

[54] **CONTINUOUS CUTTING AND GATHERING APPARATUS FOR A CONTINUOUS MINING MACHINE**

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[51] Int. Cl. **E21c 27/24, E21c 35/20**

[58] Field of Search..... **299/18, 56, 57, 64-68, 299/75, 76; 198/9**

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Primary Examiner—Ernest R. Purser

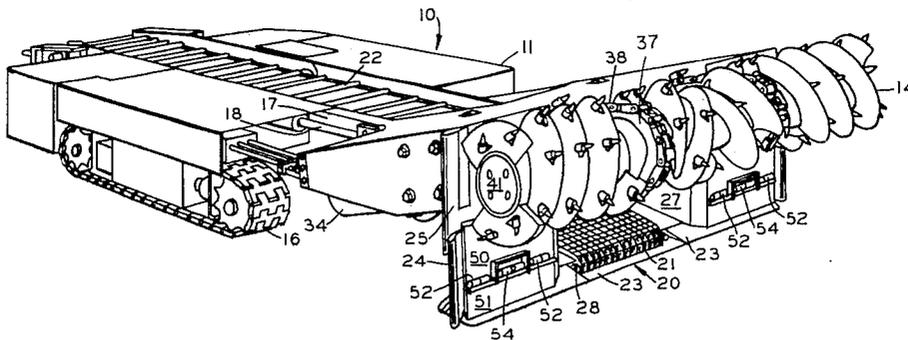
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[57] **ABSTRACT**

A gathering structure for use on the mining head of a mining machine. The mining head includes a rotary drum having helical auger flights with cutter bits

mounted on their periphery. A back up panel is disposed on the mining head just rearward and parallel to the rotary drum. A gathering head is located beneath the mining head. The gathering head includes front, vertical dozer blades on each side of a central conveyor throat. The dozer blades have their bottom edge at the floor and their upper portion extends upwardly to overlap the lower portion of the backup panel. The backup panel and dozer blade cooperate to form a continuous vertical wall behind the helical flights of the rotary drum. The mine face forms a corresponding wall in front of the helical flights. The loading of the cut mined material is achieved by the helical auger flights working in conjunction with the backup panel and dozer blades and the mine face. The panel and dozer blades are positioned immediately behind the outer helical auger sections so that with the mine face they form the walls of a screw conveyor which moves the coal to the center of the machine and onto a small pitch mat chain conveyor disposed in the central conveyor throat. The mat chain conveys the material rearwardly to conventional flight conveyors. During the mining operation, the backup panel is moved up and down with the rotary drum relative to the dozer blade. To prevent spillage of mined material behind the dozer blade as the rotary drum is moved, the upper portion of the dozer blade is hinged and spring loaded to continuously hold it firmly against the backup panel.

