

- [54] MINING MACHINE HAVING ROTARY
MOTOR EXTENDED CUTTER HEAD
[75] Inventor: Frank A. Delli-Gatti, Jr., Amity, Pa.
[73] Assignee: Lee-Norse, Company, Chalerni, Pa.
[22] Filed: Oct. 9, 1973
[21] Appl. No.: 404,296

Related U.S. Application Data

- [62] Division of Ser. No. 243,973, April 14, 1972.
[52] U.S. Cl. 299/64, 299/80
[51] Int. Cl. E21c 27/24
[58] Field of Search 299/64-68,
299/75, 76, 80

References Cited

UNITED STATES PATENTS

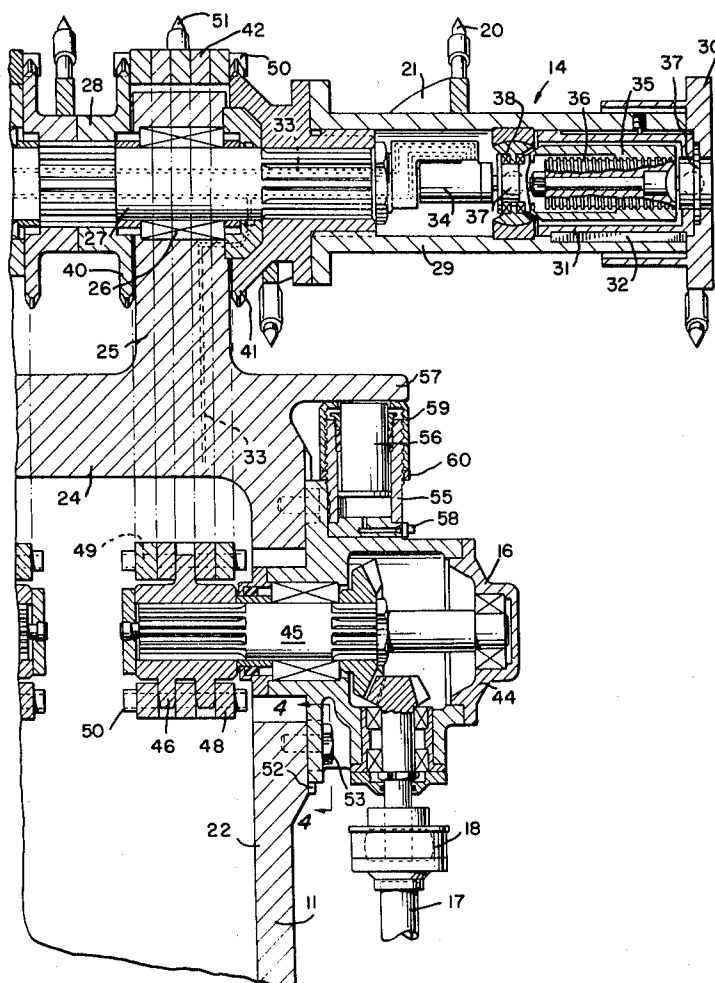
- 2,953,362 9/1960 Thassy et al. 299/80 X
3,062,518 11/1962 Osgood 299/75 X
3,469,886 9/1969 Marberg 299/80

Primary Examiner—Ernest R. Purser
Attorney, Agent, or Firm—Robert R. Paquin

[57] **ABSTRACT**

A continuous mining machine particularly adapted for low overhead coal seams having a relatively small diameter cutterhead of the non-oscillating or fixed head type driven by chains that also cut coal and convey it rearwardly to a gathering head mounted on the front of the machine. The cutter head is extendible by low pressure rotary fluid motors acting through screw-and-nut arrangements, the component screw and nut of each such arrangement each being movable for proper alignment with the other. The gathering head carries a pair of counter-rotating discs having vanes cooperating with conveyor fences for sweeping and discharging coal to a conventional conveyor mounted on the machine chassis.

