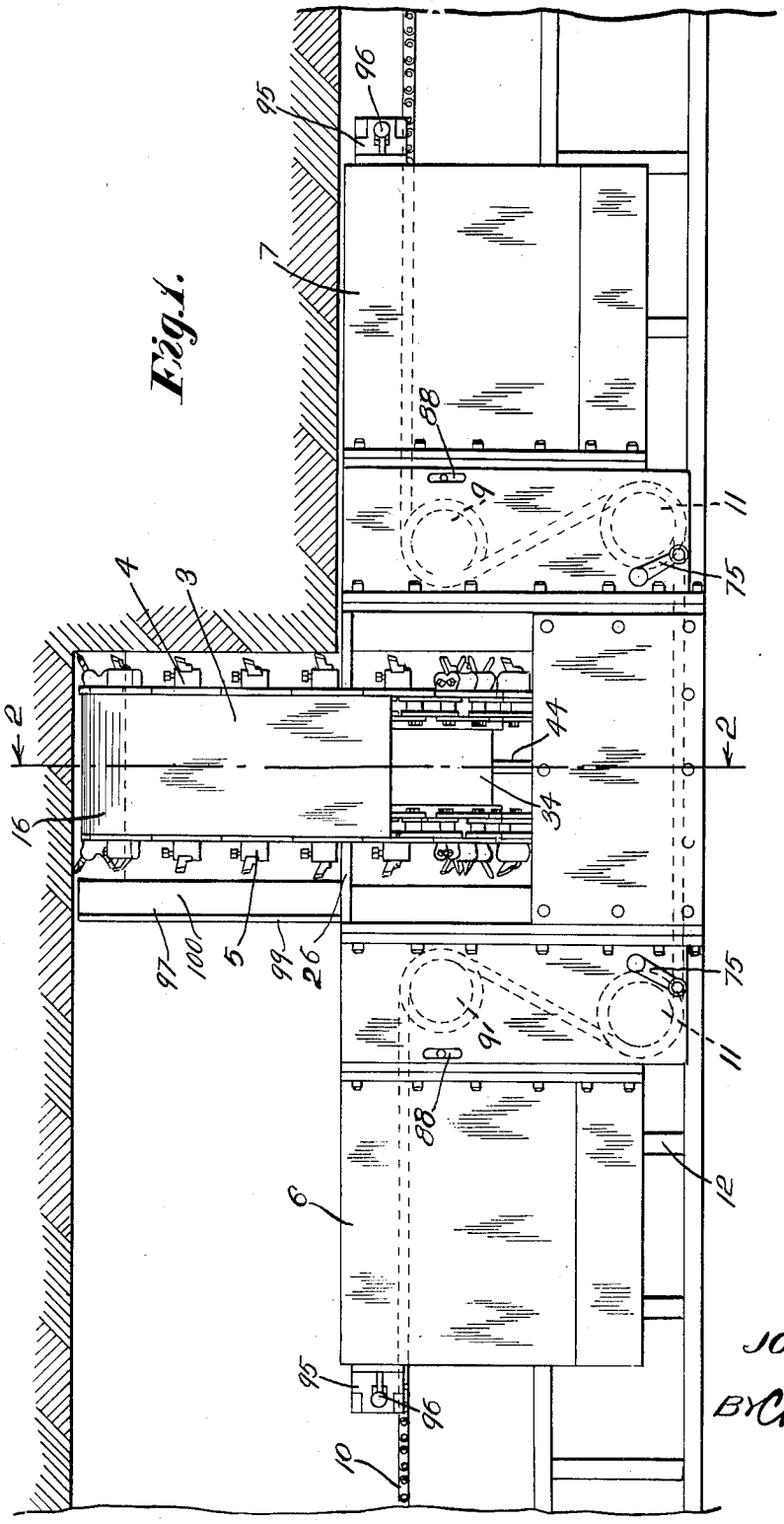
Jan. 10, 1956 J. F. JOY 2,730,346

REVERSIBLE LOOP CUTTER TYPE LONGWALL MINER

Filed March 7, 1951 5 Sheets-Sheet 1

Fig. 1.



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REVERSIBLE LOOP CUTTER TYPE LONGWALL MINER

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Fig. 2.

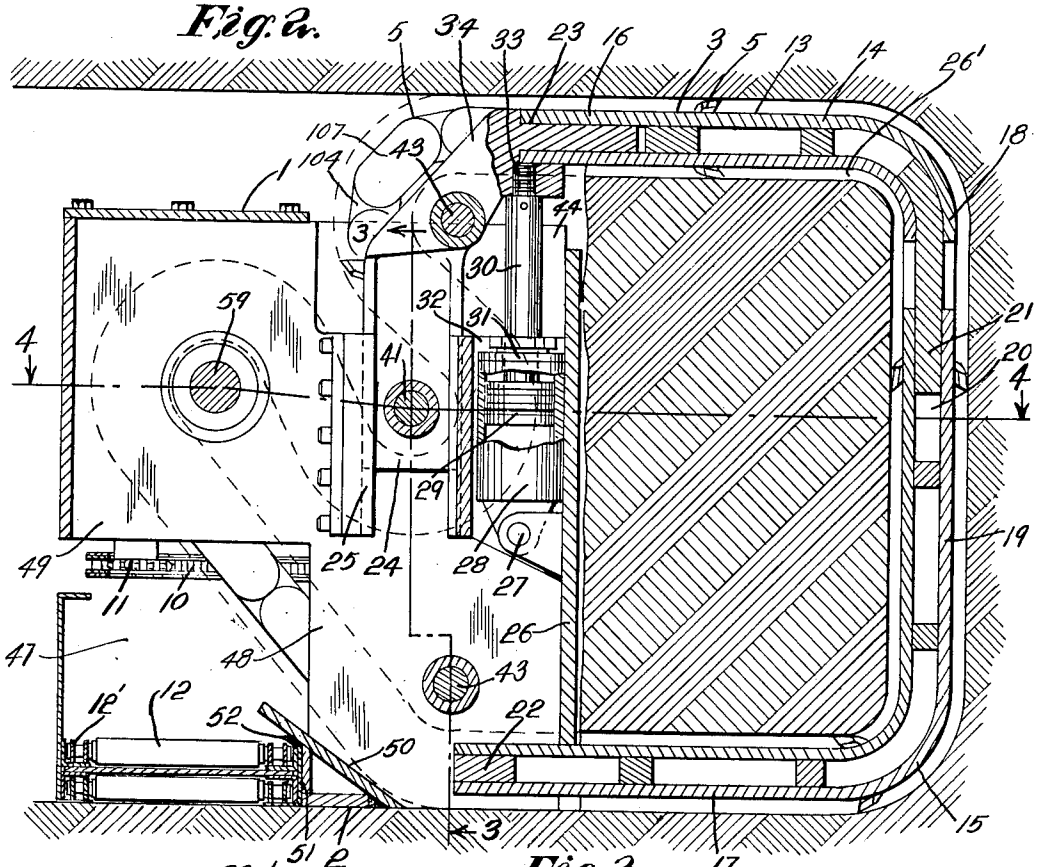
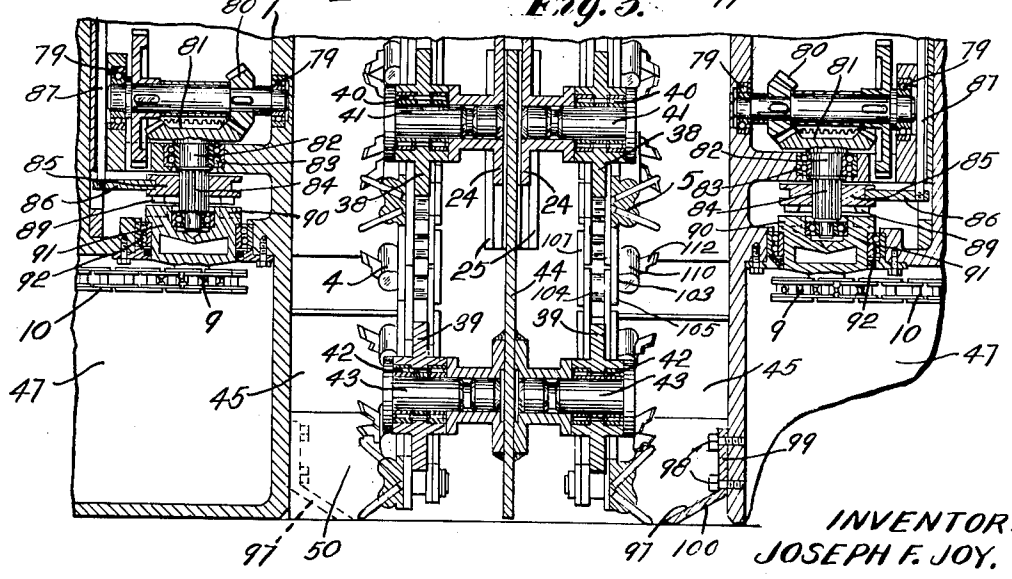