6 Claims, 4 Drawing Figures



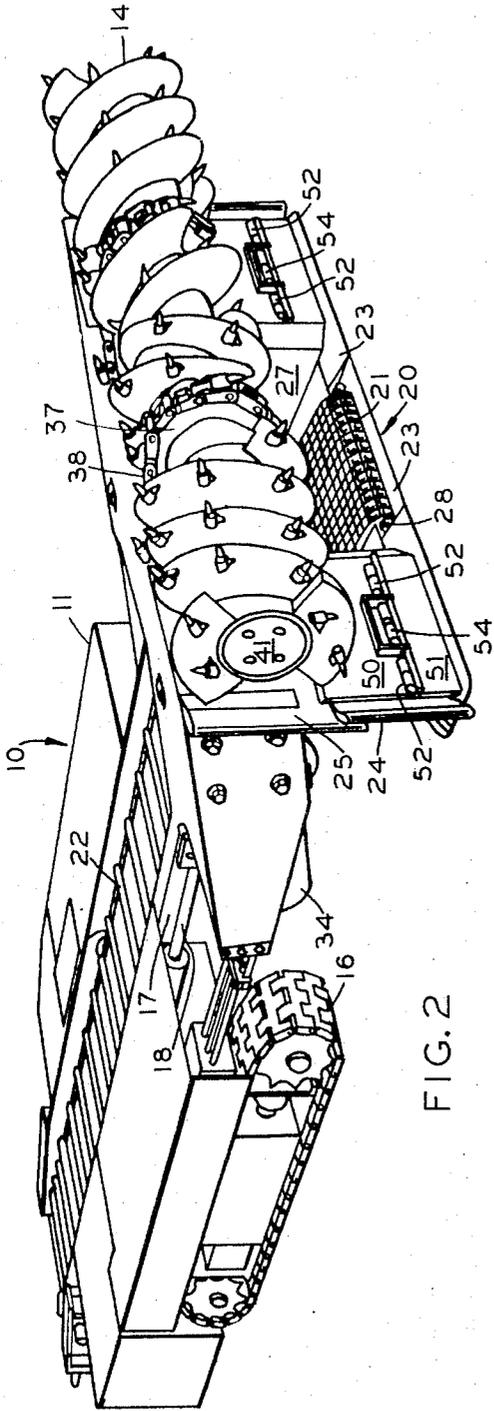


FIG. 2

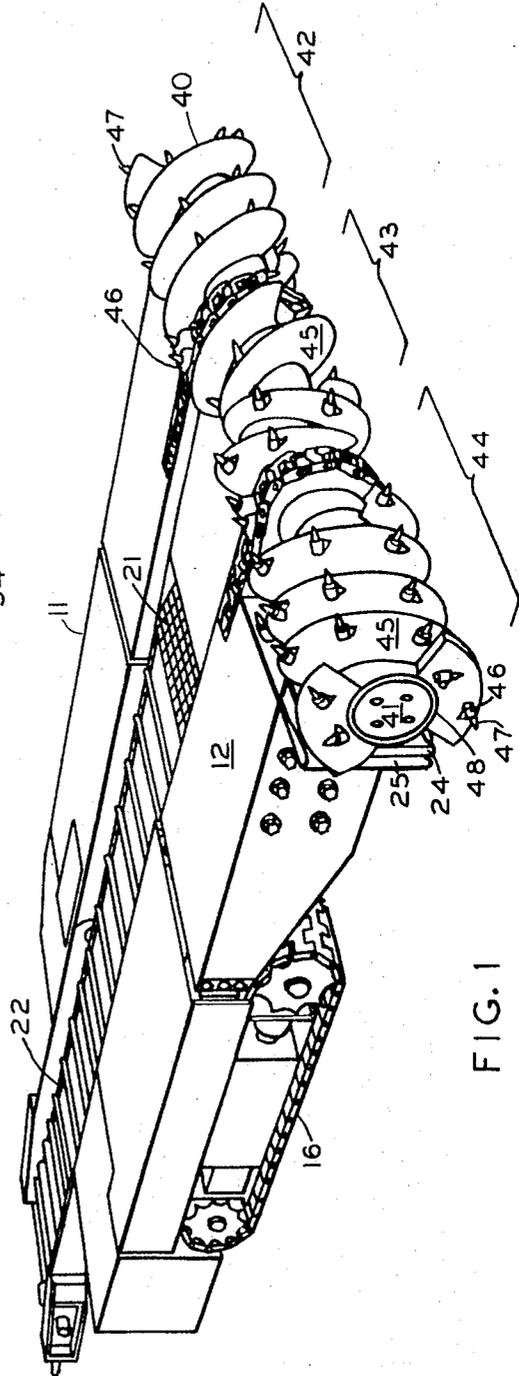


FIG. 1

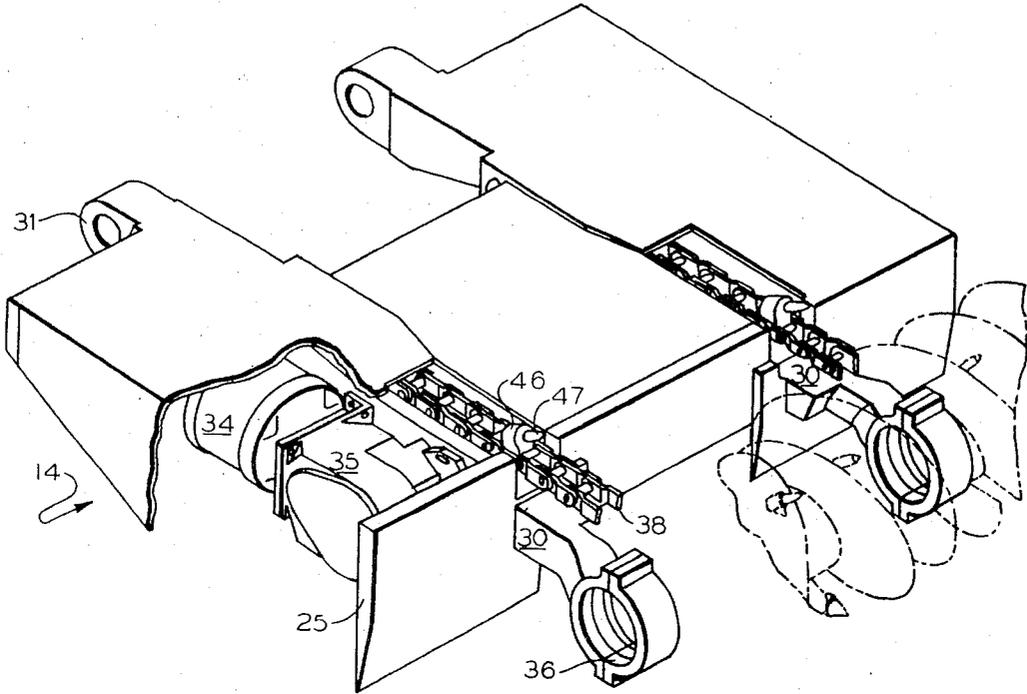


FIG. 4

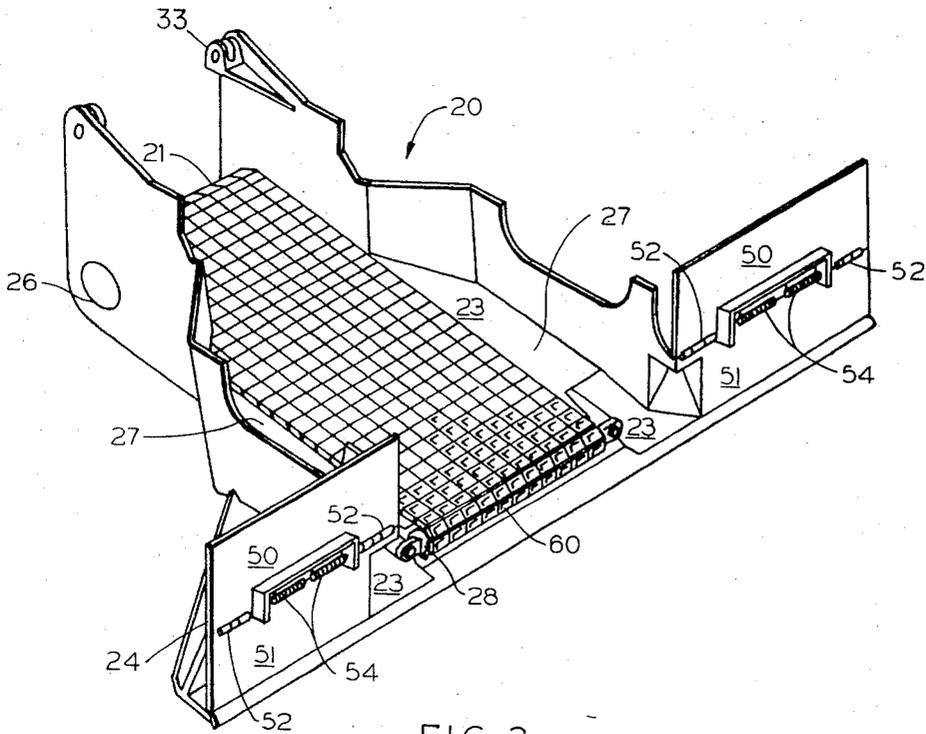


FIG. 3

CONTINUOUS CUTTING AND GATHERING APPARATUS FOR A CONTINUOUS MINING MACHINE

BACKGROUND OF THE INVENTION

The present invention relates to mining machines and more particularly to a gathering head structure for a continuous mining machine on which the rotatable mining head is disposed transverse to the forward motion of the mining machine.

A typical continuous mining machine has a mining head at the front end for cutting and breaking the material from the mine face. A gathering head is usually disposed below the mining head to collect the mined material and feed it to a conveyor which conveys it to the rear of the mining machine. From the rear of the machine the mined material is discharged to a haulage vehicle or other equipment which takes the material away from the place of the mining operation.