8 Claims, 6 Drawing Figures



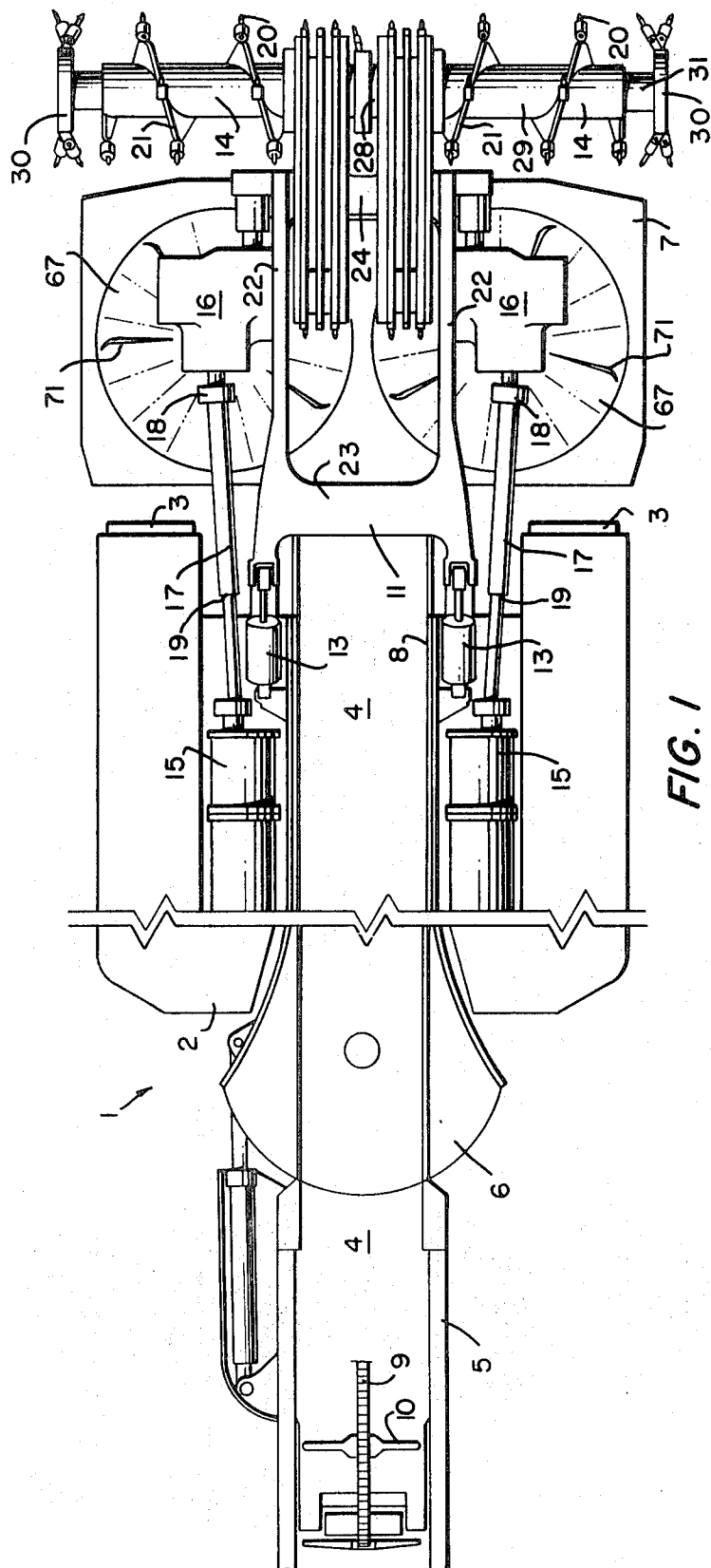


FIG. 1

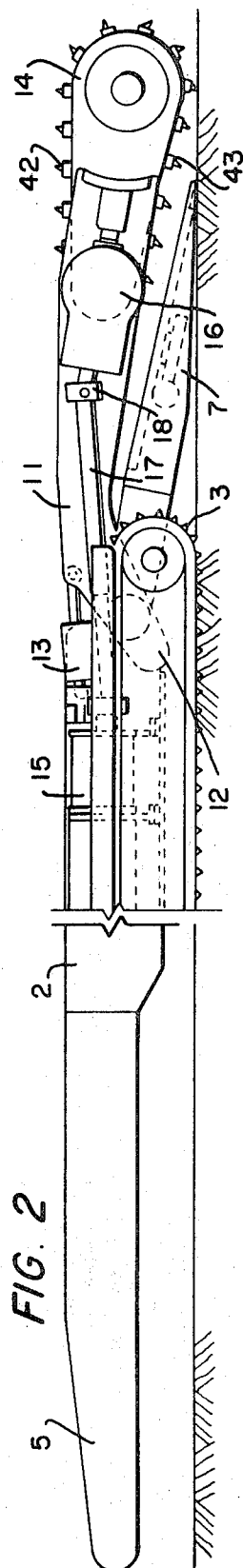


FIG. 2

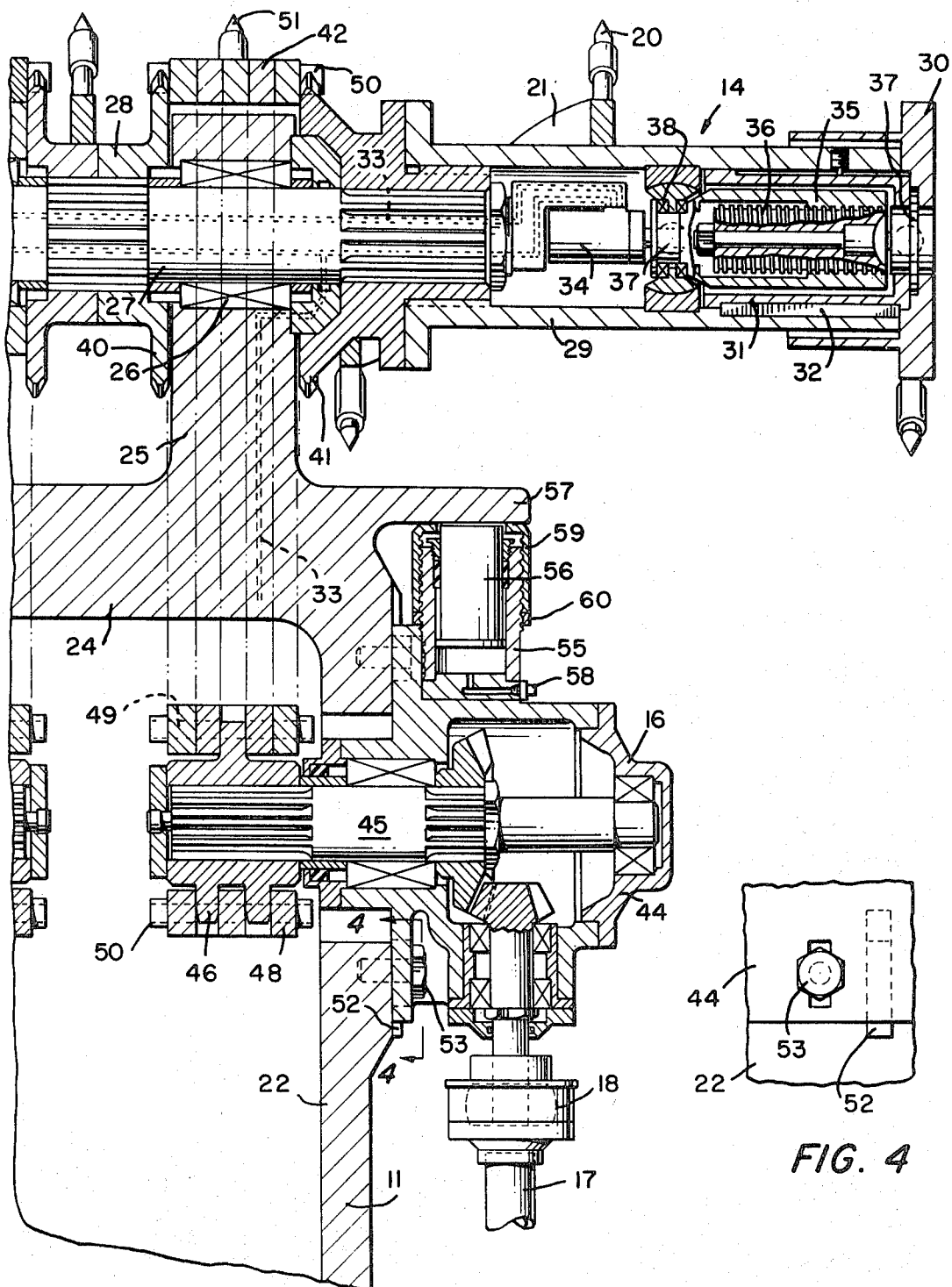


FIG. 3

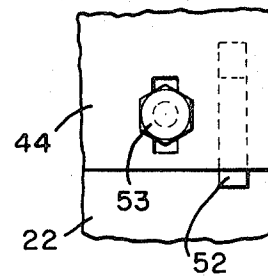


FIG. 4

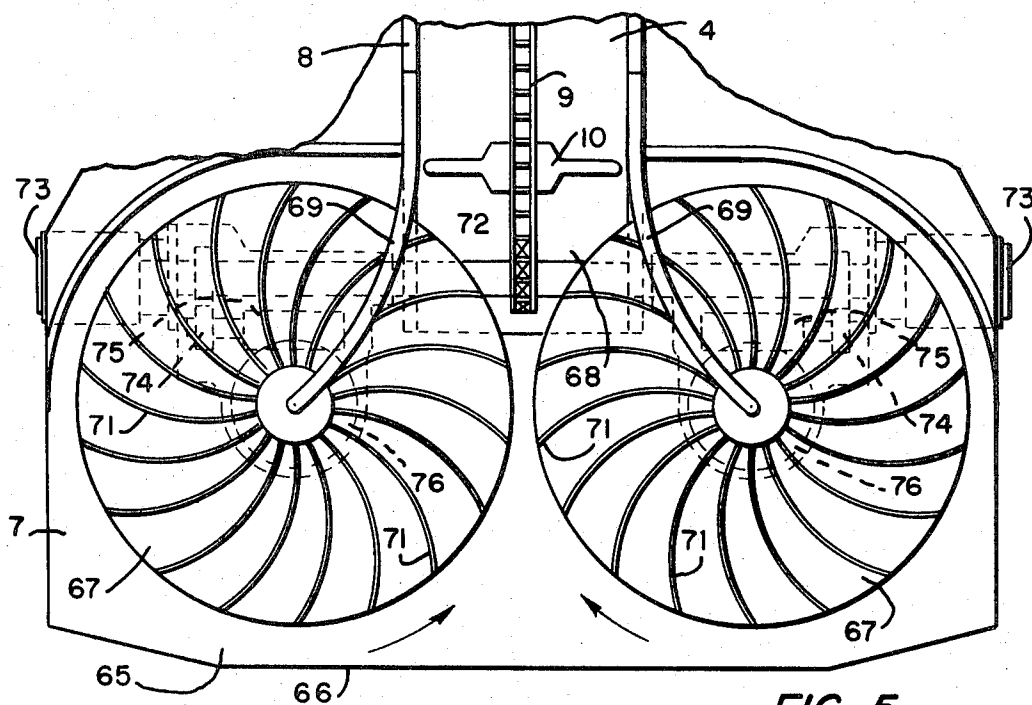


FIG. 5

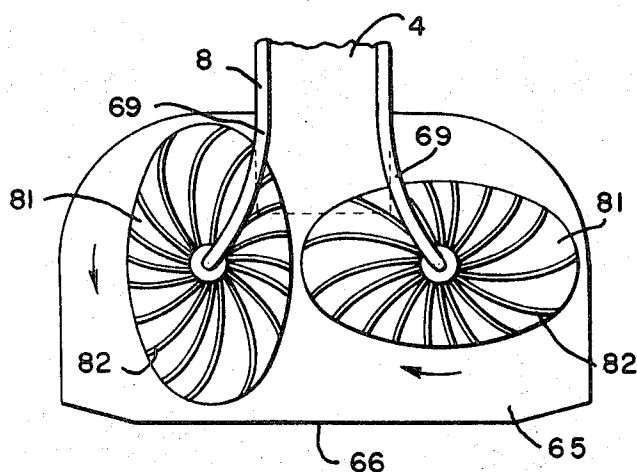


FIG. 6

MINING MACHINE HAVING ROTARY MOTOR EXTENDED CUTTER HEAD

This is a division of application Ser. No. 243,973, filed Apr. 14, 1972.

BACKGROUND OF INVENTION

This invention relates generally to the arts of mining and conveying materials and more specifically to continuous mining machines and improvements therein for mining coal and the like.

It is well known to provide continuous mining machines with a single cutter head rotating on a horizontal axis having a length greater than the width of the mining machine. The cutter head moves vertically up and down the face of a mine to mine coal, normally beginning at the top of the face and moving progressively down to the bottom and then returning to the top of the face where the machine moves forward to sump the head into the face to begin another downward sweep. Generally speaking, the trade calls this type of machine a "fixed head" miner.