Fig. 3.



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REVERSIBLE LOOP CUTTER TYPE LONGWALL MINER

Filed March 7, 1951 5 Sheets-Sheet 3

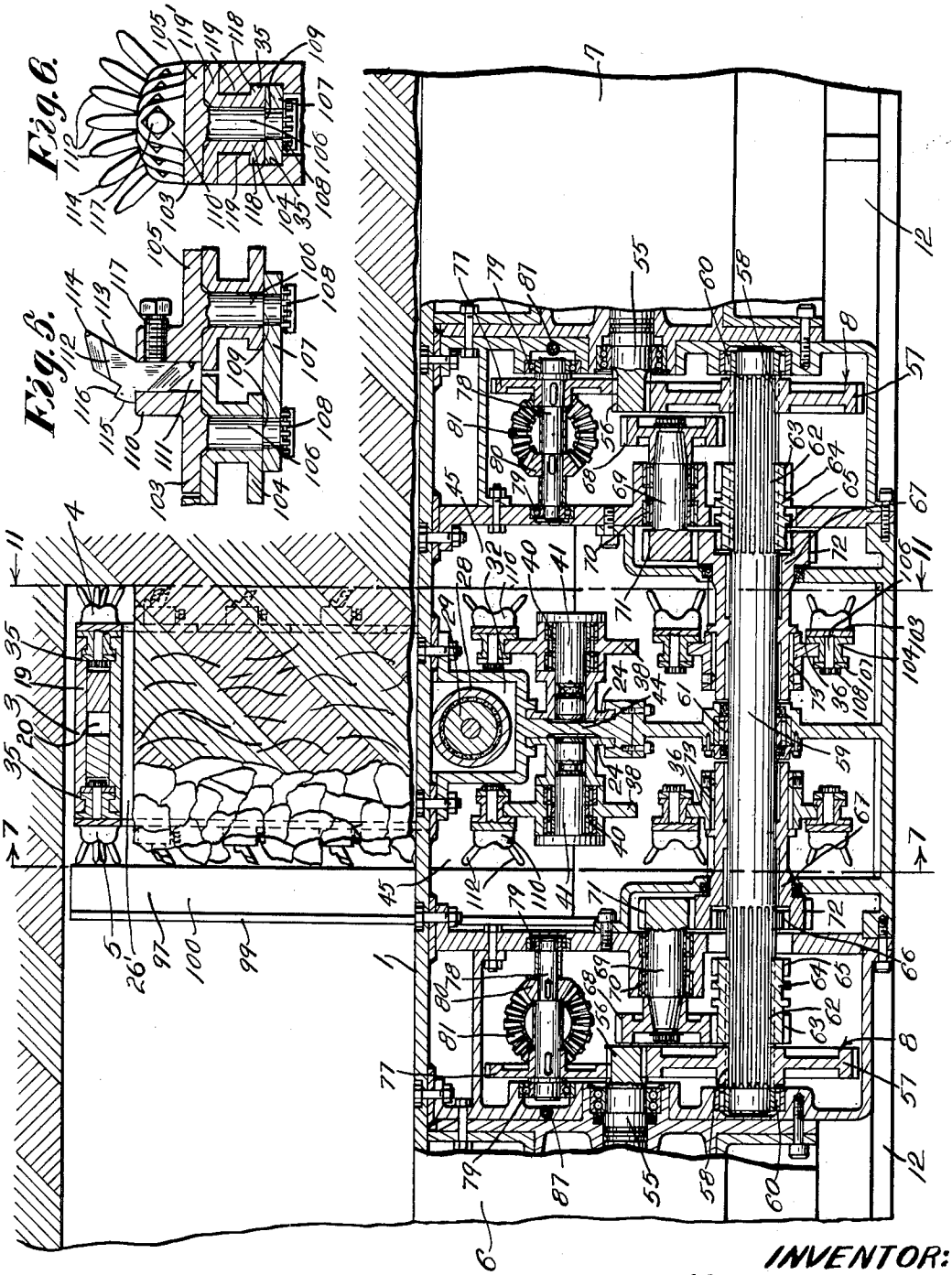


Fig. 4.

Fig. 5.

Fig. 6.

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Jan. 10, 1956 J. F. JOY 2,730,346

REVERSIBLE LOOP CUTTER TYPE LONGWALL MINER

Filed March 7, 1951 5 Sheets-Sheet 4

Fig. 7.

