

Sept. 21, 1937.

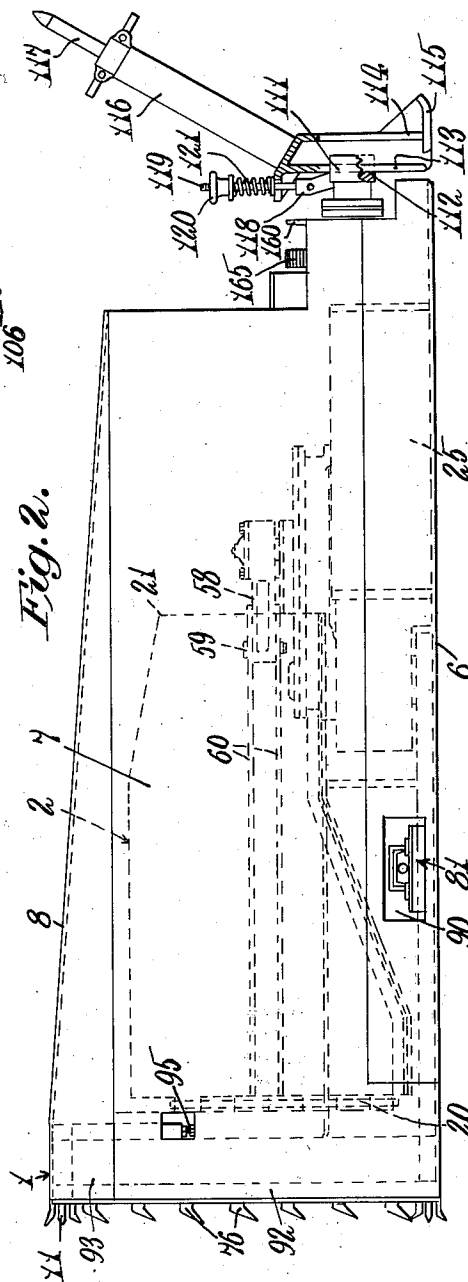
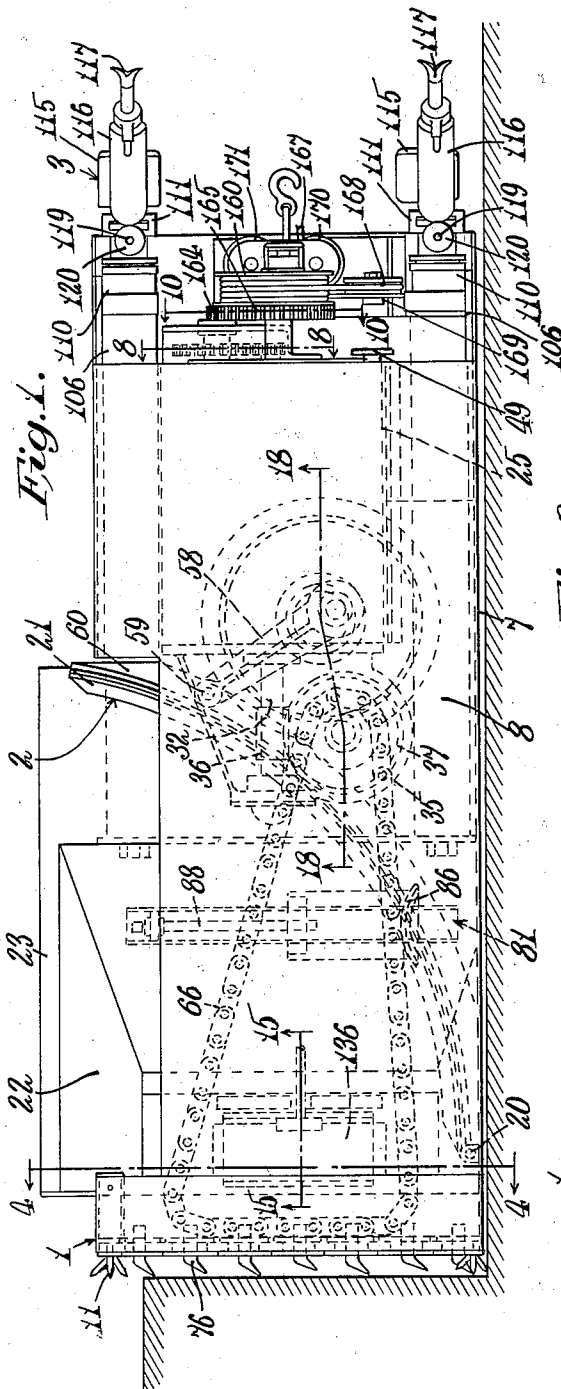
J. F. JOY

2,093,448

MINING APPARATUS

Filed May 23, 1935

8 Sheets-Sheet 1



Inventor:
Joseph F. Joy.
by Louis A. Maxson.
Atty.

