60 of 172 DOCUMENTS

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Method and Apparatus for Remote Mining in Low Seams

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ENGLISH-ABST:

A remote mining system utilizes extensible belt conveyor supported by belt support units and is suitable for operation in very low mining seams. The launch platform contains sufficient storage of conveyor belt for deep penetration into a very low seam. The mining machine is retrieved onto the platform but remains connected to the extensible belt conveyor at all times.

NO-OF-CLAIMS: 20

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PARENT-PAT-INFO:

CONTINUITY DATA

[0001] Priority is hereby claimed by provisional application 60/595,241 filed on Jun. 17, 2005.

SUMMARY:

Field of the Invention

[0002] The present invention relates generally to mining and specifically to remote mining of bedded mineral deposits.

BACKGROUND OF THE INVENTION

[0003] Known methods of remote mining in bedded mineral deposits such as coal seams employ a mining machine that excavates mine openings to some distance from the seam exposure on the surface and means of conveying are required to transport the excavated material to the surface. In most of the present systems, conveying machines consisting of multiple conveyors are advanced into the mine openings from the surface. For example, U.S. Pat. Nos. 5,112,111, 5,232,269 and 5,261,729 to Addington at al. disclose an assembly of conveyors and a mining machine advanced into the seam without interrupting the flow of aggregate material by separate means designed to pull at the forward end and push at the rearward end. Similarly, U.S. Pat. No. 5,609,397 to Marshall at al. discloses an assembly of conveyors interconnected with a mining machine and a driving device located outside the seam and consisting of rack and pinion or, alternately, reciprocating cylinders, linear tracks, linear or rotary drives, chains, cables or other mechanical devices. The U.S. Pat. 5,692,807 to Zimmerman discloses a guidance assembly for extending and retracting an assembly of conveyors in and out of the seam. The U.S. Pat. 3,497,055 to Oslakovic at al. discloses a multi-unit train of conveyors having a self-propelled unit at each end coupled to intermediate units, each end unit being capable of towing the intermediate units. The U.S. Pat. 2,826,402 to Alspaugh at al. discloses a train of wheeled conveyor sections pulled into the mine opening and pushed out of it by a self-propelled mining machine. Buckling of the train is avoided by the grooves made by the mining machine in the floor, said grooves spaced the same distance as the treads of the wheels carrying the conveyor sections. The U.S. Pat. 6,220,670 to Mraz discloses a train of self-propelled conveying units capable of advancing or retreating in the seam on its own power. The U.S. Pat. 5,299,674 to Cusitar discloses belt support cars for an extensible belt conveyor system which are connected by horizontally pivoting joints and being movable from tangential direction to an axial position for the support of the upper and the lower strands of the extensible conveyor.

[0004] In the present systems that utilize multi-unit trains of conveyors, the interconnected combination of the mining machine and a conveying assembly comprising a plurality of conveyors is advanced into the seam from a launch vehicle located on the outside. When the present mining hole is completed and the train of conveying units retreats from the seam, it is gradually disassembled and the mining machine is moved onto the launch. The launch with the mining machine then moves to the next mining hole. As the conveying assembly consists of a plurality of conveyor units, each of the individual conveyors requires a substantial headroom space for transfer of material from each conveyor unit to the next. This makes it impractical to design a belt conveyor system that would fit into seams that are less than 34 inches thick. It would be therefore desirable to utilize an endless extensible belt conveyor supported by belt support units. Such system would allow mining seams that are, at minimum, 24 inches thick or less. However, in the system proposed by Cusitar Pat. No. 5,299,674, the belt support cars would have to move to the side without entering the platform and the mining machine would have to move on its own power to the next mining hole on the highwall mining bench. The soft and muddy highwall mining bench would make such a system impractical in most mining environments. Even on exceptionally firm highwall mining bench, handling of the belt support car assembly and the

mining machine on the highwall mining bench would require excessive time and manpower. Such arrangement would also require disconnecting and reconnecting the mining machine with the extensible belt conveyor, which would further reduce productivity of the operation. It would be therefore desirable to utilize an endless belt conveyor supported by belt support units that could be assembled and disassembled similarly as the present conveyor units. It would be also desirable to move the mining machine onto the launch utilizing an endless extensible belt conveyor and move the launch as required with the mining machine on it. And, it would be desirable for the mining machine to remain connected to the extensible belt conveyor at all times.

SUMMARY OF THE INVENTION

[0005] Accordingly, it is the object of the present invention to provide a method and apparatus for connecting the mining machine to the endless extensible belt conveyor without the need of disconnecting the belt from the mining machine during the repositioning of the highwall mining launch.