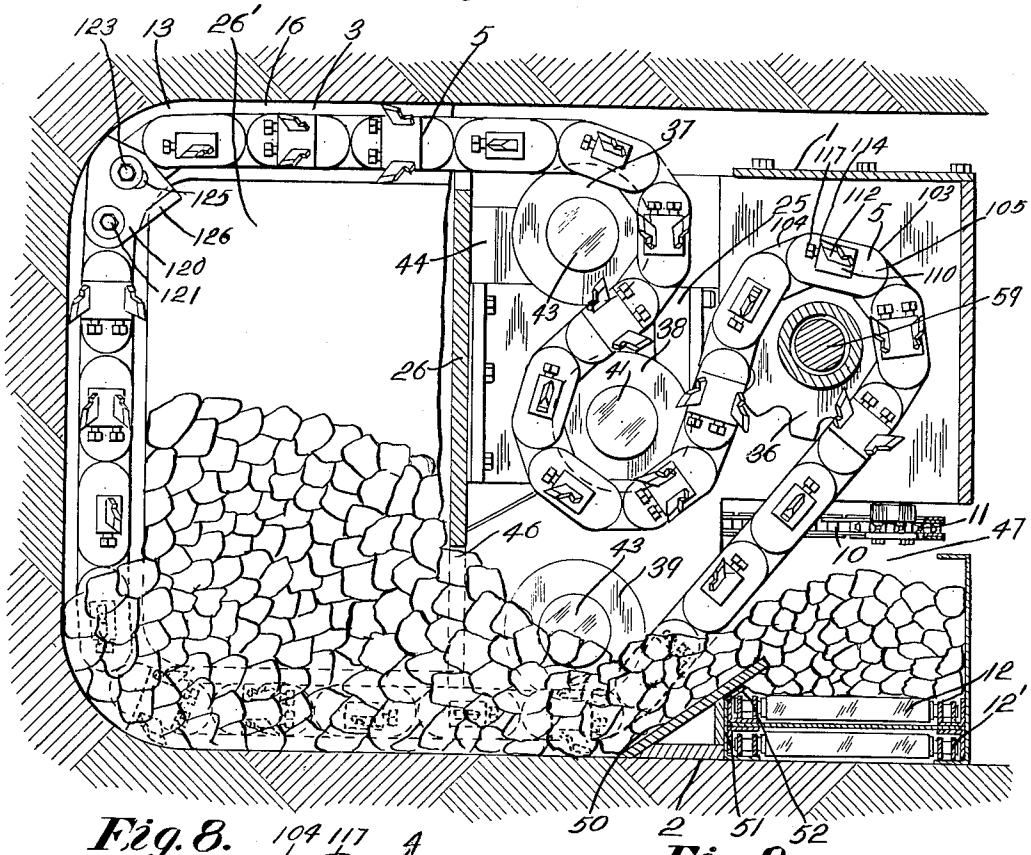


Fig. 8.

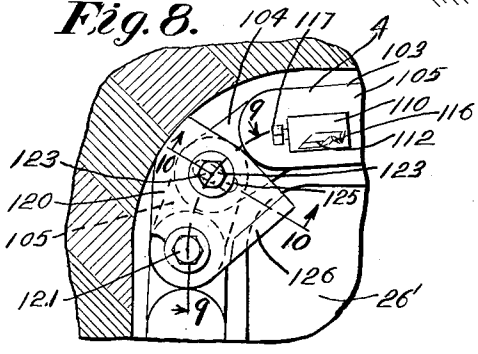


Fig. 9.

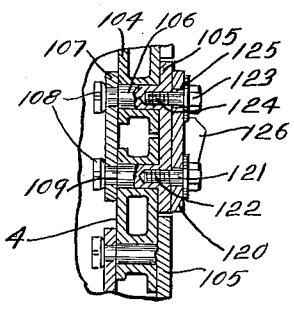
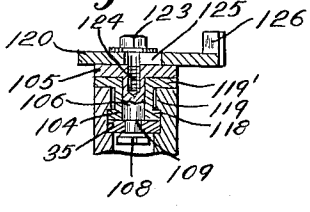


Fig. 10.



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REVERSIBLE LOOP CUTTER TYPE LONGWALL MINER

Filed March 7, 1951 5 Sheets-Sheet 5

Fig. 11.

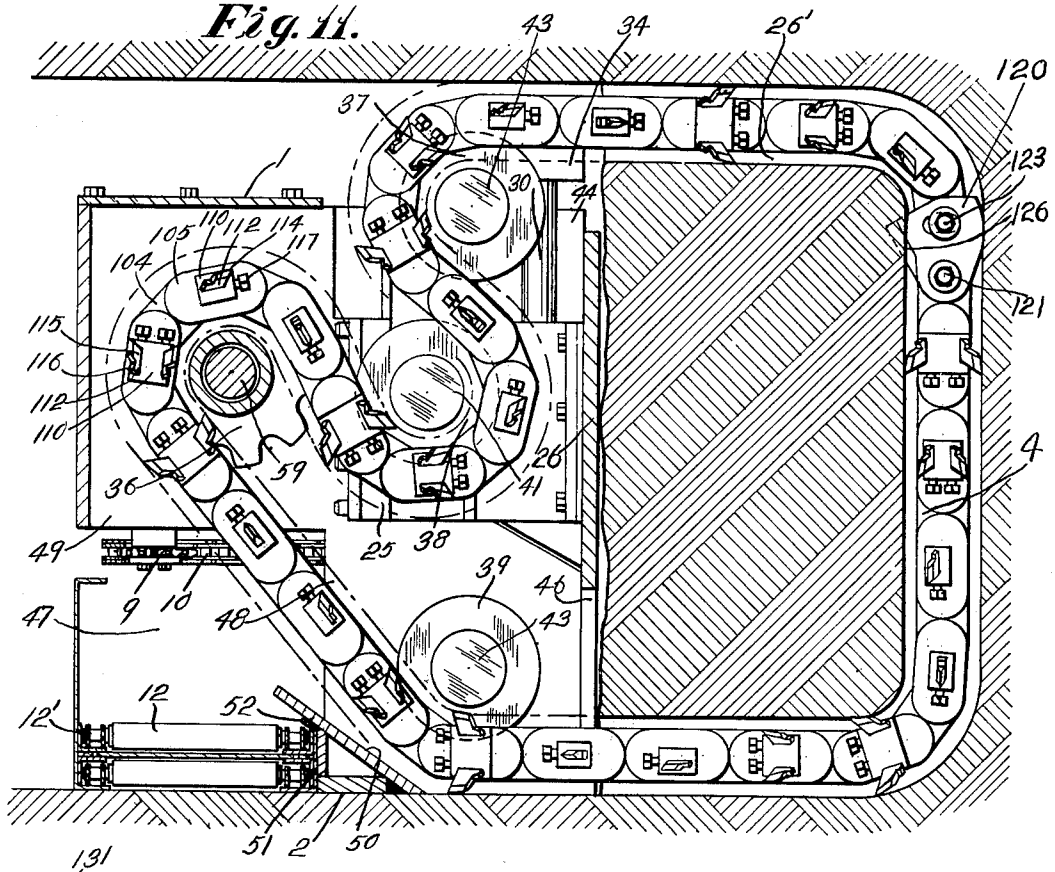
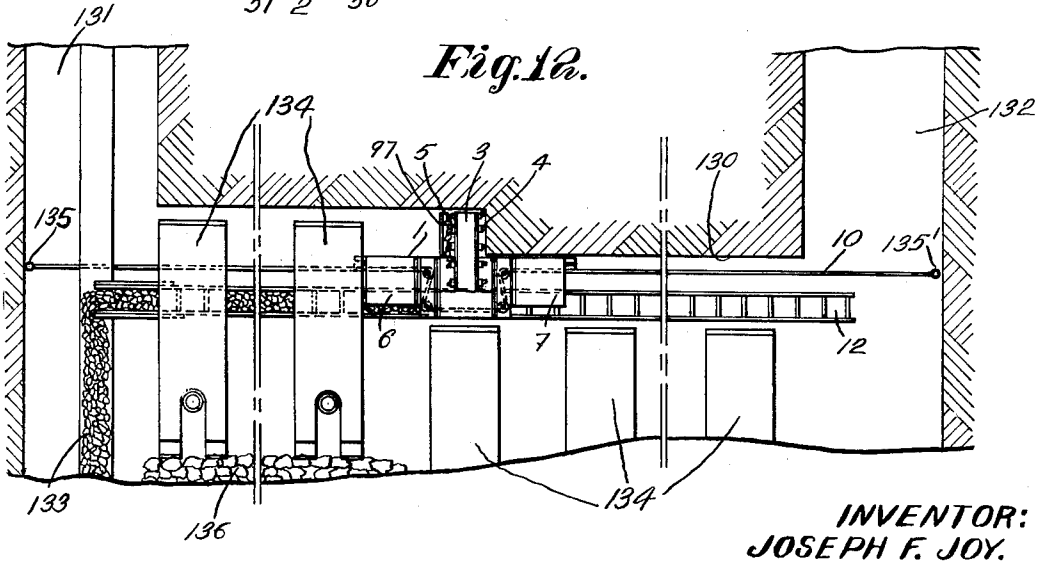


