

[54] LONGWALL MINING SYSTEM

[76] Inventors: **George Sodder, Jr.**, 607 Fourth Ave., Montgomery, W. Va. 25136;
Samuel Eugene Fish, 189 Hillside Ave., Boomer, W. Va. 25031;
Oliver Ellsworth Palmer, 315 E. Ward St., Cedar Grove, W. Va. 25039

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[51] Int. Cl. E21c 29/00; E21d 23/00

[58] Field of Search 61/45 D; 198/10; 299/31, 299/32, 33, 43-46

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Primary Examiner—Frank L. Abbott

Assistant Examiner—William F. Pate, III

Attorney, Agent, or Firm—Bacon & Thomas

[57] ABSTRACT

A longwall mining device adapted to mine a mineral face in a mine comprising:

a lower frame;

at least one set of driven tracks mounted on said lower frame and adapted to be driven along the floor of the mine;

an upper frame;

at least one set of driven tracks mounted on said upper frame and adapted to be driven along the roof of the mine;

jack means disposed between said upper and lower frames and adapted to raise the upper frame against the roof of the mine and maintain contact between the upper frame and the roof of the mine;

a cutting device adapted to be driven through the mineral in said mineral face;

means for driving said cutting device across the front of said longwall mining device in said mineral face thereby mining said mineral; and

conveyor means disposed across the front of said device adapted to collect the mined mineral and convey the same away from the mineral face.

