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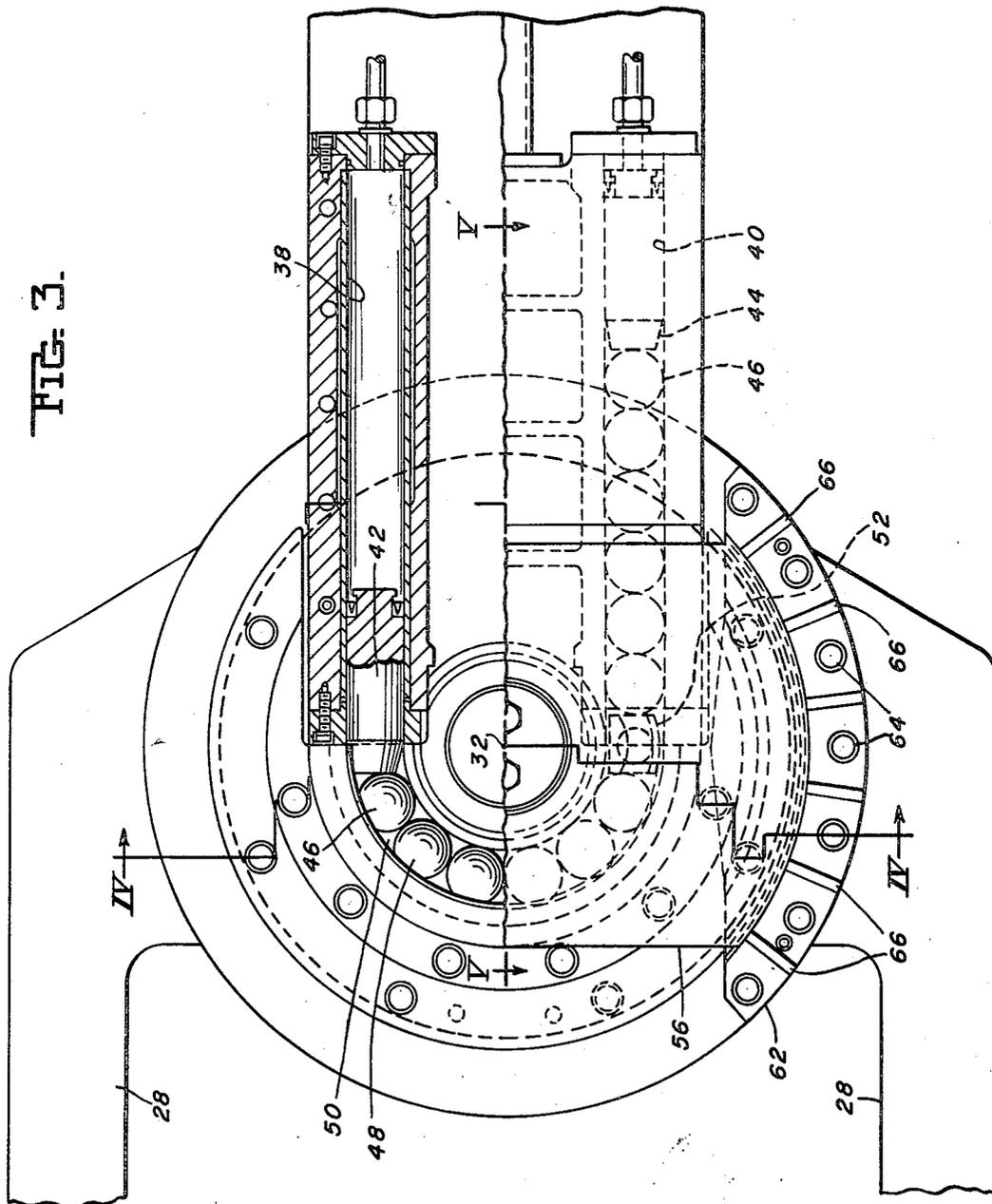
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LONGWALL MINING APPARATUS

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3 Sheets-Sheet 2

FIG. 3.