Fig. 12.



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United States Patent Office 2,730,346 Patented Jan. 10, 1956

2,730,346

REVERSIBLE LOOP CUTTER TYPE LONGWALL MINER

Joseph F. Joy, Pittsburgh, Pa., assignor to Joy Manufacturing Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application March 7, 1951, Serial No. 214,242

21 Claims. (Cl. 262—30)

This invention relates to mining machines and more particularly to a coal mining machine of the reversible loop cutter, longwall type, especially designed for use in mining coal from a longwall coal face and for loading the loose coal onto a face conveyor.

In the mining of coal from a longwall face of a coal seam it is desirable to make the mining machine reversible so that the coal may be mined from the face in either direction and without the need for turning the complete machine around after each cut. By the provision of a reversible type of mining machine the machine may operate along the face in one direction and at the completion of the cut the machine may be advanced toward the face and then fed across the face in the opposite direction, thereby substantially to reduce the time and effort consumed in the mining operation. The present invention contemplates improvements over known types of longwall mining machines in that a longwall mining machine is provided capable of accomplishing the desired functions and embodying not only means for mining the coal from a solid coal seam but also means for conveying and loading the mined coal, thereby completely to eliminate the need for blasting with explosives and the inherent dangers resulting therefrom. The mining machine of the present invention has a pair of identical, but oppositely disposed, loop cutter chains adapted to be driven at relatively different speeds so that one of the chains may operate as a cutter chain while the other operates as a conveyor chain, irrespective of the direction of travel of the machine along the coal face. The machine is relatively compact and rugged in design, well adapted for its intended purpose.

An object of the present invention is to provide an improved mining machine embodying improved features of construction and design. Another object is to provide an improved coal mining machine of the reversible longwall type adapted to operate in either direction along the coal face without the necessity for complete turning of the machine around at the end of each cut. A further object is to provide an improved coal mining machine having improved cutting means and associated conveying means whereby the coal may be removed from a solid coal seam and conveyed away from the coal face. A still further object is to provide an improved coal mining machine adapted to operate in the relatively restricted space between the longwall coal face and a face conveyor laid on the mine floor in parallelism with the coal face and having improved means for dislodging the coal from the solid coal seam and for conveying the dislodged coal for lateral discharge onto the face conveyor. Still another object is to provide an improved coal mining machine of the reversible loop cutter and conveyor type for cutting a core of coal from a solid coal seam, for dislodging fragments of the core as cutting progresses and for loading the dislodged coal in either direction along a longwall face and all in a substantially continuous manner. A further object is to provide an improved reversible longwall type loop cutter embodying an endless loop type cutter chain whereby said cutter chain may operate either at a relatively high speed to effect cutting of the coal or at a relatively low speed to effect conveying of the dislodged coal. A still further object is to provide an improved loop type longwall reversible mining machine having a pair of endless cutter carrying chains which may selectively operate either as a cutter chain or a conveyor chain depending upon the direction of movement of the machine along the coal face. Another object is to provide improved endless loop type cutting and conveying means which is adjustable in height thereby to enable operation of the machine in mines having veins of varying heights. Yet another object is to provide an improved coal mining machine having novel combinations and arrangements of parts. These and other objects and advantages of the invention will hereinafter more fully appear.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings:

Fig. 1 is a plan view of a coal mining machine constructed in accordance with a preferred illustrative embodiment of the invention.

Fig. 2 is an enlarged cross section taken midway between the ends of the machine on line 2—2 of Fig. 1, showing the adjustable bar structure for the endless loop cutter and conveyor chains.

Fig. 3 is a vertical section taken substantially on the planes of line 3—3 of Fig. 2.

Fig. 4 is a horizontal section through the coal mining machine shown in Fig. 1, the view taken substantially in the planes of line 4—4 of Fig. 2.

Figs. 5 and 6 are detail sections illustrating the loop cutter chain.

Fig. 7 is a cross section taken on line 7—7 of Fig. 4, showing the conveyor chain loading the dislodged coal onto the face conveyor.

Fig. 8 is a detail view showing the core breaker device mounted on the cutter chain.

Fig. 9 is a detail section taken on line 9—9 of Fig. 8.

Fig. 10 is a detail section taken on line 10—10 of Fig. 8.

Fig. 11 is a cross section taken on line 11—11 of Fig. 4, showing the loop cutter chain and core breaker.

Fig. 12 is a diagrammatic view showing the machine operating from left to right along a longwall coal face of a coal mine.

The invention relates to a mining machine which, as shown in the drawings, is of the reversible longwall type, but it will be evident that various features of the invention may be embodied in mining machines of other types.

