effect the transverse movement of the conveyor toward the mine face in increments along the longitudinal extent of the apparatus.

With particular regard to the improved features of the present invention, a water gun 23 having a nozzle 24 is provided which is mounted via a collar 27 on a water pipe 26 which supplies water under high pressure to water gun 23. The collar 27 encloses completely a portion of the pipe 26 in a manner permitting limited rotational movement of collar 27 with respect to pipe 26. Accordingly, the operator may grasp the handle 25 of nozzle 24 and swivel the water gun 23 about the axis of pipe 26 to cause the water jet 24' issuing from nozzle 24 to have a range in vertical direction determined by the angle between the dot-dash lines representing the limits of the water jet where the nozzle is in the positions 24a and 24b, respectively, as shown partially (in phantom) in FIG. 1. Such vertical range will permit the water gun to work against the entire area of the overhanging upper portion of the mine face, whereby to cause by the extreme hydraulic pressures utilized, a loosening of the top coal or roof coal or other mineral, such that parts will break off and fall eventually into conveyor 1, if not immediately upon the next passage longitudinally of mine planer 10 along the mine face. As the artisan will appreciate, the longitudinal movement of a mining planer of the instant type along a mine face will cause the plowing of loosened mineral to be carried out toward the site of mining operations. Thus the workmen will not suffer any decrease in the usable space at the mine site which
might hamper their activities. Naturally, it is preferable to mount the water pipe 26, and in the spaced apart water gun nozzle on either side of, the opening permitting the nozzle 24 to play a water jet 24 upon the overlapping upper mine face portion in the most direct manner possible. For this purpose, the brackets 29, carrying the water pipe 26 are mounted at a level above the upper end of the side wall 4 on conveyor 1 by reason of the presence of the bumper plate 30, the lug 33 to which the urgent piston cylinder arrangement 22, 21 is pivotally connected, is attached to side wall 4 therethrough.

It will be seen in FIG. 1 that the water in pipe 26 may also be used, if desired, to energize the piston cylinder arrangement 22, 21 by the flow line 34, controlled by the valve control 35. Under the pressure in pipe 26, water may be passed suitably through a conduit in the interior of the piston rod 22 to each side of the cylinder separated by the piston therewithin. A double acting piston is suitably employed such that pulsating fluid such as water introduced on one side of the piston within the cylinder will cause displacement of the piston in one direction, and pressure fluid introduced into the cylinder portion on the other side of the piston will cause displacement of the piston in the opposite direction. Indeed, after the piston cylinder 22, 21 is built up in line with the directed flow, a continuous extraction in the direction toward the mine face, the cylinder is caused to move forward over the already advanced piston rod dragging along therewith the braising prop 20 which has meanwhile been released from supporting engagement with the mine floor and mine ceiling. Once the forward moving or mounting plate has been completed, the blast pit prop 20 is again extended into engagement with the mine floor and mine ceiling, whereupon after the next part of the coal or other mineral has been exposed by the operation of the mining planter, the piston rod 22 will be in the desired position to permit displacement thereof from the cylinder 21 to cause the next advancing step to be effected.

It may be seen in FIG. 2 that the water pipe 26 extends longitudinally along the conveyor at the side thereof remote from the mine face, i.e. remote from the side where the mining planter 10 is conducted along ramp 6. No significant loss of space to the workmen will be entailed by the presence of pipe 26 or the spaced apart water guns 23 mounted thereon, and by the spacing of the water guns at a predetermined distance apart and by the utilization of appropriate angles of pivot in horizontal direction the arrangements at a minimum span covering range of the next adjacent water gun. This will be appreciated from the dot-dash lines indicating the maximum range of pivot in horizontal direction of the nozzle 24 shown schematically in phantom in the positions 24c and 24d. This arrangement permits extreme lateral angles of attack of the water jet with respect to the mine face to be enjoyed. When considering the vertical sweep of the water jet between the nozzle positions 24a and 24b together with the horizontal sweep of the water jet between the positions 24c and 24d of the nozzle, it will become clear that a versatile water gun arrangement is provided which will effectively loosen and cause the removal of coal or other mineral from the entire area of the particular mine face portion adjacent the particular water gun, with marginal areas of the mine face farthest from a particular water gun being within the range of both adjacent water guns 23 mounted upon the conveyor of the water jet played upon the marginal mine face areas may be less than that exerted on the mine face portion directly before the water gun, such marginal areas are served, in fact, by two water guns and thus two water jets, which together will accomplish the same result as is achieved by a single water gun jet played upon the mine face area. Naturally, the positioning of the water guns a certain distance from the mine face being worked will permit an optimum closeness of the water jet to the mine face area being attacked thereby, yet the distance between the mine face overhang and the water gun nozzle will be such that a sufficient lateral section of mine face may be loosened and the high pressure water gun to render the employment of a plurality of spaced apart water guns efficient and economical to operate. Since the urgent means 22, 21 will maintain the conveyor at approximately the same distance from the mine face at all times, the water guns of the invention will be similarly maintained. Because of the presence of the bumper plate 30, the lug 33 to which the urgent piston cylinder arrangement 22, 21 is pivotally connected, is attached to side wall 4 therethrough.