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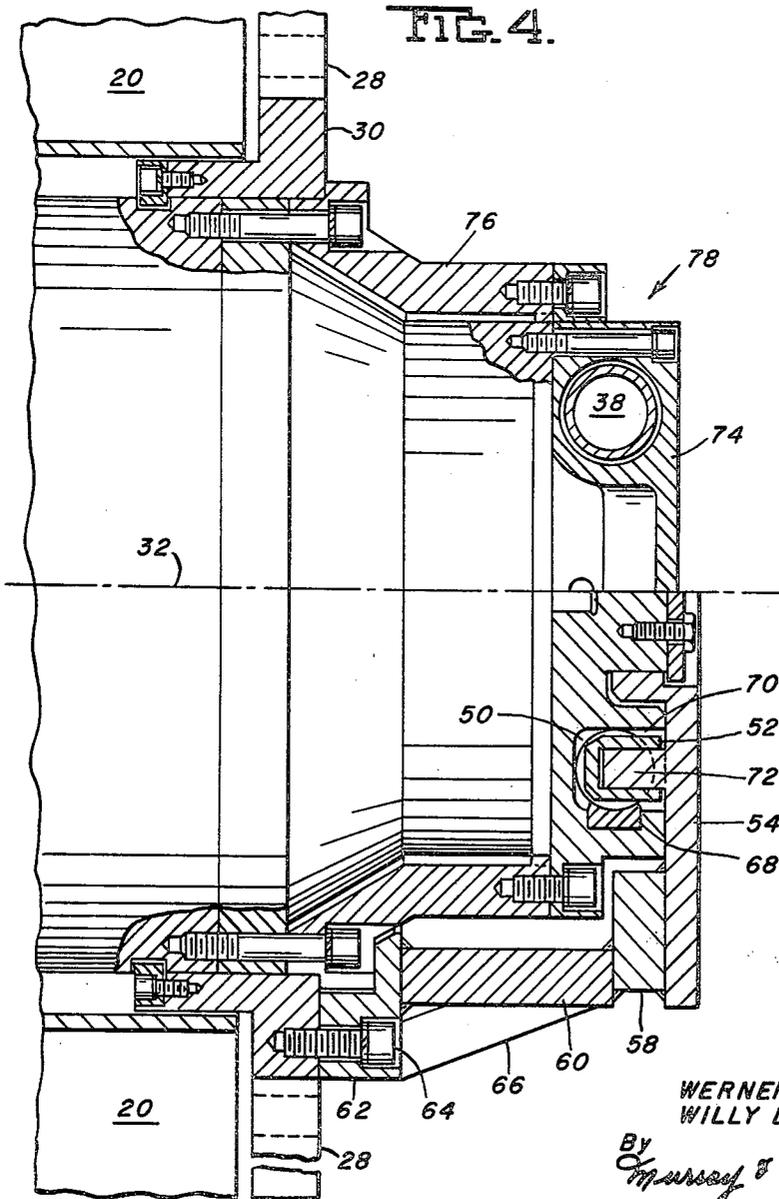
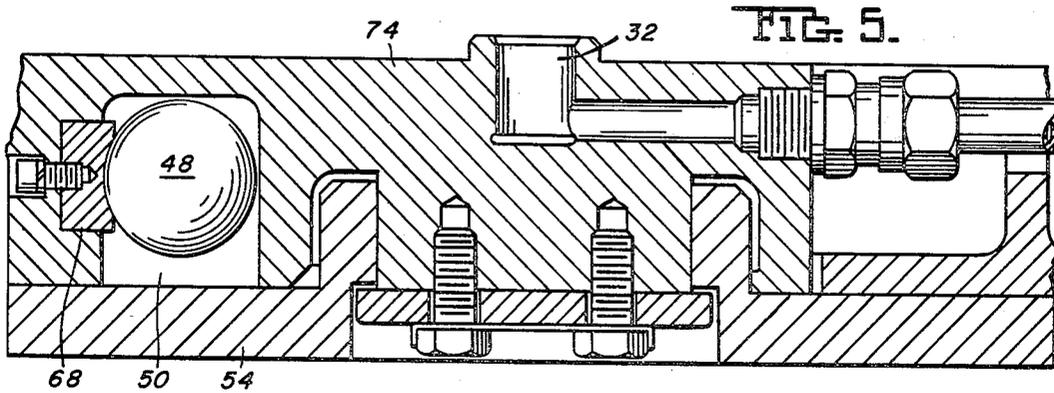
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1