The mining machine generally comprises an elongated, relatively narrow machine frame or body 1 of generally rectangular shape, provided with a smooth bottom surface 2 adapted to rest upon and slide over the floor of a mine. Projecting laterally from the face-side of the machine frame, substantially midway between the ends thereof is a loop-shaped guide frame or guide bar 3 about which endless loop-type cutter and conveyor chains 4 and 5 are guided for orbital circulation. Either loop chain may operate as a cutter chain or a conveyor chain depending upon the direction of operation of the mining machine along the longwall coal face, and identical motors 6 and 7, desirably electric motors, carried by the machine frame near its opposite ends, operating in unison and serving to drive the cutter and conveyor chains through change speed gearings generally designated 8, whereby the chain which is serving as the cutter chain may be driven at a relatively high cutting speed and the chain which is serving as the conveyor chain may be driven at a relatively low conveying speed.

The feeding means for the machine may assume various forms but herein, for illustrative purposes, comprises a

pair of feed sprockets 9 respectively driven by the motors and disposed on parallel vertical axes and arranged to engage a feed chain 10 which is guided with respect to the feed sprockets by suitable idler sprockets 11, and this feed chain has flexible portions which extend in opposite directions longitudinally from the machine frame in parallelism with the coal face and are anchored at their remote extremities by suitable roof jacks so that when the sprockets are suitably driven the machine may be fed bodily along the chain in one direction or the other. A conventional face conveyor 12 having an endless conveyor chain 12' is laid on the mine floor in parallelism with the coal face at the outer side of the machine frame in the manner shown. The loop-shaped guide frame or bar for the cutter and conveyor chains is, as shown in Fig. 2, adjustable in height and consists of a generally U-shaped outer frame structure 13 comprised of cooperating frame sections 14 and 15 having top and bottom leg portions 16 and 17 and outer upright portions 18 and 19 providing the connection between the leg portions of the U. The upright frame portion 19 has a vertical guideway 20 which slidingly receives a portion 21 secured to the upper frame portion 18 whereby the upper frame portion may be adjusted in a vertical direction relative to the bottom frame portion. The lower frame portion 17 is suitably rigidly secured at 22 to the machine frame and the upper adjustable portion is secured at 23 to sliding blocks 24 (Figs. 2 and 3) guided for vertical adjustment along vertical guides 25 secured to the machine frame. A vertical plate 26 at the inner side of the machine frame extends longitudinally through the open center 26' of the chain guide frame or bar, and pivotally mounted at 27 on lugs integral with the inner side of the plate is an upright hydraulic cylinder 28 containing a reciprocable piston 29 having its piston rod 30 extending upwardly through the packed upper head 31 of the cylinder. This hydraulic cylinder is arranged within a rectangular recess 32 formed vertically within the machine frame, as shown in Fig. 4, and the piston rod is secured at its upper end at 33 to a frame 34 integral with the sliding blocks 24 and to which the upper frame portion 16 of the chain guide frame is secured. Thus, when liquid under pressure is supplied to the lower end of the cylinder beneath the piston the latter may be moved upwardly to vary the elevation of the upper frame portion 16 relative to the lower frame portion 17 thereby to vary the cutting height of the machine to enable the operation thereof in coal seams of varying height.

As shown in Fig. 4, the U-shaped chain guide frame or bar 3 has guideways 35 at its opposite sides, and in which the cutter and conveyor chains 4 and 5 are respectively guided for orbital circulation. The chains pass around drive sprockets 36 and in order to maintain the chains under the proper tension in all positions of adjustment of the chain guide frame there are provided suitable guide rollers 37, 38 and 39 about which the chains pass, as shown in Figs. 7 and 11. The guide rollers 38, as shown in Fig. 4, are journaled at 40 on bearings supported by aligned longitudinally extending horizontal shafts 41 supported by the sliding blocks 24, and the guide rollers 37 and 39 are journaled at 42 on bearings supported by aligned shafts 43 arranged in parallelism with the shafts 41 and respectively supported by the upper and lower frame portions 16 and 17 of the loop-shaped chain guide frame. By such an arrangement of the guide rollers with respect to the drive sprockets, the cutter and conveyor chains are maintained under the proper tension irrespective of the adjusted height of the guide frame. As shown in Figs. 3 and 4, the drive sprockets and the guide rollers are arranged in pairs in coaxial relation at the opposite sides of a transverse vertical plate 44 forming the portion of the machine frame to which the vertical guides 25 are secured. The endless cutter and conveyor chains 4 and 5 are arranged to circulate within spaced chambers 45 formed within the machine frame at opposite sides of this vertical plate 44. The inner longitudinally extending vertical plate 26 is formed with suitable openings 46 (Figs. 7 and 11) through which the endless chains pass. The machine frame is recessed at 47 at its outer lower side in such manner as to provide a space for the face conveyor 12 and the outer sides and bottoms of the chambers 45 open at 48 and 49 respectively towards the face conveyor 12 so that any loose coal or other material conveyed outwardly by the cutter and conveyor chains may discharge onto the face conveyor. To direct the loose coal or other material over the side of the face conveyor near to the machine frame, as shown in Figs. 7 and 11, the lower portion of the machine frame is upwardly inclined at 50 and the conveyor frame has a side frame 51 which has an inclined portion 52 which underlies the frame portion 50. Thus, the loose coal or other material may be moved upwardly and outwardly along the inclined portion 52 for discharge onto the endless conveyor 12.

Either of the endless chains 4 and 5 may serve as a cutter chain or a conveyor chain depending upon the direction of movement of the machine along the coal face and these chains are adapted to be driven in the same direction and at relatively different speeds, as mentioned above, through the change speed gearings 8. As shown in Fig. 4, the motors 6 and 7 have longitudinally extending, horizontal, motor shafts 55 to the inner ends of which spur pinions 56 are secured, and these pinions mesh with large spur gears 57 having their hubs splined at 58 to a longitudinally extending horizontal shaft 59. The shaft 59 is supported in end bearings 60 and a centrally located bearing 61 and these bearings are suitably supported within the machine frame. Splined at 62 to the shaft 59 are gears 63 having integral shifter elements 64, the latter having clutch teeth 65 engageable with clutch teeth 66 formed within tubular sleeves 67 suitably journaled on the shaft 59. The gears 63 are movable into meshing engagement with the teeth of gears 68 having their hubs secured to horizontal shafts 69 herein arranged parallel with the shaft 59 and suitably journaled in bearings 70 supported within the frame of the machine. Secured to the shafts 69 are spur pinions 71 meshing with spur gears 72 herein formed integral with the sleeves 67. The chain drive sprockets 36 are keyed at 73 to the sleeves 67. When the right hand shifter element 64 is in the position shown in Fig. 4, with the clutch teeth 64 in engagement with the clutch teeth 66, the endless cutter chain 4 may be driven at a relatively high speed from the motor 7 through the spur gearing 56, 57, shifter element 64 and the sleeve 67, and when the left hand shifter element 64 is in the position shown in Fig. 4 the endless conveyor chain 5 may be driven at a relatively low speed from the motor 6 through spur gears 56, 57, spur gears 63 and 68, shaft 69 and spur gears 71 and 72. Evidently, when the machine is operating in the opposite direction the endless chain 5 which then acts as the cutter chain may be driven at a relatively high speed and the endless chain 4 which then acts as the conveyor chain may be driven at a relatively low speed simply by changing the positions of the shifter elements 64. The shifter elements 64 are engaged by conventional shifter yokes, not shown, which are operated by suitable hand levers 75 conveniently located exteriorly of the machine frame as shown in Fig. 1.