Heretofore, fixed head miners have generally used high pressure hydraulic systems for moving the extendible ends of the cutter head inward and outward. Such use of hydraulic fluids under relatively high pressures seems to cause leakage problems that are difficult and expensive to solve. In addition, fixed head miners generally have their cutter heads connected to a driving transmission including gears and shafts extending directly to the cutter head. This type of transmission is expensive, makes the cutter head more bulky, and requires it to be of a relatively large diameter. Thus it is difficult to use this type of transmission arrangement in a mining machine having a cutter head with a relatively small diameter.

It is known to provide gathering heads for conveyors, such as used in continuous mining machines, with counter-rotating tables or discs mounted on the deck or apron of the gathering head and to provide each rotating disc with upstanding radially extending vanes to sweep material onto a conveyor located between the counter-rotating discs. However, it has been found that arranging the vanes to extend radially reduces the ability of the vanes to efficiently sweep conveyed material onto the conveyor.

SUMMARY OF THE INVENTION

The principal object of this invention is to provide a mining machine with new and improved means for extending the extendible cutter head of the machine, which means is particularly adapted to permit employment of a relatively low pressure hydraulic system.

In general, the foregoing object may be attained in a mining machine having a cutter head having telescopically sliding end portions, each being moved inward and outward by a motor powered by relatively low pressure fluid and driving a thread means connected to each end portion.

BRIEF DESCRIPTION OF DRAWINGS

The invention is described in connection with the accompanying drawings wherein:

FIG. 1 is a plan view of a mining machine embodying the invention;

FIG. 2 is a side elevational view of FIG. 1;

FIG. 3 is a fragmentary axial section of the front portion of the miner showing a part of the cutter head and the details of the driving means for the cutter head;

FIG. 4 is a fragmentary section taken on line 4—4 in FIG. 3;

FIG. 5 is a fragmentary plan view of the gathering head; and

FIG. 6 is a view similar to FIG. 5 on a smaller scale of an alternate embodiment of the gathering head.

DESCRIPTION OF PREFERRED EMBODIMENT