13 Claims, 6 Drawing Figures

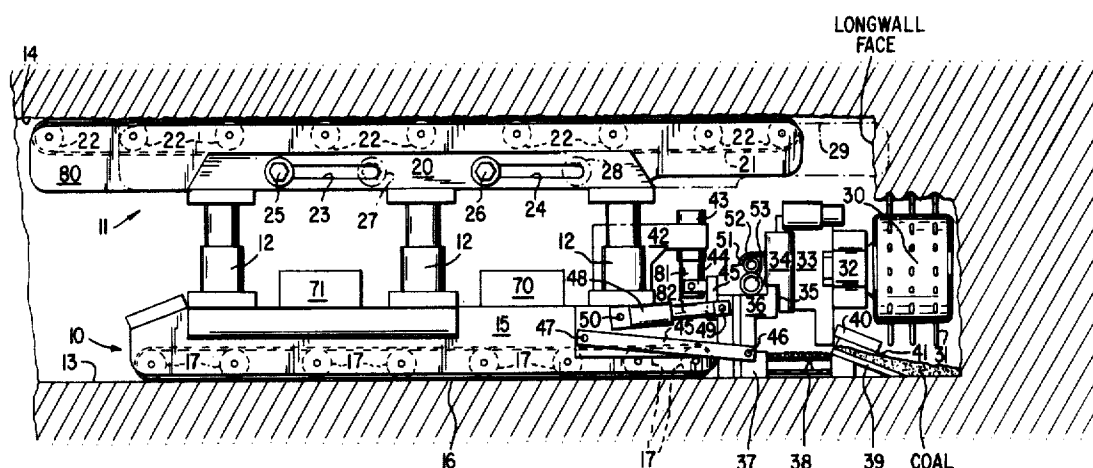


FIG 1

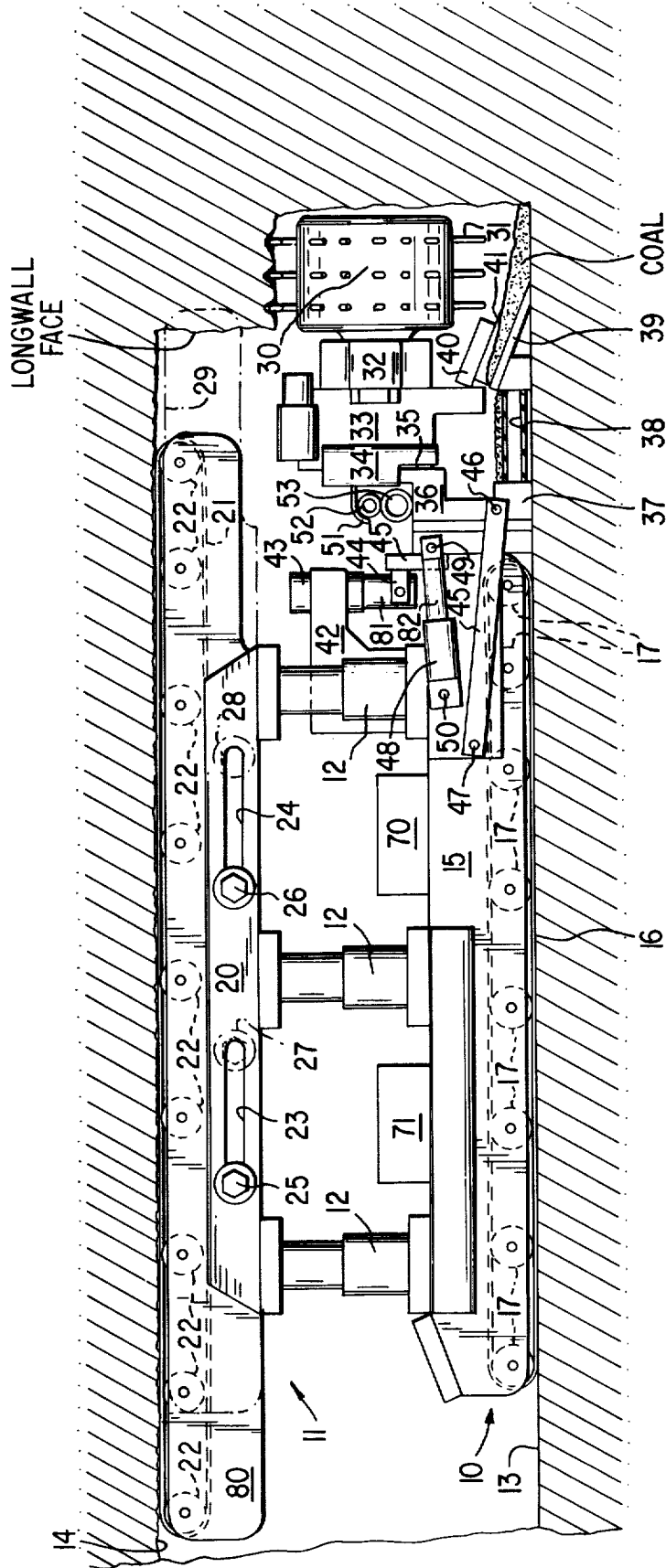


FIG. 2

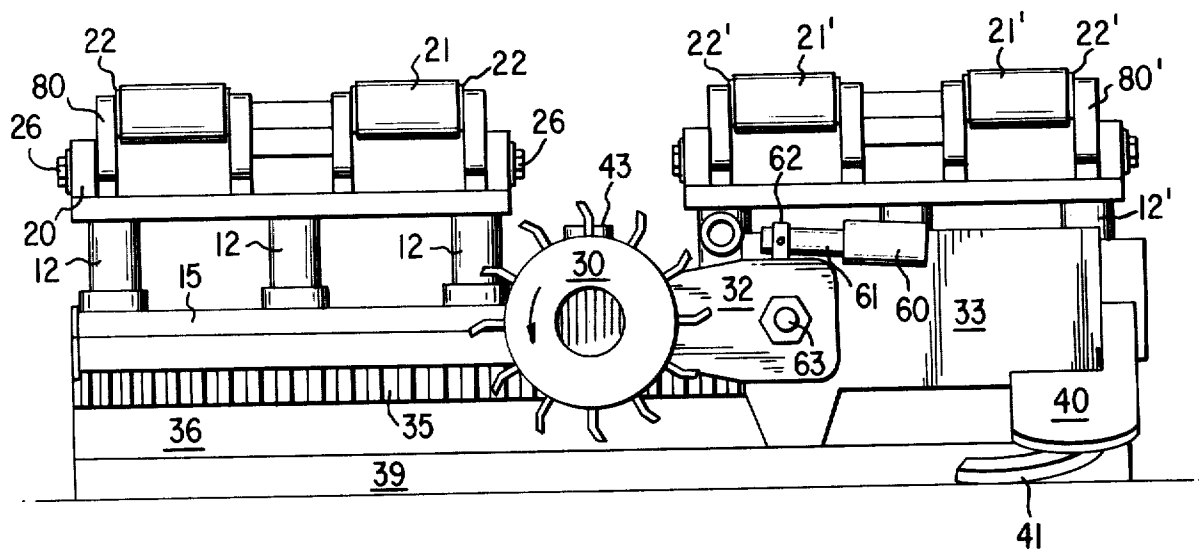


FIG. 3