The gathering head typically involves gathering arms or rotating discs both of which require separate drive means and drive connections. Mining machines are operated in very harsh, wet and corrosive environments; and the gathering heads are typically required to move hundreds of tons of mined material each day. Because of the harsh nature of the operations and the large amount of work required by the mining machine, it is advantageous to reduce the number of moving parts in an attempt to minimize the amount of maintenance required.

These needs are emphasized in low seam mining operations. In low seams, the mining machine must necessarily be smaller because of the room limitations. And the machine must necessarily be lower cost because the rate of mining coal is substantially reduced due to the nature of the seam. Some prior attempts at low seam, low maintenance machines have incorporated a helical cutter head which also acts as the gathering device. These devices have eliminated gathering arms but have supplemented the action of the front helical auger with a secondary helical conveying device. Such secondary augers are disposed just rearwardly and parallel to the front auger and must incorporate additional drive means.

SUMMARY OF THE INVENTION

Accordingly it is the object of the present invention to provide an improved continuous miner having a gathering head which has few moving parts.

Another object of the present invention resides in the provision of a continuous miner employing gathering means arranged so that the overall mining machine may be of relatively low construction.

A further object of the present invention is to provide a combination cutter head and gathering device which is relatively easy to construct and to maintain.

These and other objects of the present invention are obtained by providing a continuous miner having a front cutter head frame with a rotary cutting head rotatably mounted at its forward end. The axis of the cutting head is disposed parallel to the face of the mine. A backup panel or auger skirt is located on the cutter head frame just rearward of and parallel to the cutting head. The cutting head has spaced left and right hand helical auger sections adapted to cut the material from the mine face and simultaneously convey the materials along the backup panel to a central position on a mat

conveyor. The mat conveyor has a small pitch and is located close to the helical auger. The mat conveyor moves the material rearwardly to conventional flight conveyors positioned rearward of the mat conveyor. Directly behind and adjacent to the front helical auger is a vertical dozer blade. The dozer blade overlaps a portion of the backup panel to provide a large vertical surface against which the helical auger sections may move the material. The upper portion of the dozer blade is hinged and spring loaded so that it continuously presses against the front portion of the auger frame to prevent spillage of coal behind the gathering head as the auger is raised and lowered relative to the gathering head.

DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of the mining machine incorporating the gathering head apparatus of the present invention.

FIG. 2 is another perspective view of the mining machine shown in FIG. 1 with the mining head in the raised position.

FIG. 3 is a perspective view of the gathering head portion of the mining machine shown in FIGS. 1 and 2.

FIG. 4 is an enlarged perspective view partly in section of the mining head portion of the mining machine shown in FIGS. 1 and 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A continuous mining machine 10 shown in FIGS. 1 and 2 of the drawings has a mining head 14 with a rotary drum 40 for cutting and breaking material from a mine face. Endless crawler tractor treads 16, disposed one on each side of the main frame, propel the machine. A second frame or sump frame 12 is mounted on top of the main frame 11. The sump frame 12 is connected to the main frame 11 by means of a tongue 17 and groove (not shown) arrangement, thus enabling the sump frame to be moved horizontally away from the main frame. The sump frame 12 is moved forward and backward by a pair of hydraulic cylinders 18 located on opposite sides of the machine, one of which is illustrated. Each hydraulic cylinder 18 is connected at one end to the main frame 11 and at the other end to the sump frame. By activating the hydraulic cylinders, the rotary drum 40 is advanced or sumped into the mine face.

Because the chassis of the mining machine is configured with a central sliding sump frame, it permits the crawlers 16 to remain locked while advancing or sumping the rotary drum or augers 40 into a mine face. This design takes advantage of the fact that the static coefficient of friction between the fixed crawlers and the floor is approximately 50% greater than the dynamic coefficient of friction between moving crawlers and the floor. The hydraulic cylinders 18 act to move the sliding sump frame 12 forward. The sliding sump frame 12 carries the auger head 40, gathering head 20 and conveyor assemblies 21 and 22 in its forward and rearward movement.

The mining head 14 has two parallel support arms 30 that extend forwardly to support the rotary drum 40 at the front end of the sump frame 12 of the mining machine 10. The arms 30 are connected by a pivot structure 31 to the sump frame. A backup panel or cross member 25 is disposed at the forward end of the arms

30 just rearward of and parallel to the rotary drum 40.