Looking at FIGS. 1 and 2, the mining machine 1 conventionally comprises a chassis 2 supported on a pair of crawler tracks 3 and carrying a conveyor 4 running from the front of the chassis 2 to beyond the rear on a tail-piece 5 having an articulated joint 6. A gathering head 7 is pivoted on the front of the chassis 2 and extends forwardly therefrom for conveying coal to the forward end of the conveyor 4. The conveyor 4 includes a trough having the usual side flanges 8 and a chain 9 with cross bars 10 for carrying material along the conveyor trough. A boom 11 is pivotally mounted on the front end of the chassis 2 at 12, to extend upwardly and forwardly therefrom and is raised up and down by a pair of hydraulic cylinders 13 mounted between the chassis 2 and an intermediate portion of the boom 11. A cutter head 14 is rotatively mounted on the forward end of the boom 11. Motors 15 are mounted on the sides of the chassis 2 and are connected to transmissions 16 mounted on the outer sides of the boom 11 by shafts 17 having a universal joint 18 at each end and splined telescopic joints 19 between the ends. The cutter head 14 has the usual cutting bits 20 mounted on the ends of auger-shaped, helically extending flanges 21 arranged to urge coal broken away from a face by the bits 20 to move toward the center of the cutter head 14. It is believed that all of the foregoing structure is conventional in continuous mining machines.