Sept. 21, 1937.

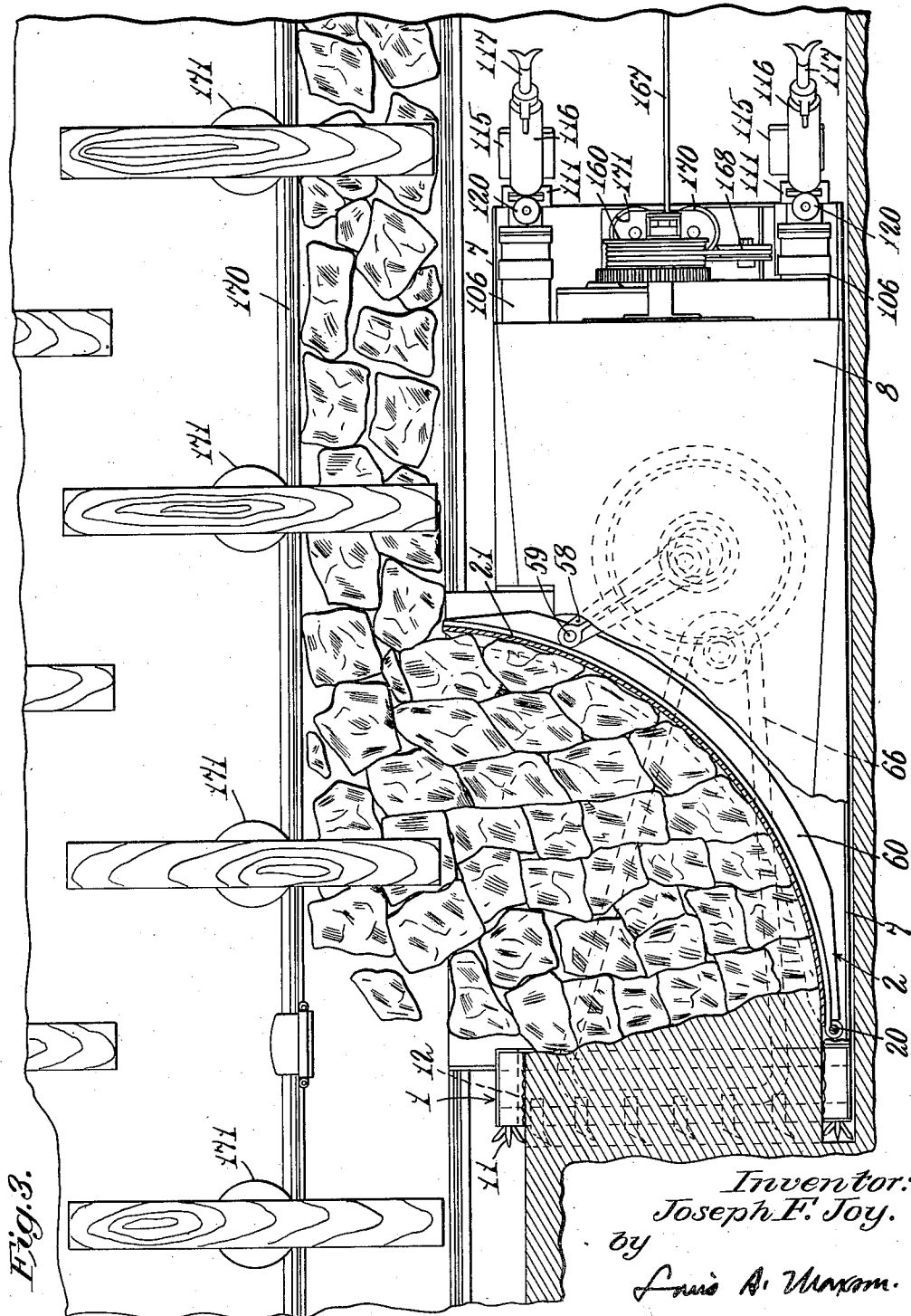
J. F. JOY

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MINING APPARATUS

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8 Sheets-Sheet 2



Inventor:
Joseph F. Joy.

by
Louis A. Maxson.

Arty.

Sept. 21, 1937.

J. F. JOY

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8 Sheets-Sheet 3

Fig. 4.