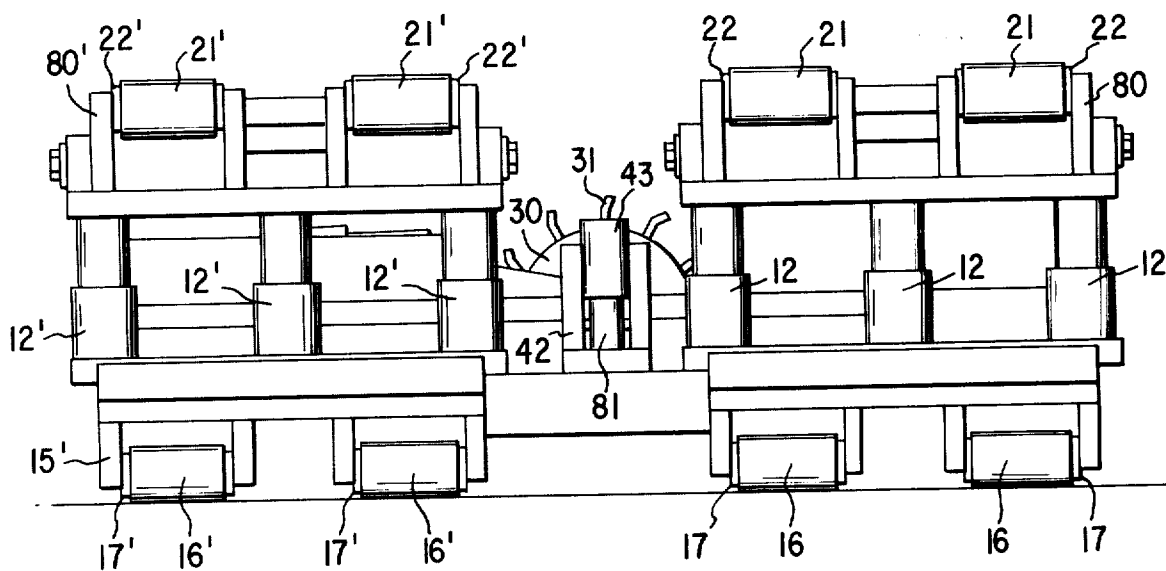


FIG 4

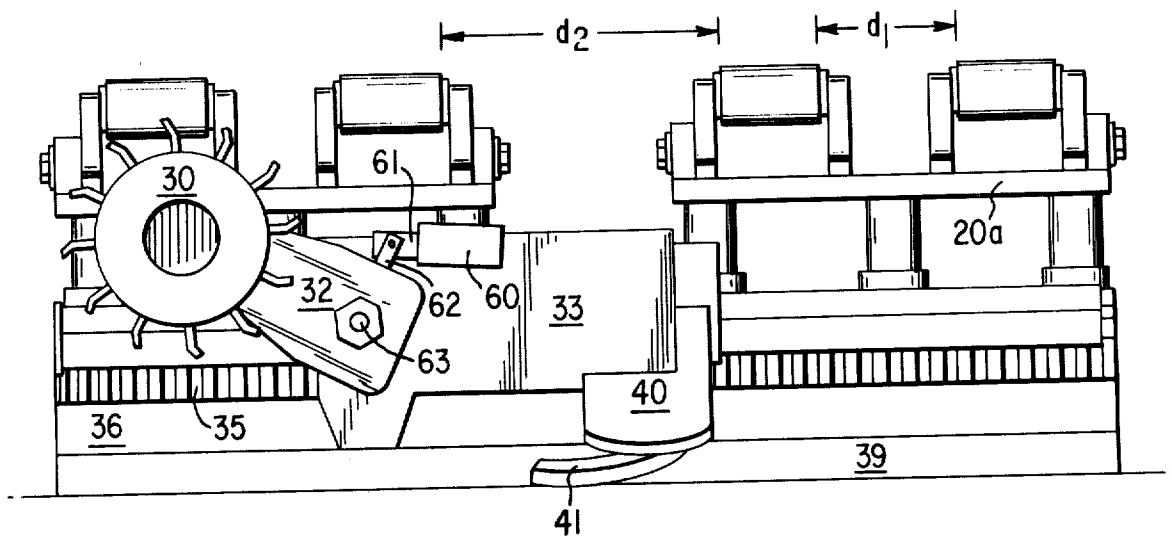


FIG 5

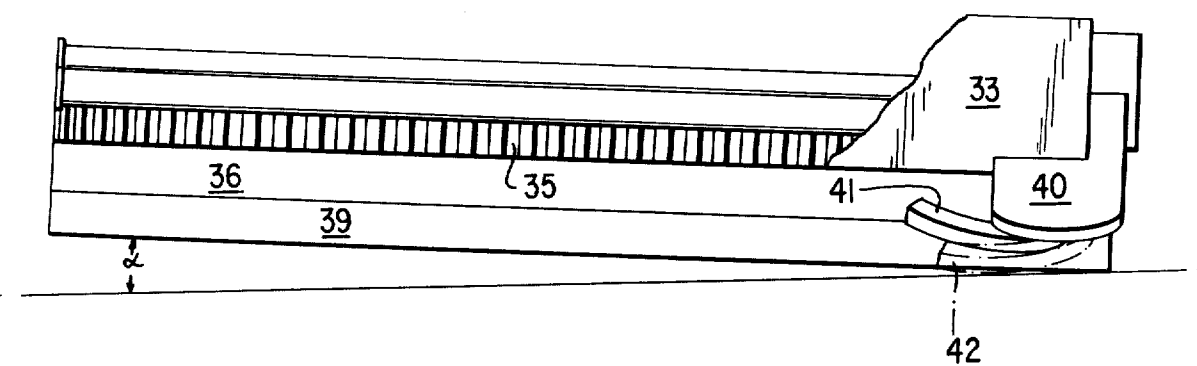
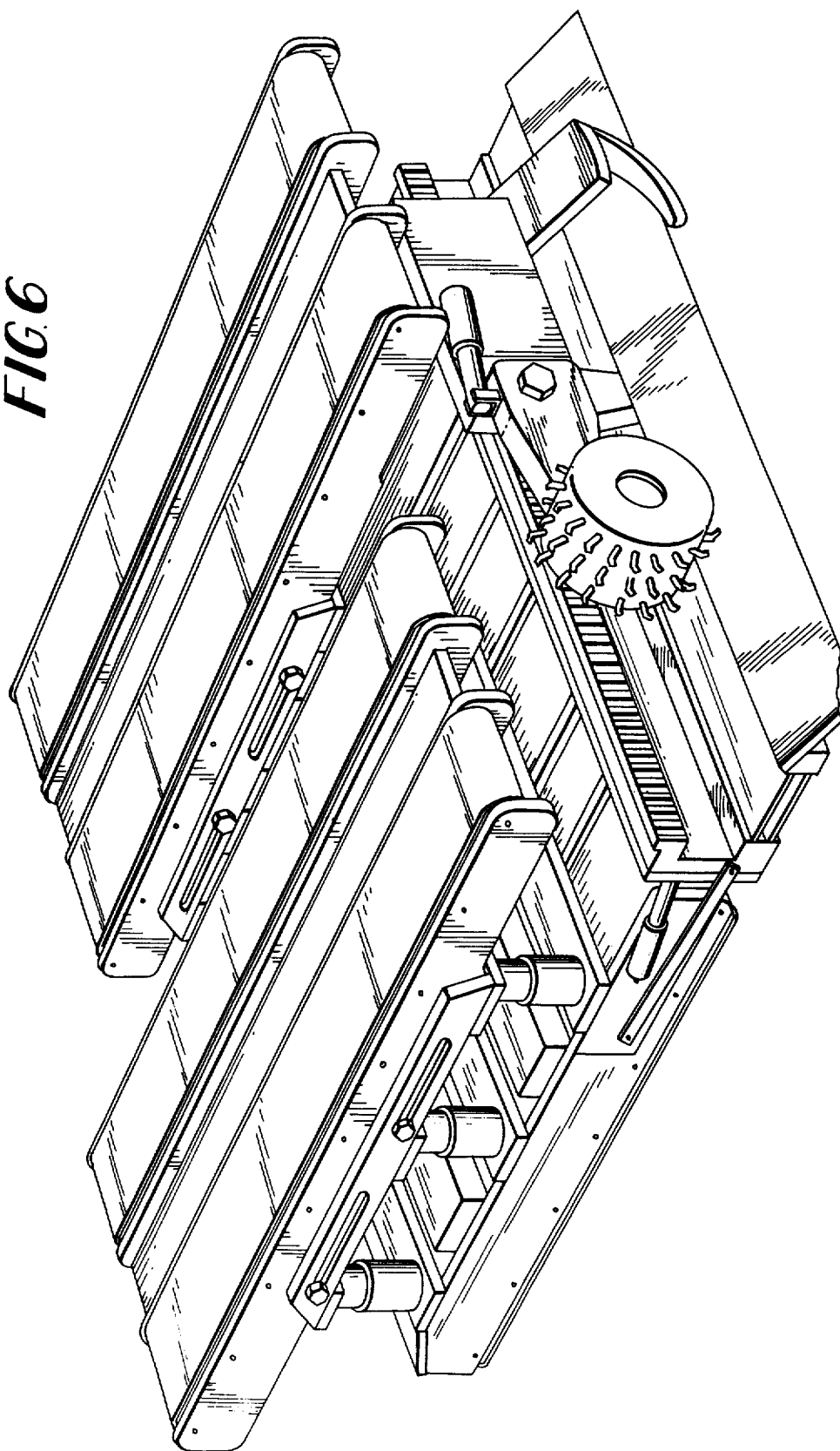