Looking at FIGS. 1 and 3, the boom 11 is composed of a pair of horizontally spaced longitudinal side members 22 interconnected by a pair of longitudinally spaced cross members to form an openwork construction seen when looking down on the boom 11. The cross members include a rear cross member 23 located intermediate the ends of the side members 22 and a front cross member 24. A pair of integral, horizontally spaced arms 25 extend forwardly from the front cross member 24 and contain bearings 26, shown in FIG. 3, supporting the shaft 27 of the cutter head 14. The cutter head 14 comprises a central drum 28, a pair of outer drums 29 and a pair of extendible end portions 30 telescoped within the outer drums 29. The central drum 28 and the outer drums 29 engage splines on the shaft 27 as shown in FIG. 3 to rotate together in unison. Each extendible end portion 30 includes an inner sleeve 31 telescoping in the interior of the outer drums 29 and keyed therein by a key 32, thus anchoring the end portion 30 to rotate with the outer drum 29 while being able to telescope relative thereto.

The means for moving each end portion 30 relative to its outer drum 29 includes a rotary hydraulic motor 34 mounted in the outer drum and driven by relatively low pressure fluid flowing through supply and return passages 33 extending through the boom arm 25 and the shaft 27. The motor 34 drives a long nut 35 threaded on a cooperating screw 36 fixed to the end portion 30. Both the nut 35 and the screw 36 are con-

nected to their respective members by a universal joint 37 that allows the nut and screw to seek their own alignment with each other. The inner end of the nut 35 rotates in bearings 38.

It has been found that the use of the relatively low pressure hydraulic fluid motor 34 in conjunction with the screw 36 and cooperating nut 35 is capable of applying relatively large forces to move the end portion 30 inwardly and outwardly relative to the outer drum 29, thus eliminating the need for pistons and cylinders requiring relatively high fluid pressures to create the necessary forces required for telescoping the end portion 30. The use of the screw 36 and nut 35 provides a self-locking system since the screw is designed so that it cannot be caused to travel in the nut 35 by thrust forces acting on the end portion 30.

The central drum 28 includes a sprocket 40 at each end, and the inner end of each outer drum 29 carries a sprocket 41. Thus the sprockets 40 and 41 are located on the opposite sides or faces of the arms 25, as shown in FIG. 3. The sprockets 40 and 41 are driven by wide multiple-strand chains 42 from the transmissions 16 mounted on the sides 22 of the boom 11. Each transmission 16 includes a case 44 containing an output shaft 45 driving a sprocket 46 engaging a chain 42.

The multiple-strand chain 42 is formed of a series of links 48 pivoted together by pins 49 having heads 50 projecting beyond the sides of the chain. The chain 42 shown in FIG. 3 contains five strands, thus being relatively wide. The chain 42 extends around the sprockets 40 and 41 in the cutter head, and the heads 50 of the pins 49 engage in the teeth of the sprockets 40 and 41 to drive the cutter head 14. In addition to transmitting torque, the chain 42 carries a series of longitudinally spaced cutting bits 51 serving to cut coal as they rotate around the cutter head and to convey coal rearwardly away from the cutter head as they travel rearwardly. It will be recognized that the chains rotate clockwise, as shown in FIG. 2, the same direction of rotation as the cutter head 14, thus cutting the coal downwardly and rearwardly from the cutter head 14. Due to being driven in a clockwise direction as shown in FIG. 2, the lower run or flight 43 of the chain 42 is tensioned which increases its effectiveness to carry the cut coal rearwardly to the gathering head 7. The tension on the lower run 43 makes the bits 51 on the chain 42 stand rigidly relative to the chain to make them more effective in carrying the coal rearwardly than they would be if the lower run 43 of the chain was slack.