Thus, in accordance with the present invention, the upper portion of the mine seam may be expediently loosened and removed without costly expenditures which would be necessary by the employment of a combination mining planter and auger and/or other mechanical means of mining the upper portion of the mine seam. If desired, the water guns may be arranged for automatic operation or for operation in unison, as for example where other adjacent water guns are articulated in the same direction at the same time and thereafter moved slowly in the opposite direction to provide a full sweep of adjacent high pressure water jets against the overlapping coal. Since the water jets overlap somewhat in their range, there will be no residual roof coal remaining after the desired water jet extraction technique has been utilized. An uninterrupted, continuous attack of the mine face is therefore, possible in accordance with the present arrangement and method, and after each pass of the mining planer in the normal way, the water jets may be employed to maintain efficient advancement of the conveyor system toward the newly exposed mine face with a more or less even extraction of material from the lower and higher mine face portions. Since the water guns are located on the guide means arrangement for the mine planer, the same will always be located at the correct distance from the mine face and will automatically always be advanced as the mining equipment itself is advanced. Little regard may be had for thick and tough materials, for example, as the high pressure water jets contemplated will be sufficient to disintegrate the upper coal face portion even though lumps of coal or other mineral which may fall may themselves be hard and tough. Such hard and tough lumps may be crushed to the desired size by manual or mechanical means well known in the art. The hydraulic power of the water jets in practice will effectively disturb the integrity of overlapping roof coal robbed of its undersupport, thus making the present invention particularly versatile and applicable universally in mining operations, and the expenditure of capital for and operating purposes.

It will be appreciated that the specification and drawing have been set forth for the purpose of illustration and not limitation, and that various modifications may be made in accordance with the present invention without departing from the spirit and scope thereof, the present invention being limited only by the scope of the appended claims.

What is claimed is:

1. Mining equipment for the extraction of mineral from the upper portion of a mine face, in conjunction with a mining planer which is conducted back and forth along the lower portion of such mine face on a substantially extending guide means adjacent the mine face being worked for the extraction of mineral from such lower portion of the mine face, which comprises at least two longitudinally spaced apart high pressure water guns articulatedly mounted on such guide means, and being spaced remotely from such mining planer, for limited pivoting about both a horizontal axis and a vertical axis to direct high pressure water jets against the upper portion of the mine face to loosen the mineral sufficiently to cause such loosened material to fall away from such upper mine face portion, said water guns being built up in line with the marginal mine face area of the water gun, a linear distance in the longitudinal direction of said guide means permitting at least slight overlap in the range of the water jets of correspondingly adjacent water guns.
2. Mining equipment according to claim 1, wherein such guide means is a mining conveyor and said water guns are mounted on the longitudinal side thereof remote from the mine face, and such planer is mounted for movement on said conveyor on the side thereof adjacent the mine face.

3. Mining equipment according to claim 2, wherein a substantially horizontally extending water pipe is attached to said conveyor on the side thereof remote from the mine face to supply water under high pressure for said water guns, each said water gun having a collar at one end outwardly enclosing said pipe and rotatable about the axis of said pipe, and a nozzle at the other end pivotable about a vertical axis, said collar flow communicating said pipe with said gun and in turn said nozzle.

4. Mining equipment according to claim 3, wherein said nozzle is pivotable about said vertical axis through a limited angle of pivot, and said gun including said nozzle is pivotable horizontally about the axis of said pipe through a limited angle of pivot, the extent of such limited pivoting being sufficient for the water jets to be played upon at least the upper portion of the mine face and to a lateral degree at least slightly more than half the distance of the mine face portion extending between adjacent water guns.

5. In a mining arrangement for the extraction of mineral from a longitudinally extending mine face, including a longitudinally extending mining conveyor positioned with one side thereof adjacent the mine face being worked and a mining planer mounted on the mine face side of said conveyor for back and forth movement therealong for the extraction of mineral from the lower portion of the mine face, the improvement for the extraction of mineral from the upper portion of such mine face in conjunction with the extraction of the mine face lower portion by such mining planer which comprises a plurality of longitudinally spaced apart high pressure water guns articulately mounted on the side of such mining conveyor remote from the mine face for limited pivoting about both a horizontal axis and a vertical axis to direct high pressure water jets against the upper portion of the mine face to loosen the mineral sufficiently to cause such loosened mineral to fall away from such upper mine face portion, said water guns being spaced apart on said conveyor a linear distance permitting slight overlap in the range of the water jets of correspondingly adjacent water guns and being spaced remotely from said mining planer and operable independently thereof.

6. Mining arrangement for the extraction of mineral from the upper and lower portions of a longitudinally extending mine face, which comprises a longitudinally extending mining conveyor positioned with one side thereof adjacent the mine face being worked and a mining planer mounted on the mine face side of said conveyor for back and forth movement therealong for the extraction of mineral from the lower portion of the mine face, a plurality of longitudinally spaced apart high pressure water guns articulately mounted on the side of said mining conveyor remote from the mine face for limited pivoting about both a horizontal axis and a vertical axis to direct high pressure water jets against the upper portion of the mine face to loosen the mineral sufficiently to cause such loosened mineral to fall away from such upper mine face portion, said water guns being spaced apart on said conveyor a linear distance permitting slight overlap in the range of the water jets of correspondingly adjacent water guns and being spaced remotely from said mining planer and operable independently thereof, and a water pipe extending substantially horizontally along said mining conveyor on the side thereof remote from the mine face to supply water under high pressure for said water guns.

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