FIG. 6



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LONGWALL MINING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a novel mining device useful in longwall mining systems, and more particularly to a longwall mining device which is capable of increased production and yet which is simpler to operate than prior art longwall systems.

2. Description of the Prior Art

The term "longwall mining" is well understood by those skilled in the art since this system of mining dates back to the last century. The term indicates the mining of an extended face of mineral, such as coal, which normally extends to about 300 feet in length, as opposed to a mining system which is limited in width to the width of a single machine. In a longwall system, a cutting device such as a shearer drum is driven across the entire length of the mineral face thereby cutting free the mineral as it proceeds along the face. The loose mineral is collected in a conveyor which is disposed below the cutting device and extending across the entire face, the conveyor operating to collect the cut mineral and to convey it away from the face and eventually out of the mine.

It is important in longwall mining systems to support the roof of the mine especially in those areas immediately adjacent the mineral face being mined. For this purpose, it is standard practice to employ roof supports held against the roof of the mine by suitable means, such as hydraulic jacks. As the cutting device proceeds across the face of the mineral, the roof supports are gradually moved up toward the face being mined to support the roof over that area which has just been mined to prevent collapse. In a longwall system where a face having a length of about 300 feet is being mined, a plurality of roof support devices is employed. As the cutting device makes one complete traversal of the longwall face, and the roof support devices are each moved up toward the face as the cutting device proceeds thereacross, the roof of the mine in those areas which have just been mined is prevented from collapsing. At the end of the complete traversal of the face, the cutting device is driven the opposite way across the face and the roof support devices are again moved up toward the face of the mineral as the cutting device is driven past. In this fashion, the conveyor, the cutting device and the roof supports are gradually worked into the face of the mineral until the entire developed area of the vein has been mined. A recent review of longwall mining systems can be found in *Coal Mining Processing*, volume 7, No. 12, December, 1970, pages 38-45 and 62.

It is standard practice at the present stage of development of longwall mining systems to drive the cutting device across the face of the mineral by means of a driven chain system. The roof support systems normally comprise upper and lower skids separated by hydraulic jacks which are employed to force the upper skids against the roof of the mine thereby supporting the same. These devices are moved toward the face being mined usually by means of hydraulic cylinders disposed parallel to the bottom skid. A typical prior art mine roof support useful in longwall mining systems is shown in U.S. Pat. No. 3,375,668 to Allen. This represents the conventional type of roof support used at the present time in longwall mining systems. The device

disclosed in the Allen patent, as is conventional, incorporates a conveyor disposed across the front of the bottom skid, the conveyor being designed to collect and transport the mineral away from the face being mined.

The support disclosed in said patent is advanced toward the face being mined by means of hydraulic rams. Essentially, these hydraulic rams function to advance the roof supports toward the face being mined in the following manner. After the cutting device has been driven across the front of the individual mine support unit (of course, many such units being required across the longwall face), it is normally desired to advance the roof supports toward the face to support the roof over that area of the face which has just been mined. This is usually accomplished by reducing pressure against the roof by means of the jacks supported between the upper and lower skids. While the skids are retracted from the floor and roof of the mine, the hydraulic rams or hydraulic cylinders disposed parallel to the bottom skid are actuated to advance either the lower or the upper skid, or both toward the face being mined. This method offers several disadvantages. Where natural conditions deteriorate, and excessive pressures bear upon the roof support systems, it is often hazardous to advance the roof support systems of the prior art since it is necessary to first free either the lower or upper skids, or both from the floor or roof of the mine. The most common occurrence is for the bottom or lower skids to be forced or compressed some distance into the floor of the mine which requires manual labor using, for example, compressed air hammers to free the lower skid before it can be advanced toward the mining face.

The prior art systems are also disadvantageous in that they must be handled by hoist ropes for loading and unloading when transported to the longwall face since they have no motive power of their own other than the hydraulic rams and because of this fact, the time required for bringing the individual roof support units to the face being mined is excessive. In addition, when the lower skid of the conventional roof support units is forced or compressed into the floor of the mine, the delay encountered in freeing the skid often significantly decreases the capacity of the longwall system. In addition, the roof support devices used in prior art longwall mining systems require significantly more labor in operating the same, thereby further increasing production costs.

Reference is made to the following U.S. Patents which disclose roof support systems which may be useful in longwall mining systems, which roof support systems are similar in construction and operation to the one shown in the aforementioned Allen U.S. Pat. Nos. 2,714,505; 2,803,444; 3,309,880; 3,473,846; 3,504,944; 3,556,601; 3,640,574; 3,640,581; 3,658,385; 3,659,900; and 3,677,703.