[0006] Another object of the present invention is to provide a method and apparatus for retreating or advancing the mining machine on the launch without disconnecting the belt from the mining machine.

[0007] Another object of the present invention is a method and apparatus of aligning the belt with the mining machine while retreating or advancing the mining machine on the launch and using the same apparatus for steering the mining machine while advancing the mining machine into the mining hole.

[0008] Another object of the present invention is a method and apparatus of adding and removing belt support on the launch.

[0009] Another object of the present invention is a method and apparatus of advancing the mining machine into and retrieving it from the mining hole.

DRWDESC:

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is a plan view of the highwall mining launch according to the preferred embodiment of the present invetion with the mining entering the mining hole.

[0011] FIG. 2 is a cross sectional view taken along the line A-A of FIG. 1, with the mining machine located on the launch before it enters the mining hole.

[0012] FIG. 3 is a cross sectional view taken along the line A-A of FIG. 1, with the mining machine located at the start of the mining hole.

[0013] FIG. 4 is a cross sectional view taken along the line A-A of FIG. 1, with the mining machine located at the start of the mining hole and the first belt support structure unit inserted onto the launch.

[0014] FIG. 5 is a cross sectional view taken along the line A-A of FIG. 1, with the mining machine located at the start of the mining hole and the first belt support structure unit connected to the mining machine.

[0015] FIG. 6 is a cross sectional view taken along the line A-A of FIG. 1, with two belt support structure units connected to the mining machine.

[0016] FIG. 7 is a side view of the mining machine and the belt support structure units in the mining hole.

[0017] FIG. 8 is a side view of the belt support structure unit.

[0018] FIG. 9 is a view of the belt support structure taken along the line B-B of FIG. 8 with a cantilever support bracket in a closed position.

[0019] FIG. 10 is a view of the belt support structure taken along the line B-B of FIG. 8 with a cantilever support bracket in an open position.

DETDESC:

DETAILED DESCRIPTION OF THE INVENTION

[0020] Referring to FIGS. 1 through 7, a highwall mining launch 1 operates in the vicinity of a highwall 2 containing a seam 3 on a highwall mining bench 4. A mining machine 5 is advanced from the launch 1 into the seam 3. The launch 1 includes the launch deck 6, means of propel 7, an assembly of belt storage magazines 8, a hydraulic power unit 21, an electrical substation 22, a power cable winder 23, a water hose winder 24 and a control cable winder 24. An endless conveyor belt 8 is wound trough a belt drive 9 around deflection rollers 16, 17, 17a and 17b, through the belt storage unit assembly, around the tail roller 32 and through telescopic idlers 13. The tail roller 32 is mounted within a tail piece 18 connected to the mining machine 5 with cylinders 19. When a belt support unit 20 is inserted onto the lauch deck 6, the upper belt 8a runs over the telescopic idlers 13 and the lower belt 8b runs through the belt support unit 20.

[0021] When the mining machine 5 is retrieved from the seam 3 onto the launch 1, the belt 8 remains wound around the tail roller 32 and the telescopic idlers 13 are contracted at the far end of the rail 14. When the launch 1 moves to a new mining position, pusher plates 26a on the tail piece 18 are engaged by pushers 25 connected to endless chains 27 engaged with the chain drive sprockets 28 and the tail sprockets 29. The mining machine 5 is moved toward the highwall 2 and begins excavating in the seam 3. The excavated material is transferred from the mining machine 5 into the tail unit 18. As the mining machine 5 advances into the seam 3, the telescopic idlers 13 are spaced along the path of the upper belt 8a. The hydraulic cylinders 19 that connect the tail unit 18 with the mining machine 5 are actuated as required to steer the mining machine 5.

[0022] When the mining machine 5 clears the launch deck 6, the belt deflection roller 17b is lifted and this lifts the lower belt 8b to provide room for the insertion of the belt support unit 20 onto the launch deck 6. After the belt support unit 20 is inserted onto the launch deck 6, pusher bars 26 on the belt support unit 20 are engaged by pushers 25 connected to endless chains 27 engaged with the chain drive sprockets 28 and the tail sprockets 29. The deflection roller 17b is lowered to allow the passage of the belt support unit 20, which is pushed toward the tail unit 18 and connected to the tail unit 18 with connectors 35.

[0023] As the mining machine 5 is advanced into the mining hole 3a within the seam 3 by forward motion of pushers 25, the cylinders 19 connecting the tail unit 18 with the mining machine 5 are actuated as required to steer the mining machine 5 in the desired direction. The upper belt 8a gradually settles onto the top of the belt support unit 20.

[0024] When the mining machine 5 is advanced into the seam 3 by the length of one belt support unit, the belt deflection roller 17b lifts the bottom belt 8b, another belt support unit 20 is inserted onto the launch deck 6 and connected to the previous belt support unit 20 with the connectors 35.