Novel means is shown for adjusting the transmissions 16 relative to the boom side walls 22 to adjust the tension on the chains 42. Each transmission case 44 is longitudinally adjustable on key ways 52 formed in the side wall 22, and is attached to the side wall 22 by bolts 53 extending through slots in the transmission case 44 and threaded into the boom side walls 22. The forward end of the transmission case 44 includes a cylinder 55 containing a piston 56 projecting forward to engage an outwardly extending wing 57 on the boom 11. Thus the cylinder 55 is located between the transmission 16 and the outwardly extending wing 57 of the boom 11. The cylinder 55 contains a grease fitting 58 connected to a passage for feeding grease under pressure into the cylinder to urge the piston 56 forwardly against the boom wing 57, and thus to force the transmission case 44 rearwardly to increase the tension on the cutter chain 42.

When the proper chain tension is achieved, the sleeve nut 59 threaded on the forward portion of the cylinder 55 is screwed outwardly until engaged solidly against the boom wing 57 and a lock nut 60 is moved to lock the sleeve nut 59 in adjusted position. It will be noted that this arrangement provides a simple means for adjusting the transmission case 44. Once the chain tension is properly adjusted, the bolts 53 are tightened to lock the transmission case 44 in place solidly on the boom side wall 22.

The gathering head 7 is shown in FIG. 5 and includes a large apron or deck 65 having a forward end 66 and is pivoted at its rear end to the chassis 2 of the miner 1 in a conventional manner. A pair of counter-rotating discs 67 are mounted in the gathering head deck 65 and rotate in the direction of the arrows to move conveyed material centrally and rearwardly to the forward end 68 of the conveyor 4. The conveyor 4 includes the parallel side flanges 8 which extend forwardly into a pair of fences 69 flaring outwardly and terminating at or near the axis of each disc 67. The fences 69 are arranged to guide or cam material off of each gathering head disc 67 as they rotate beneath the fences. At the same time, the movement of the disc 67 urges the coal or other conveyed material rearwardly onto the front end of the conveyor 68.

A novel invention of this arrangement is the idea of providing upstanding vanes 71 on each disc 67 and extending the vanes 71 relative to the radius of the disc so the vanes 71 curve outwardly and rearwardly relative to the rotating direction of each disc, whereby, as they approach the periphery of each disc, they extend at a substantial angle relative to the radius and rearwardly relative to the direction of rotation of the disc. This manner of extending each vane 71 is preferred as it serves to aid in guiding the conveyed material off of the disc as each vane 71 passes beneath a fence 69. It can be seen that if the vane 71 extended radially, the material might be caught between the vane 71 and the fence 69 to cause damage to either member. It is preferable to curve each vane 71 relative to the curve of the fence 69 so that each portion of the vane 71 extends generally at a right angle relative to the fence 69 as it passes beneath it.

In an example of a gathering head constructed by the inventor, the surface of the discs 67 lie in the plane of the deck surface and the vanes 71 project above the deck surface about five-eighths inches.

The foregoing type of gathering head is particularly useful in a continuous miner designed for very low seams, i.e., seams of less than 30 inches in height.

The discs 67 are driven by a system shown in dotted lines in FIG. 5, including a shaft 72 driven at each end by a motor 73 and driving gears 74 connected to a worm 75 engaging a worm gear 76 fixed to each disc 67. In addition, the shaft 72 simultaneously carries a sprocket driving the conveyor chain 9.

Another embodiment of gathering head 80 is shown in FIG. 6 employing oval or elliptical discs 81 arranged to rotate 90° out of phase with each other and carrying vanes 82 similar to the vanes 71. This arrangement will oscillate the central area between the discs 81 back and forth and is believed to benefit the feeding of material onto the conveyor.

While one or more embodiments of the invention have been shown and described in detail, this invention is not limited simply to the specifically described em-

bodiments, but contemplate other embodiments and variations utilizing the concepts and teachings of this invention.