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LONGWALL MINING APPARATUS

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4 Claims

2

ABSTRACT OF THE DISCLOSURE

This patent discloses a roll cutter for use in longwall mining that is provided with a bucking plate. Convenient, compact power-operated means for swinging the bucking plate from one side of the roll cutter to the other are disclosed, these comprising an articulated power-transmitting mechanical means connected to the bucking plate and traveling in a semicircular path about the pivot axis with respect to which the bucking plate turns, the articulated means being powered by hydraulic cylinders of relatively short stroke. Also disclosed is a bucking plate having a portion which may be pivoted through 90°, to avoid contact with the arm by means of which the cutter rollers are moved up and down, when placing the bucking plate on the same side of the axis of the cutter roll as that arm.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to longwall mining apparatus.

Description of the prior art

In the longwall mining of coal or other minerals, it is usual to provide a conveyor that runs generally parallel to the face to be cut and a cutter having a rotary drum that sweeps along the surface of the mineral face to be cut, dislodging mineral therefrom and, preferably, also urging it toward the conveyor. Longwall mining differs from room-and-pillar mining in that instead of so cutting the mineral as to leave a number of pillars to place to support the mine ceiling, a cut is taken along a face, and then, the conveying means and its associated roof support are moved toward the face that has just been cut, and the cutter then traverses the face in the opposite direction, dislodging additional mineral; no support is provided for the roof in the areas that have been mined.

From this it will be understood that it is essential, for convenient operation, for the cutter to be capable of moving in either direction along the face which it cuts—that is, either from right to left or from left to right, looking down upon the operation.

Various practices or means are known for insuring that substantially all of the dislodged mineral is received by the conveying means. This can be done manually, by means of motorized shovels, or by means of a bucking plate. A bucking plate is rather a heavy structure that extends between the newly cut face and the conveying means and is arranged to follow behind the cutter roll and urge the mineral that it has dislodged into the conveying means.

The reversal of the position of a bucking plate at the end of one traverse of the cutter along the face of mineral

being cut has presented problems. If the reversal of position, is done manually, hard and time-consuming physical work is required. Power-operated means for changing the position of the bucking plate are known. For example, pressure cylinders have been provided at the face wall of the cutter. They bring the bucking plate to the desired side of the cutter roll with a rope cable. Moreover, both pressure cylinders act on both cable rope ends with the ends of their piston rods. If one of the two cylinders is under pressure, it brings about a swining motion of the bucking plate by means of the cable rope, which is wound many times around a circular projection of the support of the bucking plate.

It is also known to swing a bucking plate with the use of a single pressure cylinder of the double-acting kind. This pressure cylinder is placed to pivot at the face wall of the cutter and can be made to bring the bucking plate to the other side of the cutter roll in two stages. This takes two strokes, since the 180° angle of traverse cannot be executed in a single stroke because of the limitation on pressure-cylinder length imposed by the narrow space available.

The prior art has lacked a convenient and compact swiveling mechanism that may be hydraulically operated and is particularly suited for the turning of a bucking plate in roll cutters for longwall mining.

Roll cutters are frequently made in each a way that the cutter roll is mounted on an arm that is located between the conveyor and the face to be mined and turns about a pivot so that the cutter roll may be moved up and down; otherwise, the swath cut by the roll cutter would be limited to the diameter of the cutter roll. This poses a problem with the bucking plate, however. Prior to the present invention, it has been the practice either to limit the length of the bucking plate so that it may be swung from one side of the cutter roll to the other without coming into contact with the above-mentioned arm, or not to provide for turning of the bucking plate. The former has the drawback that a portion of the mine floor is left unswept, and the latter has the drawback that motion of the roll cutter is limited to one direction of traverse.

SUMMARY OF THE INVENTION

This invention overcomes the above-indicated problems by providing a roll cutter having a bucking plate which may be moved from one side to the other of the roll cutter by means of an articulated power-transmitting mechanical means which is connected to the bucking plate and travels in a semicircular path about the pivot axis with respect to which the bucking plate turns, the articulated means being powered by hydraulic cylinders or the like of relatively short stroke. Further in accordance with the invention, the bucking plate extends substantially from the face to the conveyor, and it has a portion which may be pivoted through 90°, to avoid contact with the arm by means of which the cutter roll is moved up and down, so that contact between the bucking plate and the arm is avoided in placing the bucking plate on the same side of the axis of the cutter roll as that arm.