The feed sprockets 9 of the machine feeding means may be driven from the motors 6 and 7 respectively through gears 77 (Fig. 4) meshing with the motor pinions 56 and keyed to horizontal shafts 78 herein arranged parallel with the shafts 59 and 69 and suitably journaled within the bearings 79 supported within the machine frame. Rotatable with the shafts 78 are beveled gears 80 meshing with beveled gears 81 (see also Fig. 3) secured to vertical shafts 82 journaled in bearings 83 suitably supported within the frame of the machine. Splined at 84 to the shafts 82 are clutch shifter elements 85 engaged by shifter yokes 86 secured to vertical sliding operating shafts 87 having handles 88 conveniently located

at the top of the machine frame (Fig. 1). The clutch elements 85 have clutch teeth 89 engageable with clutch teeth 90 formed on shafts 91 to which the feed sprockets 9 are secured. These shafts 91 are arranged coaxially with the shafts 82 and are suitably journaled in bearings 92 supported within the machine frame. Thus, the feed sprockets 9 may be alternately driven from the motors 6 and 7 through the spur gears 56, 77 and beveled gears 80 and 81, thereby to effect feed of the machine in either of opposite directions without reversing the motors.

As shown in Fig. 1, conventional hydraulic hand pumps 95 operated by hand levers 96, are arranged at the opposite ends of the machine frame for supplying liquid under pressure to the hydraulic cylinder 28 for changing the height of the chain guide frame or bar 3 on which the cutter and conveyor chains are guided. Liquid trapped in this cylinder serves to lock the guide frame in adjusted position. Evidently, the pumps may be motor driven, if desired.

A transposable cuttings deflector or guard 97 is attachable, as by screws 98, selectively in reversed positions with respect to the outer walls of the chambers 45 in which the cutter and conveyor chains operate, so as to confine the loose material dislodged from the mine vein in the path of the conveyor chain during either direction of travel of the machine. This deflector extends outwardly in parallelism with the guide frame 3 at the trailing side thereof. As shown in Fig. 3, this guard has relatively inclined, angle portions 99 and 100 with one portion attachable to the vertical sidewall of the frame and the other portion extending outwardly toward the conveyor chain into adjacency with the mine floor. The reversed position of the deflector is indicated in dotted lines in Fig. 3.

Now referring to the detail structure of the endless chains 4 and 5 and their associated breaker devices, it will be noted that each chain comprises, as shown in Figs. 5 and 6, a series of multi-part chain blocks 103 pivotally connected by strap links 104. Each block comprises an outer side link portion 105 having parallel hinge pins 106 integral therewith, and the inner ends of these pins are engaged by an inner link portion 107 held thereon by nuts 108 threaded on the reduced inner end portions of the hinge pins. The hinge pins have inner shoulders 109 which are engaged by the inner link portion 107 to maintain the inner link portion in spaced parallelism with the outer link portion, and the strap links project between these parallel block portions and respectively pivotally engage the hinge pins. Formed integral with the outer link portions 105 are lateral lugs 110 having sockets 111 for receiving cutter bits 112. These cutter bits have relatively inclined cutting portions 113 provided with wear-resisting cutting tips 114, and the rear side of the bit has a central projection 115 provided with opposed abutment surfaces 116 engageable with the outer surface of the block lug in the reversed positions of the bit of the block, to maintain the proper bit gauge. A conventional set screw 117, threaded within the block lug, engages the inactive cutting portion of the bit to hold the latter firmly in position on the block with the active cutting portion 113 extending outwardly and forwardly, as shown in Fig. 5. The socketed block lugs are arranged in relatively inclined positions on the different chain blocks, as shown in Figs. 3 and 4 so as to provide proper lacing of the cutter bits to enable cutting of a kerf of sufficient width to receive the guide frame or bar 3. Since this cutter chain structure is being disclosed and claimed in a copending application, Serial No. 217,332 filed March 23, 1951, further detailed discussion thereof is herein considered unnecessary. The bar guideways 35 are of generally T-shape in cross section, as shown in Fig. 6, and the strap links have lateral gibs 118 which underlie inward projections 119 on the bar, to retain the chains within the guideways. The outer flanges 119' of the strap links ride against the outer surface of the bar, thus providing wide bearing surfaces.

The core breaker device associated with the cutter chain comprises a breaker plate 120 which is pivotally mounted on a screw 121 threadedly secured at 122 within a threaded opening formed in one of the hinge pins of the outer link portion 105. A screw 123 threaded at 124 within the threaded opening in the adjacent hinge pin of the outer link portion passes through an arcuate slot 125 in the breaker plate, and this screw 123 when tightened serves to hold the breaker plate firmly in position on the chain block. Projecting laterally inwardly of the breaker plate is a cam-shaped breaker portion 126 which is engageable with the core of coal formed by the loop cutter chain at periodic intervals to effect breaking down or dislodging of the core. By loosening the screw 123 the breaker plate may be swung into different angular positions about its pivot and thereafter be again clamped into position thereby to enable variation in the projection of the cam portion 126 with respect to the inner side of the cutter chain. A similar breaker device is mounted on the conveyor chain but during the conveying operation is not in use.

The general mode of operation of the improved mining machine is as follows: As shown somewhat diagrammatically in Fig. 12, a longwall coal face 130 extends transversely between parallel mine passageways or so-called roadways 131 and 132 and the face conveyor 12 extends in parallelism with the coal face between these roadways with its discharge end overlying a conventional main haulage conveyor 133, which may be a shaker conveyor, arranged longitudinally in the left hand roadway 131. The mine roof outwardly beyond the face conveyor is supported by walking type roof jacks 134 and as the mining machine operates to mine out the coal the roof jacks at the rear side of the machine are advanced into the positions shown to support the roof. In Fig. 12 the mining machine is shown operating from left to right and the flexible portions of the feed chain 10 are extended in opposite directions from the machine to roof jacks 135 and 135' located near the outer walls of the roadways. The front cutter chain 4 is sumped into the end of the coal face at the inner wall of the left hand roadway 131 and as the machine is fed across the face the cutter chain cuts out a core of coal and as the core is formed the breaker cam 126 on the cutter chain periodically applies a breaking down pressure to the core of coal formed by the cutter chain (see Fig. 11). The core of coal as it is broken into fragments and dislodged from the solid coal seam is received by the rear conveyor chain 5, as shown in Fig. 4, and is conveyed outwardly from the coal face through the bottom of the machine to discharge onto the face conveyor 12, in the manner shown in Fig. 7. The active cutter chain is driven by both motors at a relatively high speed and the rear conveyor chain is driven by both motors at a relatively low speed. The breaker device may, if desired, be removed from the conveyor chain during the conveying operation. The machine as it moves across the face, it mines and loads out the coal, and when the machine moves into the right hand roadway and the cut is completed, the machine and the face conveyor are advanced by the walking jacks toward the face. The clutch shifter members 64 may then be shifted to connect the chain 5, which previously served as the conveyor chain, to the high speed drive gearing driven by the motors 6 and 7, and the chain 4, which previously served as the cutter chain, is connected to the low speed drive, and the feed is then reversed by disconnecting the then active feed sprocket from its drive and connecting the other feed sprocket to its drive. The machine is then fed from right to left across the coal face to mine and load out the coal. As the machine and conveyor are advanced, the walking jacks 134 are advanced to provide adequate support for the roof, and the mine roof at the rear sides of the roof jacks