The mining head 14 is pivotally mounted by the pivot structure 31 and is moved upwardly and downwardly by a pair of hydraulic cylinders (not shown) located on opposite sides of the sump frame 12. Each of these hydraulic cylinders is pivotally connected at one end to the sump frame 12 and at the other end to the arms 30.

The rotary drum 40 is driven by a pair of electric motors 34 one of which is shown in FIG. 2, that are disposed at opposite sides of the sump frame 12. The motors 34 drive motor gear transmissions and a clutch and brake mechanism 35. Each of the clutches is connected by means of a drive sprocket (not shown) to a drive chain 38 that delivers drive by means of a second sprocket 37 to the rotary drum.

The forward sprocket wheel is fixed to a shaft 41 which extends transversely to the arms 30. Fixed to the shaft are three auger cutting sections 42, 43, and 44. Each auger section comprises a pair of helical blades 45 having their inner peripheries fixed securely to the adjacent portion of the casing 48 of the shaft 41 and the outer peripheries of a substantial constant radial extent. The pitch of the blades 45 of each section is such that when rotated they will serve to convey the material inwardly toward the forward end of the centrally disposed conveyor 21.

The outer periphery of each helical blade 45 of each auger section 42, 43, 44 has secured thereto a plurality of spaced bit holders 46 arranged to receive bits 47 of conventional structure that extend outwardly from the periphery of the blade 45. The bits on each blade are spaced apart equally in a longitudinal or axial direction.

There is a gathering head structure 20 at the front of the mining machine structure 10 below the arms 30. The gathering head 20 is pivotally mounted on a pivot point 26 separate from the mining head pivot 31. The gathering head structure 20 has an apron or front deck 23 with its leading edge at the floor. The gathering head structure carries a vertical dozer blade 24 on each side of a center conveyor throat 27 and provides a deck upon which a mat conveyor chain 21 may operate. A small diameter roller foot shaft 28 is positioned very close to the front of the gathering head 20 to provide a pivot structure for the small mat conveyor 21.

The upper portion 50 of the vertical dozer blade 24 is hinged at hinge points 52 to the lower portion 51 of the blade 24. Four torsional springs 54 spring load the upper portion 50 of the blade and force it rearwardly towards the backup panel 25 of the mining head 14, which is located immediately behind the rotating drum 40. As the rotary drum 40 is raised or lowered relative to the gathering head 20, the upper edge of the hinged dozer blade 24 remains in contact with the mining head backup panel 25. The pivoting and spring loading of the upper portion 50 of the dozer blade keeps the blade in continuous contact with the backup panel 25 and prevents any gaps from occurring between the backup panel 25 and the dozer blade 24. Such gaps would allow coal to fall behind the gathering head 14. The dozer blade and backup panel also cooperate to provide a continuous vertical surface immediately behind the auger.

The loading of cut mined material is achieved by the helical auger flights 42,44 working in conjunction with the backup panel 25 and dozer blades 24 on one side and the mine floor and mine face on the other sides. The backup panel 25, the dozer blades 24, the mine

floor and the mine face combine to form three exterior walls of a screw conveyor. The three walls contain the mined material within the outer helical auger flights 42,44 so that the material may be moved to the center conveyor throat 27 of the machine 10. At this center point, the combination of the return position of the drive chains 38 and the center auger section 43 pushes the mined material back and onto the mat chain conveyor 21.

Because of the small pitch of the chain links 60 and the resulting flexible nature of the gathering chain conveyor 21, the small diameter foot shaft 28 may be used and positioned very close to the front of the gathering head 20. This permits the conveyor 21 for the mined material to be located immediately behind the center auger section 43, thus eliminating the need for auxiliary gathering apparatus.

It is noteworthy that this gathering head design uses no moving parts. Instead the gathering structure 20 carries a pair of dozer blades 24 behind each of the outer augers 42,44 which when working at the mine face in conjunction with the helical scrolls 45 on the auger act as a screw conveyor to move the mined material to the center conveyor throat 27 of the gathering head 20 where it is picked up by the auxiliary gathering chain conveyor 21. The gathering conveyor 21 carries the mined material about four feet to the rear where it is transferred to the rear conveyor 22. The drive for the conveyor 21 is a hydraulic motor (not shown) having appropriate drive connection means to the conveyor through the interior of the pivot structure 26.