U.S. Pat. No. 1,737,327 O'Toole discloses a mining machine for use with the longwall type of mining machines and more particularly relates to a combined roof support advancing rig for use with such machines. The device is illustrated in FIG. 8 of the drawings of this patent, and it can be seen from this figure that the lower and upper members contacting the floor and roof of the mine, respectively, have tracks which are simultaneously driven as shown in the figure. The tracks are of the type used in tractors and are designed to engage both the floor and roof of the mine to drive the device

toward the wall being mined. No individual control of the upper and lower tracks is disclosed in this patent.

U.S. Pat. No. 2,899,800 Joy discloses a somewhat related apparatus for supporting the roof of a mine in a longwall system. The upper and lower members are provided with caterpillar-like tracks, but these tracks are not motor driven or capable of being individually driven. The tracks are primarily employed to provide friction against the roof and floor of the mine as the roof support units are advanced horizontally using, for example, hydraulic cylinders or rams.

The prior art longwall systems therefore suffer many disadvantages which inhibit production rates, increase production costs and are generally difficult to operate. There therefore has been a long need for an effective longwall mining system which requires less labor than those of the prior art. There has also been a need for an effective longwall mining system which is capable of greater production rates than have been possible with prior art systems. Further, there has been a need in the past for longwall mining systems which are easier to operate than those systems of the prior art.

SUMMARY OF THE INVENTION

It is therefore a primary object of the present invention to remedy the above disadvantages and provide a longwall mining system which solves the many problems of the prior art.

It is a further object of the present invention to provide a longwall mining system which is capable of increased production compared to prior art systems.

It is yet a further object of the present invention to provide a longwall mining system requiring fewer operators than prior art systems.

It is yet a further object of the present invention to provide a longwall mining system which can be operated in a mine whose height varies from the minimum encountered in prior art devices to a maximum which is several times greater than the present economic maximum height of the prior art systems, thereby enabling the longwall mining system of the present invention to be useful in mining minerals in a vein whose thickness greatly exceeds thicknesses which prior art devices could handle.

It is still a further object of the present invention to provide longwall mining devices which, when a plurality of the same are assembled, form a longwall mining system.

It is yet a further object of the present invention to provide longwall mining systems which are individually powered and which can be brought into place at the longwall face under their own power.

It is yet a further object of the present invention to provide longwall mining devices which can be advanced toward the longwall mining face during the mining operation without the necessity of using hydraulic rams.

It is yet a further object of the present invention to provide longwall mining devices wherein the upper frame which contacts the roof of the mine can be advanced independently of the base of the device to support the roof of the mine in the area above the face just mined.

The present invention accomplishes the above objects, and others, by providing a longwall mining device which comprises, essentially:

a lower frame having at least one set of driven tracks adapted to contact the floor of the mine and adapted to be driven therealong;

an upper frame having at least one set of driven tracks adapted to be driven along the roof of the mine in contact therewith, and having the capability of being driven independently of the tracks on the lower frame;

jack means, such as hydraulic cylinders, disposed between the upper and lower frames and adapted to raise the upper frame against the roof of the mine and support the upper frame against the roof;

a cutting device adapted to be driven across the longwall face being mined;

means for driving the cutting device across the longwall face; and

conveyor means disposed across the front of the device adapted to collect the mined mineral and convey the same away from the longwall face.

Other objects and advantages will be apparent from the ensuing description of the preferred embodiment when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the device of the present invention.

FIGS. 2 and 3 are front and back elevational views of the device.

FIGS. 4 and 5 are front elevational views, with parts eliminated, showing the operation of the cutting device and conveyor, respectively.

FIG. 6 is a perspective view of the device of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, FIG. 1 shows the preferred longwall mining device of the present invention in side elevation. The device generally comprises a lower frame generally designated 10 and an upper frame generally designated 11. Between the two frames are disposed a plurality of hydraulic cylinders 12, the number and capacity of which are variable depending upon many factors, such as the height one wishes to extend the upper frame from the lower frame, the amount of pressure exerted by the roof of the mine, etc. The device of the present invention is operable with any number of hydraulic cylinders 12 as long as the number is sufficient to support the upper frame 11 against the roof 14 of the mine.

The lower frame, generally designated as 10, comprises a frame member 15 having a plurality of rollers 17, some of which are driven. Around the rollers 17, and attached to the periphery thereof, is provided an endless track 16 which is driven by the rollers 17. The track 16 may be any conventional type of track, such as those used in caterpillar-type tractors. The track 16 engages the floor 13 of the mine, and since some of the rollers 17 can be driven, the entire apparatus can be driven on the floor 13 of the mine.

The upper frame, generally designated 11, comprises an upper frame member 20 having a plurality of horizontally-extending guide means such as slots 23 and 24. Disposed in these slots are members 25 and 26 which are slidable therein from the position shown in solid lines to the position shown in phantom by 27 and 28, respectively. Members 25 and 26 support a top

frame 80 which is thus slidable in slots 23 and 24. Frame 80 supports a plurality of rollers 22, some of which are capable of being driven which in turn support an endless track 21 which engages the roof 14 of the mine. This track can be of the same type as the lower track 16, and generally comprises a conventional caterpillar-type track. Some of the rollers 22 are driven rollers enabling the frame 80 to be propelled across the roof 14 of the mine by advancing the top frame 80 carried by members 25 and 26 in slots 23 and 24 from the position shown in solid lines to the position 29 shown in phantom lines in the drawing.

Separate control means (not shown) are normally provided for driving each set of rollers 17 and 21, each capable of being driven independently of the other.

The means for driving rollers 17 and 22 (and thereby tracks 16 and 21) are not shown. Any conventional apparatus can be employed by those skilled in the art since the particular device used to drive the rollers is not critical. Thus, no attempt will be made here to describe such driving apparatus.