BRIEF DESCRIPTION OF THE DRAWINGS

A complete understanding of the invention may be obtained from the foregoing and following description thereof, taken together with the appended drawings, in which:

FIGURE 1 is a schematic side view of a cutter and its associated equipment, in accordance with the invention;

FIG. 2 is a plan view of the parts shown in FIG. 1;

FIG. 3 is a detailed elevation view, partly in section, of a portion of the apparatus shown in FIGS. 1 and 2;

FIG. 4 is a detailed elevation view taken on the line IV—IV of FIG. 3; and

FIG. 5 is a detailed elevation view, in section, taken on the line V—V of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, there is shown a view, looking toward the face to be cut, of longwall mining apparatus in accordance with the invention. Extending along the mine floor 2 for substantially the full length of the face to be cut, there is a conveyor 4, which serves not only to convey loosened mineral toward one end of the face but also to move the cutter 6, continuously or intermittently, from one end of the face to the other. For example, in the view shown in FIG. 1, the cutter 6 has dislodged the coal in the area 8 and will be moved in the direction of the arrow 10 to dislodge the mineral in the area 12. This is done by moving the base 14 upon which the cutter 6 rests.

The cutter 6 comprises a body 16 containing suitable power and drive equipment, an arm 18, and a cutter roll 20. Suitable means (not shown) are provided to cause the roll 20 to revolve, coming into contact with the mineral of the face and dislodging it. It is also usual for the roll 20 to have means arranged helically on its cylindrical surface to urge the loosened mineral toward the conveyor 4.

To raise the roll 20 up and down, so that the cut is not limited to the diameter of the roll 20, there is provided equipment comprising a hydraulic cylinder 22, arranged to operate a bell crank 24 and thus move the arm 18.

A bucking plate 26 is connected by means of arms 28 to a ring 30, which is arranged concentrically about the axis 32 of the roll 20. The bucking plate 26 follows behind the roll 20 and serves also to urge dislodged mineral toward the conveyor 4.

In accordance with one feature of the invention, the bucking plate 26 is provided with a portion 34 near the conveyor 4 which may be swiveled 90° about a pivot 36, in order to avoid contact between the bucking plate 26 and the arm 18 when the bucking plate 26 is swiveled 180°, so as to lie on the other side of the cutter roll 20. The dimensions of the portion 34 are such that it may, after a motion of the bucking plate 26, be again turned about the pivot 36 so as to lie perpendicular and next to the conveyor 4, without coming into contact with the arm 18. Moving of the bucking plate 26, to cause it to lie on the other side of the roll 20, is done when the cutter 6 has finished one traverse along the face of mineral to be cut; as mentioned above, it is essential that the bucking plate 26 follow the roll 20, so that it is necessary either to provide for such swiveling motion of the bucking plate or to limit the use of the apparatus to the making of traverses in only one direction along the face. As has also been mentioned, the known practices and equipment for moving the bucking plate 26 from one side of the roll 20 to the other have left much to be desired. Either the change was made manually, which involved hard physical labor, or the change was done with equipment not affording the advantages of the present invention.

As indicated in FIG. 1, there is provided, in accordance with the present invention, equipment for moving the bucking plate 26 from one side to the other of the roll 20, this equipment comprising a pair of hydraulic cylinders 38 and 40 of relatively short stroke, these cylinders having pistons 42 and 44, respectively, which bear upon the end ones 46 of a plurality of balls 48 arranged in a passage 50 having, as shown, a semicircular portion, with there being a dog 52 positioned between and adapted

to be driven by the middle ones of the balls 48. The dog 52 is connected to a plate 54, which has an eccentric portion 56, by means of which the plate 54 turns the ring 30 and thus the arms 28 that are connected to the bucking plate 26. The pistons 42 and 44 are of the recuperating type, so that as the piston 42 is advanced, the piston 44 is retracted, and vice versa. From an examination of FIG. 1, it can readily be seen that, if the cutter 6 were at the end of its traverse, so that there were no coal in the position of the portion of the face 12 that would impede motion of the bucking plate 26 to a position on the opposite side of the roll 20, it would be possible, by advancing the piston 44 and simultaneously retracting the piston 42, to cause the dog 52 to be driven around the semicircular portion of the passage 50. This would effect a change of 180° in the position of the ring 30 and thus move the bucking plate 26 to the desired new position. It is to be understood, however, that before activating the pistons 42 and 44, the portion 34 of the bucking plate 26 is turned inwardly 90° about the pivot 36, so that the bucking plate 26 avoids contact with the arm 38 during its movement to the other side of the roll 20.