FIGS. 3 and 4 are included to illustrate the separate structure and relationship of the mining head 14 and the gathering structure 20. As shown on the perspective view of FIG. 4, the mining head 14 comprises two parallel spaced apart support arms 30. The support arms 30 are connected by the horizontal pivot structure 31 to the sump frame 12. The rotary drum 40 is rotatably mounted within bearing support member 36 at the forward end of the arms 30. Power for rotating the drum 40 is transmitted from electric motors 34 through gear transmission means in the housing 35 to a rear drive sprocket (not visible) to the drive chains 38. The drive chains 38 drive forward sprocket wheels 37 that are secured to the drive shaft 41.

The backup panel or front cross member 25 extends across the front of the mining head 14 to form a substantially vertical surface behind the rotary drum 40.

FIG. 3 illustrates the gathering head structure 20 in a perspective view that is similar to the perspective view of the mining head in FIG. 4. The gathering structure comprises a front vertical dozer blade 24 disposed on either side of a conveyor throat 27. The dozer blade 24 is substantially parallel to and overlaps the backup panel 25 to form a continuous vertical surface behind the right and left auger sections 42,44. The surface extends from behind the upper portion of the augers downwardly.

The deck or apron 23 provides a floor in the throat 27 to support the upper flight of a gathering conveyor 60. Conveyor 60 is driven at its rearward end by means (not shown) and pivots at its forward end about a foot shaft 28.

The gathering structure 20 pivots about a pivot 26 and is raised or lowered by hydraulic cylinders (not shown) that attach at their rearward end to the sump frame 12 and at their forward end to clevice 33 on the

gathering head 20. During a mining operation, the gathering head 20 will typically remain on the floor. The mining head 14 will be pivoted upwardly about the pivot 31 and then sumped into the mine face.

As the rotary drum 40 is raised, the backup panel 25 5 moves with it away from the dozer blades 24. To assure that no gaps form between the dozer blades 24 and the backup panel 25, the top portions 50 of the blades 24 are hinged at points 52 and are spring loaded rearwardly by springs 54. The springs 54 press the upper 10 edges of the dozer blades 24 firmly against the backup panel 25. Thus the structure 20 assures that no gaps form between the dozer blades 24 and backup panel 25.

Having thus described the invention, those skilled in 15 the art will recognize various uses for and changes in the details and arrangements of parts without departing from the scope of the invention as it is defined in the appended claims. For example, although it is preferred to hinge the upper portion of the dozer blade rearwardly against the backup panel, it is possible to have 20 the backup panel be forward of the dozer blade. Thus the blades would be necessarily hinged forwardly against the panel. Similarly, the backup panel may have its lower portion hinged and held against a rigid dozer 25 blade. In another embodiment the conveyor throat and gathering chain conveyor may be located to one side of the machine rather than down the center of the mining machine. It is therefore respectfully requested that the invention be interpreted as broadly as possible accord- 30 ing to the provisions of the patent statutes and limited only by the scope of the appended claims.

We claim:

1. A mining machine, comprising:

a frame mounted for movement toward a mine face; 35
a mining head mounted on the forward end of the frame, the mining head including a shaft mounted for rotation at the forward end of the mining head and disposed transverse to the direction of move- 40 ment of the frame;

a plurality of helical cutter members mounted about the rotatable shaft, the helical cutters being shaped to direct mined material along the axis of the shaft;

a back up panel mounted on the mining head just rearward of the periphery of the helical cutters and 45 substantially parallel thereto to provide a surface against which the helical cutter members may move the mined material; and

a gathering structure mounted at the forward end of the frame beneath the mining head including a 50 gathering conveyor throat having a conveyor mounted therein for rearward movement of mined material fed to it; and

a substantially vertical dozer blade disposed to one 55 side of the conveyor throat just rearward of the periphery of the helical cutters and substantially parallel thereto, an upper portion of the dozer blade being pivotable about hinged structures provided at its lower edge, the dozer blade having means 60 tending to pivot the upper portion about the hinged edge to maintain the upper portion in contact with the back up panel.