is allowed to subside, as shown at **136** in Fig. 12. Thus, by repeated rectilinear movements of the machine back and forth across the coal face, with intermediate advances of the machine and conveyor, the solid coal between the roadways may be completely mined out, in a relatively rapid and efficient manner.

As a result of this invention an improved mining machine is provided having improved reversible cutting and conveying means whereby the coal of a solid coal seam may be mined out and loaded in a substantially continuous manner and without the need for dangerous blasting with explosives. By the provision of the endless cutter and conveyor chains, and the plural speed drives for the chains, whereby they may be selectively driven at relatively different speeds, either one of the chains may operate as a cutter chain or as a conveyor chain, depending upon the direction of machine movement across the coal face. The loop cutter chain forms a core which is cut from the solid coal and the breaker device on the cutter chain applies periodically powerful breaking down pressures to the core to dislodge fragments of the core as cutting progresses and the conveyor chain receives the dislodged coal and conveys it away from the coal face. By the provision of the reversible cutting and conveying means the machine may mine and dislodge coal along a longwall coal face and the direction of movement of the machine may be readily reversed at each end of the coal face without the need for completely turning the machine around thereby greatly reducing the time and effort consumed in the mining of the coal. By the provision of cutting and conveying means which are adjustable in height the machine may be accommodated to coal seams of varying heights. These and other objects and advantages of the invention will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a mining machine of the character disclosed, a guide bar having an open center and providing guideways at its opposite sides, endless loop cutter carrying chains guided for orbital circulation along the guideways of said guide bar and carrying cutting elements, one of said loop cutter chains disposed on said guide bar in advance of the other, and motor operated driving means for said chains for driving the advance one of said chains at a relatively high cutting speed to cut the mineral of a solid mine vein and for driving said other trailing chain at a relatively low conveying speed for conveying the loose mineral dislodged from the previously-cut mine face in a lateral direction out of the machine-path.

2. In a mining machine of the character disclosed, cutting mechanism for cutting mineral from a solid mine vein and including an endless loop type cutter chain, conveying mechanism including an endless loop type conveyor chain, said cutter chain disposed in advance of said conveyor chain, means for guiding said chains for circulation in similar but parallel orbits, motor operated means for driving said advance cutter chain at a relatively high cutting speed for cutting the mineral of a solid mine vein, and motor operated means for driving said trailing conveyor chain at a relatively low conveying speed for conveying the loose mineral dislodged from the previously-cut face in a lateral direction away from the face.

3. In a mining machine of the character set forth in claim 2 wherein said motor operated driving means for said chains includes a pair of interconnected driving motors operating in unison and common to the drive of both chains.

4. In a mining machine of the character set forth in claim 2 wherein the machine is reversible and may operate in either direction along the face of a mine vein, said motor operated driving means for said chains includes a multi-speed drive individual to each chain for effecting drive of the same at either a cutting or a conveying speed.

5. In a mining machine of the character disclosed, a body movable in either of opposite directions along the face of a mine vein without turning around of said body, a generally loop-shaped guide frame supported by and projecting from said body and having guideways at its opposite sides one disposed in advance of the other, endless chains guided for orbital circulation along said guideways respectively and each carrying cutting elements, and mechanism carried by said body for driving either of said chains at relatively different speeds whereby either chain may operate as a cutter chain or as a conveyor chain, the advance chain traveling at a relatively high cutting speed and operating as a cutter chain and the trailing chain traveling at a relatively low conveying speed and operating as a conveyor chain, irrespective of the direction of movement of the machine.

6. In a mining machine of the character disclosed, a body movable in either of opposite directions along the face of a coal seam, a generally loop-shaped guide frame projecting laterally from said body substantially midway between the ends of said body, said guide frame having guideways at its opposite sides and provided with an open center, endless loop chains guided for orbital circulation along said guideways respectively and each carrying cutting elements, and motor operated mechanism carried by said body for driving either of said chains at relatively different speeds whereby either chain may operate as a cutter chain or as a conveyor chain depending upon the direction of movement of said body along the coal face.

7. In a mining machine of the character disclosed, a body movable along the face of a mine vein, a movable cutter supported by and projecting from said body for cutting the mineral of a solid mine vein, a movable conveyor supported by and projecting from said body in substantial parallelism with said cutter at the trailing side of the latter, said conveyor adapted to receive the previously cut mineral dislodged from the mine vein and to move the mineral received thereby laterally from the machine, means carried by said body for guiding said cutter and said conveyor for movement along similar adjacent paths relative to the machine-body, and motor operated mechanism carried by said body for driving said cutter at a relatively high cutting speed and for driving said conveyor at a relatively low conveying speed.

8. In a mining machine of the character set forth in claim 7 wherein said motor operated driving mechanism includes driving motors interconnected for operation in unison and common to the drive of said cutter and said conveyor.

9. In a mining machine of the character disclosed, a body movable in either of opposite directions along the face of a mine vein, a guide frame supported by and projecting from said body and having guideways at its opposite sides, said guide frame having an open center, endless loop chains guided for orbital circulation along said guideways respectively and each carrying cutting elements, either of said chains adapted to operate as a cutter chain or as a conveyor chain depending upon the direction of movement of said body along the mine face, motors arranged near the opposite ends of said body for concurrently driving said chains, and feeding means for the machine comprising relatively rotatable feeding elements journaled on said body for rotation in relatively opposite directions and adapted to cooperate

with flexible feeding means which is anchored at its opposite extremities in the mine, and means for alternately effecting drive of said feeding elements to effect feed of said body along said flexible feeding means selectively in opposite directions.

10. In a mining machine of the character disclosed, an elongated, relatively narrow body adapted to operate in the relatively restricted space between a longwall coal face and a face conveyor arranged parallel with the face, an endless loop cutter projecting laterally from said body at the face side thereof and carrying cutting elements and a breaker device both movable in a vertical orbit, for cutting out a core of coal from a solid coal seam and for dislodging fragments of said core as cutting progresses, an endless loop conveyor carried by said body and movable in a vertical orbit of the same size and shape as said vertical orbit of said loop cutter and projecting laterally from said body in parallelism with said cutter at the trailing side of the latter for conveying the dislodged coal laterally from the coal face to discharge onto said face conveyor.