Further, means other than slots 23 and 24 carrying therein support members 25 and 26 (which may, for example, be rotatable rollers) may be employed to enable the movable frame 80 to be movable independently of the lower frame. As long as the means selected permits the upper driven track to advance along the roof of the mine while the lower driven track is stationary, those skilled in the art can employ any suitable device to accomplish this purpose, such as gearing systems, clutching mechanisms, etc. Means may even be provided for selectively actuating either of the lower and upper driven tracks, such as electrical switching means which permits each track to be driven independently of (or simultaneously with) the other. Such means may be conventional and therefore, for purposes of brevity, they will not be described in detail here.

As is conventional in longwall mining systems, it is desired to advance the roof support device toward the longwall face being mined after the cutting device has traversed the front of the roof support device. The phantom lines designated 29 indicate this advanced position. The length of slots 23 and 24 in frame member 20 of course regulates the distance which frame member 80 can be advanced toward the longwall face. The distance of advance should be at least that distance which results in the mine roof over the conveyor being supported (as shown in FIG. 1). However, the maximum extension can be all the way to the mineral face exposed by the cutting device. Generally, the roof support of the invention is actuated to support the roof to the same extent as in prior art systems. Depending upon the size of the entire apparatus, and depending upon the width of mineral being mined by the cutting device, the upper frame member 80 can be advanced any desired distance merely by actuating the driven upper rollers 22 which in turn advance the track 21 along the roof 14 of the mine.

The cutting device which traverses the longwall face can be any conventional type of mining device and normally comprises a shearer drum or other similar device 30 carrying thereon a plurality of cutting blades 31. The drum 30 is fixedly attached to a movable arm member 32 which in turn is rotatably connected to frame member 33 (see FIGS. 2 and 4). The arm member 32 is pivoted about connection point 63 which rotatably connects the arm 32 with the frame 33. The en-

tire frame member 33, carrying thereon arm 32 and drum 30 is capable of being driven across the front of the device in the following manner. Frame 33 is fixedly connected with housing 34 (see FIG. 1) which contains therein a pinion which is drivable and which engages rack teeth 35 disposed across the front of the device. By driving the pinion (not shown) the entire frame member 33 is advanced in either direction across the teeth face 35 in front of the device of the present invention. A suitable power means (not shown) can be employed to rotate drum 30, and in fact, any conventional cutting device can be employed with the mining device of the present invention. However, the technique of driving the cutting device of the present invention, (i.e., the rack and pinion device shown) represents an improvement over the prior art which conventionally uses a chain to physically haul the cutting device back and forth across the longwall face being mined.

The front of the device of the present invention comprises a frame member 36 which supports the tooth face 35 as shown in FIG. 1. The lower portion of frame 36 (designated 37 in FIG. 1) supports an endless conveyor 38 which transverses the front of the device of the present invention. Suitable power means is provided (not shown) for driving the conveyor. Also attached to lower frame member 37 (or an integral part thereof) is an inclined member 39 which is designed to feed the coal or other mineral being mined onto conveyor 38. The tendency of the coal to flow over member 39 onto conveyor 38 is aided by gathering arm 41 which is actuated by a driving mechanism located within housing 40 (fixedly attached to and carried by frame 33 as shown in FIG. 2). Gathering arm 41 is caused to reciprocate as is schematically shown in FIG. 5 to force the coal which has been mined from the longwall face up over inclined member 39 and onto conveyor 38 whereby it is transported away from the front of the device and away from the longwall face being mined. Any conventional gathering arm device can be employed for this purpose.

The vertical movement of cutting member 30 can be adjusted as follows. Referring to FIGS. 2 and 4, a hydraulic cylinder 60 or other such similar device is attached to frame member 33, and the extendible piston 61 of the hydraulic cylinder 60 is attached to arm 62 which is in turn rigidly connected to pivoting member 63. Thus, as the piston 61 of cylinder 60 is withdrawn into the cylinder (referring to FIGS. 2 and 4), the rotating member 63 rotates in a clockwise direction thereby raising arm 32 in the same direction which in turn raises cutting drum 30. The size of these respective members can be varied depending upon the entire size of the device and depending upon the thickness of the mineral vein being mined. In addition, any other means can be employed to provide vertical movement to cutting drum 30 as is obvious to those skilled in the art. The preferred means shown in FIGS. 2 and 4 enables one to easily vary the height of cutting drum 30.

The entire front frame 36 (and including the conveyor 38, frame 33, gathering arm 41, etc.) of the device of the present invention is also capable of being moved in a vertical direction. Supported on a frame member 42 (see FIGS. 1 and 3) is another hydraulic cylinder 43 which in turn has its piston 81 connected with a horizontal connecting member 44 which is in turn connected to frame 36 through vertical member 45 (see FIG. 1). By raising and lowering the piston 81

of hydraulic cylinder 43, the entire frame 36 can be moved up and down in a vertical direction in front of the device of the present invention. Any number of cylinders can be employed in the raising and lowering of frame 36, and one cylinder is usually sufficient depending upon, inter alia, the weight of frame 36 and its associated members, and the degree of vertical movement desired.

Frame member 36 is also provided with means for adjusting its angle relative to the horizontal. Specifically, reference is made to FIGS. 1 and 5, the latter showing the frame 36 in a position wherein it is disposed at an angle " α " from the horizontal. This tilting of the frame 36 can be accomplished as follows. Movable arm 45 (see FIG. 1) is pivotally connected with lower frame member 15 at point 47 and at frame 36 at point 46 as shown in FIG. 1. Of course, the other side of the device would also have a similar pivoting arm. A hydraulic cylinder 48 is provided which is pivotally connected with frame 15 at point 50 (e.g., employing a ball joint) and at frame 36 at point 49. By adjusting the degree of extension of the piston 82 of hydraulic cylinder 48 as the frame 36 is moved vertically (using hydraulic cylinder 43), the entire frame 36 can be tilted. Specifically, by extending the piston 82 of hydraulic cylinder 48, the left-hand side of frame 36 (as viewed from the front) will be lowered, and likewise, by withdrawing the piston 82 of hydraulic cylinder 48 into the cylinder, the left-hand end of frame 36 will be raised as is illustrated in FIG. 5.