From the foregoing, it will be understood that in one aspect, the invention resides in the use of an articulated power-transmitting mechanical means to swivel the bucking plate 26 from one side to the other of the cutter roll 20. In broader aspects, the invention comprises also other uses of such an articulated power-transmitting means, such as to produce the swivel movement of the roll support arm 18 up and down, or to move the cutter 6 about a pivot so as to change the angle between the axis 32 and the face 8. Those skilled in the art of machine design will perceive still other uses of the means.

Elements of various kinds may be used as the mechanical articulated power-transmitting means, and among these may be mentioned stranded wires, spiral windings which are rigid in themselves, and roller chains.

As FIG. 3 also shows, the plate 54 has an eccentric portion 56. The periphery of the plate 54 is a semicircle at the upper part, in the position of the plate shown in FIG. 3. The plate 54 has a somewhat larger radius than the outer wall of the guide passage 50. The periphery of the plate 54 is extended downward in the form of tangents laid on this semicircle, until it strikes a circular portion which is below, in the position of the device shown in FIG. 3. At this wider end of the plate 54, the radially extending connecting piece 58 is attached inwardly thereof. This is best seen in FIG. 4. To the piece 58 is connected a second connecting piece 60, which is likewise segmented and runs in the peripheral direction. It is integral at the interior with a connecting piece 62, which also extends radially. The connecting piece 62 is screwed to the ring 30 by means of screws 64. The support arms 28 of the bucking plate 26 rest on the ring 30. Attached slanted ribs 66, which may be seen in FIGS. 3 and 4, serve to strengthen this segment connection.

Moreover, as best seen in FIG. 4, the passage 50 comprises a square semicircular recess within which are contained the balls 48, which are dimensioned in accordance with the bore of the cylinder 38 and 40 and are held and guided in the recess 50 by means of a pressure bar 68, which is adapted to the radius of the balls 48.

The passage 50 has an outer slot 70 which extends over the entire semicircle. A connecting piece 72 slides into it. The piece 72 connects the dog 52, which slides in the guide passage 50, with a freely movable plate 54 placed in front of the plate 74 opposite it. The front plate 74 cooperates with a conically tapered part 76 to form a support body 78, which accommodates the parts of the device for rotating the bucking plate 26.

While we have shown and described herein a certain embodiment of our invention, we intend to cover as well any change or modification therein which may be made without departing from the spirit and scope of the invention.

5

We claim as our invention:

1. In longwall mining apparatus, the combination with a cutter having a cutter roll rotatable about an axis and a bucking plate, of means for swiveling said bucking plate from one side of said cutter roll to the other about said axis, said means comprising,

support means for said bucking plate movable about a pivot centered on said axis,

power-transmitting articulated means guided for movement about said axis and including means for urging a dog along a substantially semicircular path, said path lying substantially closer to said pivot than said bucking plate does,

means connecting said dog to said support means whereby movement of said dog effects movement of said support means, and

power means comprising a pair of single acting hydraulic cylinder and piston units of relatively short stroke for effecting movement of said articulated means, the pistons of said units each engaging an opposite end of said articulated means such that during a power stroke of either of said units one of said pistons is advanced within its cylinder and the other is retracted within its cylinder with said articulated means moving about said axis and said bucking plate swiveling from one side of said cutter roll to the other about said axis.

2. The combination as defined in claim 1 wherein said power-transmitting articulated means comprises a plural-

6

ity of balls of the same size adapted to the diameter of said cylinders, there being an equal number of said balls on both sides of said dog.

3. The combination as defined in claim 1 wherein one of said cylinder and piston units is disposed above said axis and the other below said axis.

4. A combination as defined in claim 1, further characterized in that said cutter roll is mounted on an arm for movement in a vertical plane and said bucking plate has in its portion most distant from the face of coal being cut by said apparatus a part that is so mounted for motion about a pivot that it may be turned toward said face, said part being so constructed and arranged as to avoid contact with said arm while said device moves said bucking plate from one side of said cutter roll to the other.

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