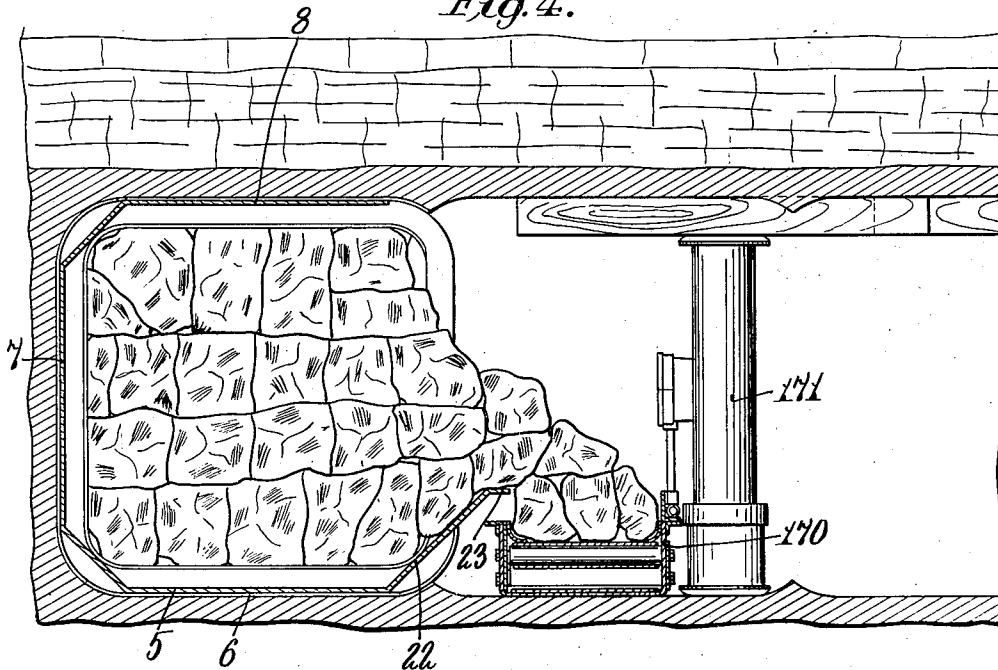
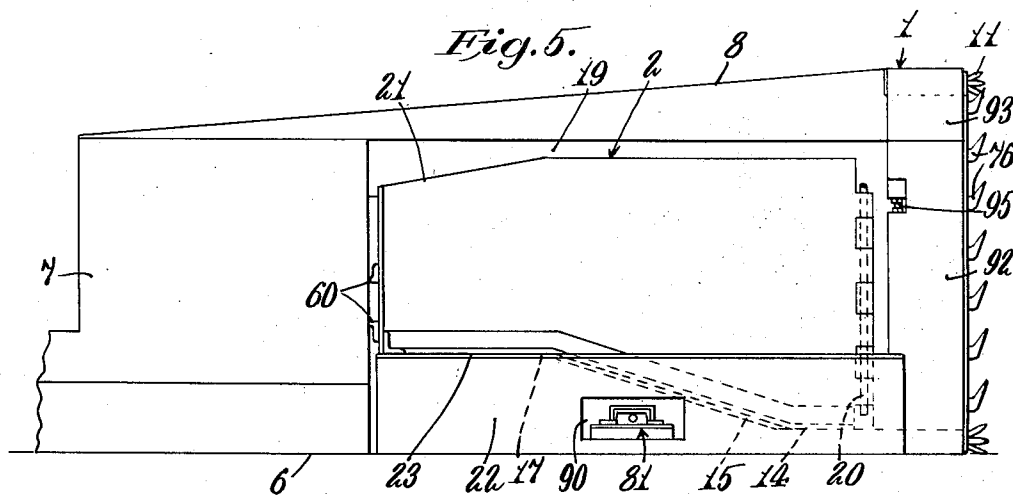


Fig. 5.



Inventor:
Joseph F. Joy.
by Louis A. Maxson.
Atty.

Sept. 21, 1937.