2. A mining machine, comprising:

a frame mounted for movement into a mine face; 65
a mining head mounted on the forward end of the frame, the mining head including a support arm attached near its rearward end to a pivot structure on

the frame and at its forward end to a rotatable shaft mounted transverse to the direction of movement of the frame;

means for moving the rotatable shaft up and down about the pivot structure;

a plurality of helical cutter members mounted about the rotatable shaft, the helical cutters being shaped to direct mined material along the axis to the shaft; a backup panel mounted on the support arm just rearward of the periphery of the helical cutters and substantially parallel thereto;

a gathering head structure at the front end of the frame adjacent the mining head for gathering the mined material including a conveyor throat having a conveyor mounted therein for a rearward move- ment of mined material fed to it;

a substantially vertical front dozer blade disposed to the side of the conveyor throat just rearward of the periphery of the helical cutters and substantially parallel thereto, the dozer blade having an upper portion overlapping the backup panel and being pivotally connected along its lower edge, the dozer blade having means tending to pivot the dozer blade about the pivot to maintain the upper portion of the dozer blade against the overlapped backup panel during the upward and downward movement of the rotatable cutter shaft to continuously provide a contiguous surface against which the helical cutter members may move mined material to the conveyor.

3. A mining machine, comprising:

a frame mounted for movement into a mine face; a mining head mounted on the frame for movement into a mine face, the mining head including a support arm attached near its rearward end to a pivot structure on the frame and at its forward end to a rotatable cutter shaft mounted transverse to the di- rection of movement of the frame;

means for moving the mining head about the pivot structure such that the rotatable cutter shaft may be raised or lowered;

a plurality of helical cutter members mounted about the rotatable shaft, the helical cutters being shaped to direct mined material inwardly of the ends of the shaft;

means for rotating the shaft and cutter members mounted thereon;

a back-up panel mounted near the forward end of the support arm just rearward of the periphery of the helical cutters and substantially parallel thereto;

a gathering structure near the forward end of the frame beneath the mining head for gathering the material mined and fed to it by the helical cutter members, the gathering structure including a central conveyor throat having a conveyor mounted therein for rearward movement of mined material fed to it, and a substantially vertical dozer blade disposed at each side of the central conveyor throat just rearward of the periphery of the helical cutters and substantially parallel thereto, each dozer blade having upper and lower portions, the upper portions overlapping the back up panel and being pivotally connected to the lower portions, the dozer blade having means tending to maintain the upper portion against the overlapped backup panel during the raising and lowering of the rotatable cutter shaft to continuously provide a contiguous surface

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against which the helical cutter members may move mined material inwardly to the central conveyor.

4. A mining machine as recited in claim 3 wherein the upper portion of the dozer blade is pivoted rearwardly into contact with the backup panel. 5

5. A mining machine as recited in claim 4 wherein the means tending to pivot the upper portion of the dozer blade rearwardly to maintain the upper portion in contact against the backup panel is a torsional spring. 10

6. A low seam mining machine, comprising:
a main frame provided with endless traction crawlers for propelling the mining machine;
a sump frame slidably mounted on the forward end of the main frame; 15
means for sliding the sump frame forward of the main frame;
a mining head mounted on the sump frame for movement therewith into a mine face, the mining head including a support arm attached near its rearward end to a pivot structure on the sump frame and at its forward end to a rotatable cutter shaft mounted transverse to the direction of movement of the frame; 20 25

means for moving the mining head about the pivot structure such that the rotatable cutter shaft may be raised or lowered;
a plurality of helical cutter members mounted about 30

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the rotatable shaft, the helical cutters being shaped to direct mined material inwardly of the ends of the shaft;

means for rotating the shaft and cutter members mounted thereon;

a back-up panel mounted near the forward end of the support arm just rearward of the periphery of the helical cutters and substantially parallel thereto;

a gathering structure near the forward end of the frame beneath the mining head for gathering the material mined and fed to it by the helical cutter members, the gathering structure including a central conveyor throat having a conveyor mounted therein for rearward movement of mined material fed to it, and a substantially vertical dozer blade disposed at each side of the central conveyor throat just rearward of the periphery of the helical cutters and substantially parallel thereto, each dozer blade having upper and lower portions, the upper portions overlapping the back up panel and being pivotally connected to the lower portions, the dozer blade having means tending to maintain the upper portion against the overlapped backup panel during the raising and lowering to the rotatable cutter shaft to continuously provide a contiguous surface against which the helical cutter members may move mined material inwardly to the central conveyor.

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