[0025] Referring to FIGS. 8 through 10, the belt support unit 20 consists of the frame 20a, the cantilever beams 20b, main beams 20c and support wheels 36. The cantilever beams 20b carry troughing belt idlers 33 and the frame 20a carries return belt idlers 34. The structural pockets 37 provide means for handling the belt support unit 20 with a fork lift or a front-end loader. During the insertion of the belt support unit 20 onto the launch deck 6, the swingable support

brackets 38 are lifted out of the way in order to insert the bottom belt 8b between the frame 20a and the cantilever beams 20b and than re-engaged in order to support the upper cantilever beams 20b during the operation. The upper belt 8a is supported by the troughnig idlers 33 mounted on the cantilever beams 20b and the lower belt 8b is supported by the return idlers 34.

[0026] The foregoing preferred specific embodiment has been shown and described for the purpose of illustrating the functional and structural principles of this invention and is subject to change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

ENGLISH-CLAIMS:
Return to Top of Patent

What is claimed is:

1. A method of remote mining and conveying with an endless conveyor comprising: connecting mining means to a tail roller of an endless conveyor; advancing said mining means from a launch platform into a seam by pushing said tail roller while releasing belt stored within a belt storage means; inserting belt support units within said endless conveyor and connecting them to said tail roller and to one another to form a belt support train; advancing said belt support train into the seam while releasing belt stored within a belt storage means; on completion of a mining hole, pulling said belt support train out of the seam; removing said belt support units while re-storing said belt within said belt storage means; repositioning said mining means on said launch platform while it remains connected to said tail roller; moving said launch platform to the next mining hole; advancing said mining means into said next mining hole.

2. A method according to claim 1, where said mining means and said tail roller are connected with an advancing means and said mining means is advanced independently of said belt support train.

3. A method according to claim 1, where said mining means and said tail roller are connected with a steering means and said mining means is steered with respect to said belt support train.

4. A method according to claim 2, where said mining means and said tail roller are connected with an advancing means and said mining means is advanced and steered with respect to said belt support train.

5. A method according to claim 2, where said advancing means is capable of bracing itself within said mining hole and said belt support train is advanced into said mining hole by pulling with said advancing means.

6. A method according to claim 2, where said advancing means is capable of bracing itself within said mining hole and said belt support train is advanced into said mining hole by a combination of pulling with said advancing mans and pushing from the launch platform in order to avoid buckling of said belt support train.

7. An apparatus for remote mining and conveying with an endless extensible conveyor, comprising: mining means for remote excavating of material from a seam; endless belt conveyor with a drive; means of storing and releasing conveyor belt; movable tail roller unit of said endless conveyor; means of connecting said tail roller unit to said mining means; means of inserting belt support means within said endless conveyor and connecting it to said tail roller unit or to another said belt support means; and means of advancing or retrieving said mining means within said seam by pushing or pulling on said tail roller unit or said belt support means.

8. The apparatus according to claim 7, where the means of belt storing and releasing is at least one belt storage magazine.

9. The apparatus according to claim 8, where said belt storage magazine is disposed vertically.

10. The apparatus according to claim 7, where said means of connecting said tail roller unit is at least one hydraulic

cylinder.

11. The apparatus according to claim 7, where said means of connecting said tail roller contains at least one set of bracers capable of bracing said connecting means within a mining hole.

12. The apparatus according to claim 7, where said means of advancing or retrieving is at least one endless chain puller.

13. The apparatus according to claim 7, where said means of advancing and retrieving is at least one hydraulic cylinder.

14. An apparatus for supporting an endless extensible conveyor in remote mining, comprising: fabricated frame; means of engagement of said apparatus with the ground; means of supporting the upper and the lower strand of said endless extensible conveyor; horizontally disposed cantilever beams allowing the insertion of said apparatus over and under said lower strand of said endless extensible conveyor; means of connecting said apparatus in a multi-unit train; means of engaging a pushing means; and means of handling said apparatus with mobile equipment.

15. The apparatus according to claim 14, where said means of engagement with the ground are free-wheeling wheels.

16. The apparatus according to claim 14, where said means of engagement with the ground are skids.

17. The apparatus according to claim 14, where said means of supporting said conveyor belt are rollers.

18. The apparatus according to claim 14, where said cantilever beams are supported by one or more swingable brackets which provide a structural reinforcement of said cantilever beams while allowing insertion of said belt.

19. The apparatus according to claim 14 whose overall height is 20 inches or less.

20. The apparatus according to claim 15, where said means of engaging is combined with an axle connecting said wheels.

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