The capability of tilting the entire front frame of the device of the present invention provides the advantage that if the mineral vein is at an angle to the horizontal, the entire front mechanism can be tilted at substantially the same angle in order to facilitate mining thereof and to avoid mining and recovering undesired material. In addition, the tilting can be performed independently of the position of the lower and upper frames, and therefore the latter can remain in a horizontal position retaining its stability while the front frame member 36 can be tilted at any desired angle to facilitate mining of the mineral.

If desired, hydraulic cylinders (like 48) can be provided on both sides of the front of the device in order to extend the tilting capability of the front frame member 36. However, as is obvious, only one such hydraulic cylinder 48 is necessary to provide the tilting capability of front frame member 36.

A related feature of the present invention is that the entire device can be operated on a mine floor which is at an angle to the horizontal. In this instance, since both upper and lower frames are pressed against the roof and floor, respectively, the device remains in place without sliding. If the angle is especially severe, growers can be inserted in the upper and lower tracks. These tip-like elements, which extend from the tracks into the floor and roof of the mine, prevent the device from sliding. At the same time, however, the tracks can be driven with the growers contained therein thus enabling the device of the invention to operate even at severe angles.

Also shown in FIG. 1 and attached to frame 36 are supply conduits 52 and 53 which may be employed to supply, for example, water (for spraying for dust control) and power (to the motors which drive the cutting drum 30, the pinion in housing 34, gathering arm 41, etc.). These conduits 52 and 53 may be protected by

means of a shield 51 which is disposed above the same. Similarly, between the upper and lower frame members may be provided power sources such as at 70 and 71. However, the particular manner of providing power to the various motors, hydraulic fluid to the hydraulic cylinders, water and the like, necessary to operate the device, is not critical and these can be provided in any manner selected by those skilled in the art.

As stated above, some of rollers 22 in the upper frame 80 are driven, and these driven rollers have the capability of being driven independently of driven rollers 17 such that the upper frame 80 can be advanced toward the longwall face without the necessity of advancing at the same time the lower frame. Thus, in operation, as the cutting drum 30 is driven past the front of the device of the present invention, the driven rollers 22 can be actuated thereby advancing the entire upper frame 80 toward the longwall face thereby protecting the roof of the mine in the area above the conveyor 38 and above the other apparatus located in front of the device of the present invention.

As shown in FIGS. 2-4, both the upper and lower frame members are provided with two sets of driven tracks. As viewed in FIG. 2, assuming cutting head 30 is advancing from right to left, as it advances past the right-hand set of tracks 21', and is in the position approximately shown in FIG. 2, the upper right-hand rollers 22' are driven thereby causing tracks 21' to advance frame 80' toward the longwall face being mined in order to support the roof in the area just mined. It will be appreciated that as the cutter drum 30 is driven past the left-hand upper set of tracks 21, they too are actuated in a similar manner to drive the upper frame member 80 toward the longwall face being mined, thereby supporting the roof in that area. It is thus unnecessary to advance the lower frame member until the entire longwall face has been traversed by the cutting drum 30 since the advancing upper frame members are supporting the roof of the mine. This provides an important advantage in that a wider conveyor belt can be employed than has been employed with prior art systems. This is because the prior art systems normally advance the entire roof support after the front of the prior art devices have been traversed by the cutting device. The result is a "snaking" of the conveyor (i.e., from the advanced device to the adjacent non-advanced device) thereby limiting the width of the conveyor since a relatively wide conveyor belt does not have the capability of being "snaked" along the longwall face being mined. With the instant apparatus, since the lower frame member is advanced toward the longwall face only after the cutting drum 30 has traversed the entire face, a wider conveyor may be employed thereby increasing the capacity of the same and thereby increasing production.

FIG. 3 is a rear view of the device shown in FIGS. 1 and 2, with like numerals referring to like parts. With the cutting device 30 in the position shown in FIG. 3 (and moving from left to right as viewed therein), the left-hand upper set of tracks 21' are actuated thereby driving frame 80 toward the longwall face. Tracks 21 are similarly advanced after cutting device traverses in front of the same.

FIG. 6 is a perspective view of a single device of the present invention in operation, with one set of upper tracks advanced toward the longwall face to support the roof of the mine in this area.

Of course, it will be appreciated that a plurality of the devices shown in the drawings will be employed in a complete longwall mining system. Suitable means (such as "quick-connections") are provided at the side ends of the lower frame of each device for connecting each of the tooth faces 35 such that the pinion driving gear may be driven along the aligned tooth faces across the entire longwall face. Similarly, connecting means are provided for connecting the water and power conduits on each device such that a continuous flow of the same can be accomplished across all of the devices arranged at the longwall face.

The advantages of the present longwall mining system are numerous as compared to the prior art systems. The minimum operating height of prior art systems is about 40 inches, and the device of the present invention has approximately this minimum operating height. However, the maximum operating height of the present system is limited only by the size of the hydraulic cylinders 12 disposed between the upper and lower frame members, and extends at least to a maximum of about 15 or 20 feet, or even greater if the cylinders 12 are large enough. Further, since the lower frame and upper frame are independently driven, the upper frame can be advanced toward the longwall face without simultaneously having to advance the lower frame. Thus, with the upper frame brought down to its minimum operating height, the entire device can be driven or "trammed" to the longwall face without the necessity of being handled with hoists as is necessary with conventional prior art devices since they are not capable of being independently driven. Thus, the time required for going from one longwall face to another is greatly reduced with the device of the present invention and therefore the present invention provides for a more efficient use of the devices compared to the devices of the prior art.

In addition, the labor requirements for the device of the present invention are reduced compared to the devices of the prior art. It has been found that only six operators are required for an entire longwall mining system made up of the devices of the present invention as compared to a minimum of nine or ten with the prior art devices.