11. A mining machine of the character set forth in claim 10 wherein said body is recessed longitudinally at its outer lower side to provide a space for receiving a face conveyor whereby said machine conveyor may project laterally above the face conveyor in said space, said machine conveyor extending outwardly from the face and upwardly above said face conveyor.

12. In a mining machine of the characted disclosed, a body movable in either of opposite directions along the face of a mine vein, an adjustable, generally U-shaped guide frame carried by and projecting from said body and comprising relatively adjustable frame portions whereby the effective height of said guide frame may be varied, said guide frame providing guideways at its opposite sides and having an open center, endless loop chains guided for orbital circulation along said guideways respectively and each carrying cutting elements, motor operated means carried by said body for driving either one of said chains at relatively different speeds whereby either chain may act as a cutter chain to cut out a core of mineral from a solid vein or a conveyor chain to convey dislodged mineral depending upon the direction of operation of the machine along the face, means engaging said chains for guiding the latter and for maintaining the same under the proper tension irrespective of the adjusted height of said guide frame, and means for relatively adjusting said frame portions of said guide frame to vary the effective operating height of said cutter and conveyor chains.

13. A mining machine of the character set forth in claim 12 wherein said motor operated means includes change speed gearings, one gearing individual to each chain, whereby either chain may be driven at relatively different speeds.

14. A mining machine of the character set forth in claim 12 wherein said motor operated driving means for said chains includes means for driving either chain at a relatively high cutting speed or a relatively low conveying speed.

15. A mining machine of the character set forth in claim 12 wherein said chains each carry a breaker device for periodically applying breaking down pressures to the core of mineral cut by the then cutter chain to dislodge fragments of such core as cutting progresses, and the then conveyor chain receives the dislodged mineral fragments and conveys them away from the face of the mine vein.

16. In a mining machine of the character disclosed, a body movable in either of opposite directions along the face of a mine vein, a generally U-shaped guide frame carried by and projecting laterally from said body substantially midway between the ends of the latter, said guide frame providing guideways at its opposite sides and having an open center, endless loop chains guided for orbital circulation along said guideways respectively and each carrying cutting elements whereby either chain may serve as a cutter chain depending on the direction of movement of said body along the mine face, and a transposable deflector member attachable to said body at either side of said guide frame and projecting in parallelism with said guide frame at the trailing side thereof whereby the chain which is inactive as a cutter chain may serve as a conveyor chain, said deflector member in either of its transposed positions cooperating with the chain which acts as the conveyor chain to confine the material to be conveyed in the path thereof, and means for attaching said deflector member in either of its transposed positions to said body.

17. In a reversible mining machine of the character disclosed, a body movable in either of opposite directions along the face of a mine vein, a guide frame supported by and projecting from said body and having guideways at its opposite sides, said guide frame having an open center, endless loop chains guided for orbital circulation along said guideways respectively and each carrying cutting elements, either of said chains adapted to operate as a cutter chain or a conveyor chain depending upon the direction of movement of said body along the mine face, and motor operated means for concurrently driving said chains embodying means for driving the chain which is acting as a cutter chain at a relatively high cutting speed and the chain which is acting as a conveyor chain at a relatively low conveying speed.

18. In a mining machine of the character disclosed, a body movable along the face of a mine vein, a movable cutter supported by and projecting from said body for cutting the mineral of a solid mine vein, a movable conveyor supported by and projecting from said body in substantial parallelism with said cutter at the trailing side of the latter, said conveyor disposed to receive the previously cut mineral dislodged from the mine vein and to move the mineral received thereby laterally out of the machine-path, means carried by said body for guiding said cutter and said conveyor for movement along similar adjacent paths lying in parallel vertical orbits, and motor operated mechanism carried by said body for driving said cutter at a relatively high cutting speed and for driving said conveyor at a relatively low conveying speed.

19. In a mining machine of the character disclosed, an elongated, relatively narrow body adapted to operate in the relatively restricted space between a longwall coal face and a face conveyor arranged parallel with the face, an endless loop cutter projecting laterally from said body at the face side thereof and carrying cutting elements and a breaker device, for cutting out a core of mineral from a solid mine vein and for dislodging fragments of said core as cutting progresses, an endless loop conveyor carried by said body and projecting laterally therefrom in parallelism with said cutter at the trailing side of the latter for conveying the loose mineral dislodged from the previously-cut face laterally away from the mine face to discharge onto said face conveyor, said endless loop cutter and said endless loop conveyor movable in parallel vertical orbits which are of the same shape and size and have open centers so that said core of mineral may be surrounded by the cutter and conveyor orbits, said loop conveyor trailing behind said loop cutter as the machine is advanced along the face, and means for driving said loop cutter at a relatively fast cutting speed and said loop conveyor at a relatively slow conveying speed.

20. A mining machine as set forth in claim 6 wherein said chain which is operating as a cutter chain cuts out a core of mineral, and breaking means is provided for periodically applying a breaking pressure to the core of mineral to dislodge fragments thereof as mining progresses.

21. In a reversible mining machine of the character disclosed, a body movable in either of opposite direc-

tions along the face of a mine vein, a guide frame supported by and projecting from said body and having guideways at its opposite sides, said guide frame having an open center, endless loop chains guided for orbital circulation along said guideways respectively and each carrying cutting elements, either of said chains adapted to operate as a cutter chain or as a conveyor chain depending upon the direction of movement of said body along the mine face, motor operated means carried by said body for concurrently driving said endless loop chains, and feeding means for the machine comprising relatively rotatable feeding elements journaled in said body for rotation in relatively opposite directions, flexible feeding means with which said elements cooperate and which is anchored at its opposite extremities in the mine, and means for alternately effecting drive of said feeding elements to effect feed of said body along said flexible feeding means selectively in opposite directions.

References Cited in the file of this patent

UNITED STATES PATENTS

1,336,039	McCarter	Apr. 6, 1920
1,549,654	Dillon	Aug. 11, 1925
1,661,629	Osgood	Mar. 6, 1928
1,778,298	Levin	Oct. 14, 1930
1,979,694	Logan	Nov. 6, 1934
2,024,458	Kraft	Dec. 17, 1935
2,033,441	Moore	Mar. 10, 1936
2,093,448	Joy	Sept. 21, 1937
2,189,670	Lewis	Feb. 6, 1940
2,276,730	Lewis	Mar. 17, 1942
2,504,598	Sheppard	Apr. 18, 1950
2,551,510	Sproul	May 1, 1951

FOREIGN PATENTS

447,612	Germany	July 30, 1927
570,671	Germany	Feb. 23, 1933
597,277	Great Britain	Jan. 22, 1948
619,805	Great Britain	Mar. 15, 1949
630,112	Great Britain	Oct. 5, 1949