I claim:

1. A mining machine including:

a mobile chassis carrying a movable boom extending forwardly therefrom;

a cutter head rotatably mounted on said boom;

said cutter head including a drum portion and an end portion movably mounted in said drum portion for telescoping travel inwardly and outwardly relative to said drum portion; and

power means for moving said end portion inwardly and outwardly including a fluid driven rotary motor mounted in said drum portion and driving thread means interconnected between said end portion and said drum portion;

said thread means including a nut driven by said motor and a screw connected to said end portion; and

at least one of the connections between said motor and nut, and screw and end portion, including a universal joint allowing the thread means to move slightly relative to said cutter head in seeking proper alignment between the nut and screw.

2. The mining machine of claim 1 wherein:

said thread means is self-locking so that it cannot be moved by force applied to said end portion.

3. A mining machine comprising supporting means, rotary cutter head means carried by said supporting means and including at least one extendible end portion, means drivingly connected to said cutter head means for rotatably driving said cutter head means, and moving means for moving said extendible end portion of said cutter head means, said moving means including rotary motor means and thread means drivingly connecting said motor means with said end portion, said thread means comprising a nut connected to one of said motor means and end portion and a screw connected to the other thereof, and at least one of the connections between said nut and its connected said one of said motor means and end portion, and said screw and its connected other thereof, including a universal joint allowing said thread means to move relative to said cutter head means for proper alignment between said nut and said screw.

4. A mining machine according to claim 3, wherein said thread means is self-locking to prevent it from being moved by force applied to said end portion.

5. A mining machine according to claim 3, wherein said nut is connected to said motor means and said screw is connected to said end portion.

6. A mining machine comprising supporting means, rotary cutter head means carried by said supporting means, gathering means operatively associated with said cutter head means for gathering material mined by said cutter head means, driving chain means drivingly connected to said cutter head means generally centrally thereof to be actuatable for rotatably driving said

cutter head means, driving means connected to said driving chain means for actuating said driving chain means to rotatably drive said cutter head means, cutter means carried by said driving chain means for mining material during said actuation of said driving chain means, said actuation of said driving chain means causing said driving chain means to convey mined material towards said gathering means, said cutter head means including at least one extendible end portion, and moving means for moving said end portion, said moving means including rotary motor means and thread means drivingly connecting said motor means with said end portion, said thread means comprising a nut connected to said motor means and a screw connected to said end portion, and at least one of the connections between said motor means and nut, and screw and end portion, including a universal joint allowing said thread means to move relative to said cutter head means for proper alignment between said nut and said screw.

7. A mining machine according to claim 6, wherein said thread means is self-locking to prevent it from being moved by force applied to said end portion.

8. A mining machine comprising a chassis, a boom mounted on said chassis for vertical movement thereto and projecting forwardly of said chassis, a horizontal cutter head rotatably mounted on the forward end of said boom, gathering means below said boom for gathering material mined by said cutter head, driving chain means drivingly connected to said cutter head generally centrally thereof to be longitudinally movable for rotatably driving said cutter head, driving means connected to said driving chain means for longitudinally driving said cutter chain means to cause said driving chain means to rotatably drive said cutter head, cutter means carried by said driving chain means for mining material during the driven longitudinal movement of said driving chain means, said driving chain means including upper and lower runs, the driven longitudinal movement of said driving chain means by said driving means causing said driving chain means to be driven in a direction whereby said lower run thereof is under driving tension and said driving chain means rearwardly conveys mined material towards said gathering means, said cutter head including extendible end portions, and moving means for moving said end portions, said moving means for each said end portion including rotary motor means and thread means drivingly connecting said motor means with the end portion, each said thread means being self-locking to prevent it from being moved by force applied to its respective said end portion, each said thread means comprising a nut connected to its respective said motor means and a screw connected to its respective said end portion, and at least one of the connections between each said motor means and nut, and screw and end portion, including a universal joint allowing the thread means to move relative to said cutter head for proper alignment between such nut and screw.

* * * * *