In addition, a wider conveyor can be employed with the devices of the present invention as discussed above, and the use of the wider conveyor, coupled with the ability to eliminate some of the labor requirements, increases production while at the same time decreasing production costs, and thus the longwall mining system of the present invention is economically more feasible than those of the prior art.

If desired, the cutting drum 30 may be provided with cutting teeth on its front surface to drive or "sump" the cutting head 30 into the longwall face directly before it is driven across the same. Thus, in essence, the devices of the present invention may also function as continuous miners (as this term is used in the art) where the teeth are normally provided on the front face of the miner and the cutting drum rotates about an axis parallel to the face of the devices rather than perpendicular to it as illustrated in FIG. 1.

It is to be understood that the drawings show only a preferred embodiment of the present invention. Thus, the minimum number of tracks required on the upper and lower frames is the minimum required for driving the respective frames against the floor and roof of the

mine. Normally, at least one set of tracks is provided on the upper and lower frame, with the preferred arrangement being two sets of tracks driving two separate portions of the upper frame as shown in FIGS. 2 and 3. The distance which the upper frame can be advanced toward the longwall face is only limited by the length of the slots 23 and 24. By making the slots longer, the upper frame can be extended a greater distance as is apparent.

In addition, any number of the rollers 17 or rollers 22 in the lower and upper frames, respectively, can be driven rollers. The particular number of these rollers that are driven is not critical as long as the necessary power is provided to the tracks 16 and 21 for driving the lower and upper frames against the floor and roof of the mine, respectively.

Similarly, the size and number of the hydraulic cylinders 12 supporting the upper frame is not particularly limited, and those skilled in the art can vary both the size of the cylinders and their number depending upon the conditions existing in the mine.

Similarly, any conventional cutting device or shearer drum, and any conventional gathering arm can be employed with the mining device of the present invention, with the invention not being limited to any particular type. Likewise, the size of all other hydraulic cylinders can be varied depending upon the size of the apparatus, the weight of the same, the degree of movement required, etc. Those skilled in the art can select appropriate elements to accomplish any desired function within the above guidelines.

Although power sources are certainly required for the apparatus of the present invention, they are not per se part of the invention, with any conventional devices being operable. In addition, the specific mechanical linkages employed in the apparatus are not important, as long as the device functions as described above.

The distance between the tracks in each set (i.e., the distance d_1 in FIG. 4) and the distance between sets of tracks (i.e., d_2 in FIG. 4) should be as small as possible to prevent any uneven roof rock from fouling the tracks. The same holds for the lower tracks. Those skilled in the art will be able to determine the optimum distances depending on the conditions under which the apparatus is employed.

A conventional conveyor can be employed to remove the mineral from the mine by extending to the end of the conveyor which extends across the longwall face.

To facilitate movement of the tracks along the floor and roof of the mine under heavy pressure conditions, the tracks may be relatively smooth, and they may be driven independently by an electric motor connected thereto through a speed reducer, providing both forward and reverse movement.

The lower horizontal portion 20a of upper frame 20 (see FIG. 4) may be in the form of a solid plate to protect the motors, pumps, drive units, etc. that are preferably located underneath the same.

While the invention has been shown and described with reference to preferred embodiments thereof, it is to be expressly understood that various changes and modifications may be made in the same without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A longwall mining device comprising:
a lower frame;

at least one set of power driven tracks, on said lower frame, for advancing said frame along the floor of a mine in a forward direction;

an upper frame;

adjustable jack means supporting said upper frame on said lower frame and adapted to raise said upper frame substantially vertically toward the roof of the mine;

a top frame mounted on said upper frame for forward and rearward horizontal movement thereon, said top frame having at least one set of power driven tracks thereon engageable with the roof of the mine and operable to advance said top frame forwardly along said upper frame while in engagement with the roof of the mine;

guide means carried by and extending laterally across the front of said lower frame and a mineral cutting device movable along said guide means; and conveyor means carried by and extending laterally across the front of said lower frame.

2. A device as defined in claim 1 wherein said guide means is mounted on a sub frame mounted on said lower frame for vertical movement thereon.

3. A device as defined in claim 2 wherein opposite ends of said guide means are independently vertically movable on said lower frame whereby said guide means may be tilted.

4. A device as defined in claim 2 wherein said guide means are mounted on said lower frame for tilting about an axis longitudinally thereof.

5. A device as defined in claim 1 wherein said guide means includes an elongated rack bar extending therealong for engagement by a drive gear on said mineral cutting device.

6. A device as defined in claim 2 including hydraulic means for moving said guide means vertically on said

lower frame.

7. A device as defined in claim 1 wherein said mineral cutting device comprises a carriage movable along said guide means and a cutter member mounted on said carriage for vertical movement thereon.

8. A device as defined in claim 1 wherein said upper frame is provided with guide slots therein, said top frame having rollers journaled thereon and extending into said guide slots.

9. A device as defined in claim 1 wherein said guide means comprises a generally L-shaped frame member having a vertical leg and a forwardly extending horizontal leg, said conveyor means being carried by said horizontal leg, said horizontal leg terminating in a forwardly and downwardly sloping plate for directing material onto said conveyor.

10. A device as defined in claim 9 including an arm member on said cutting device for pushing material up said sloping plate onto said conveyor.

11. A device as defined in claim 10 wherein said arm member is mounted on said cutting device for swinging movement over said plate in response to movement of said cutting device along said guide means.

12. A mining device as defined in claim 1 wherein at least a second upper frame and jack means is provided on said lower frame, and a second top frame is movably carried by said second top frame and having power driven tracks thereon, the tracks of said top frames being independently and separately drivable.

13. A mining device as defined in claim 1 including at least one additional like device arranged side-by-side thereto, said devices being arranged with their guide means in longitudinal alignment to define a continuous guide, there being a single cutting device movable along said continuous guide.

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