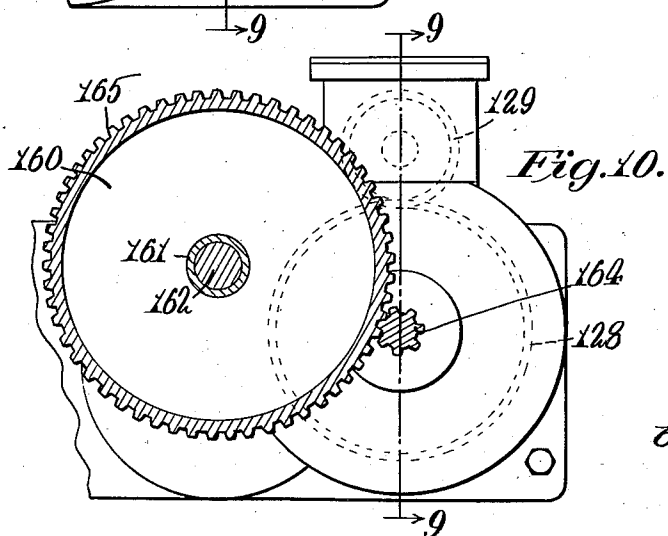
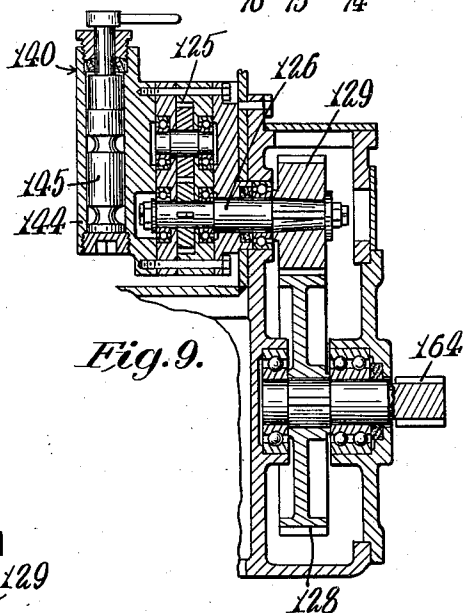
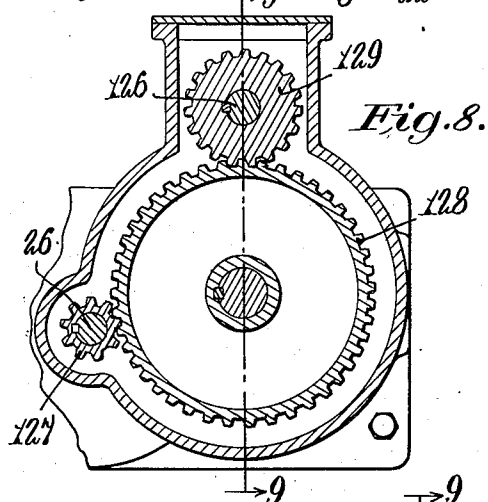
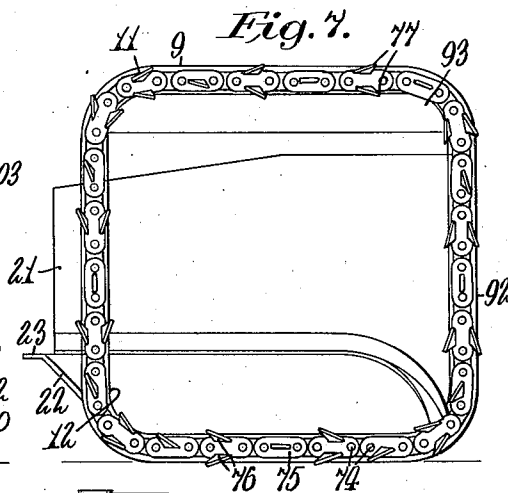
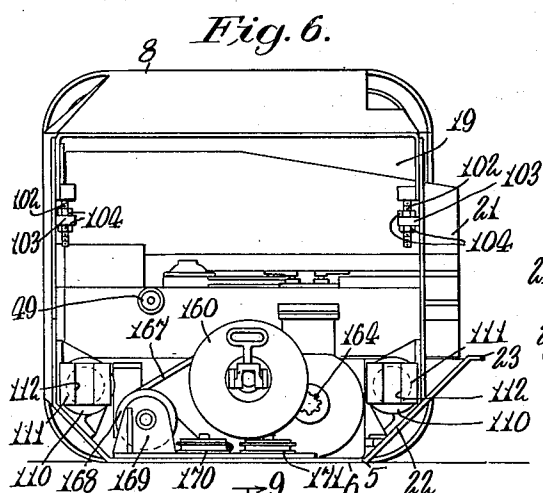
J. F. JOY

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8 Sheets-Sheet 4



Inventor:
Joseph F. Joy.
by Louis A. Waxson.
Atty.

Sept. 21, 1937.

J. F. JOY

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MINING APPARATUS

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8 Sheets-Sheet 5

Fig. 11.

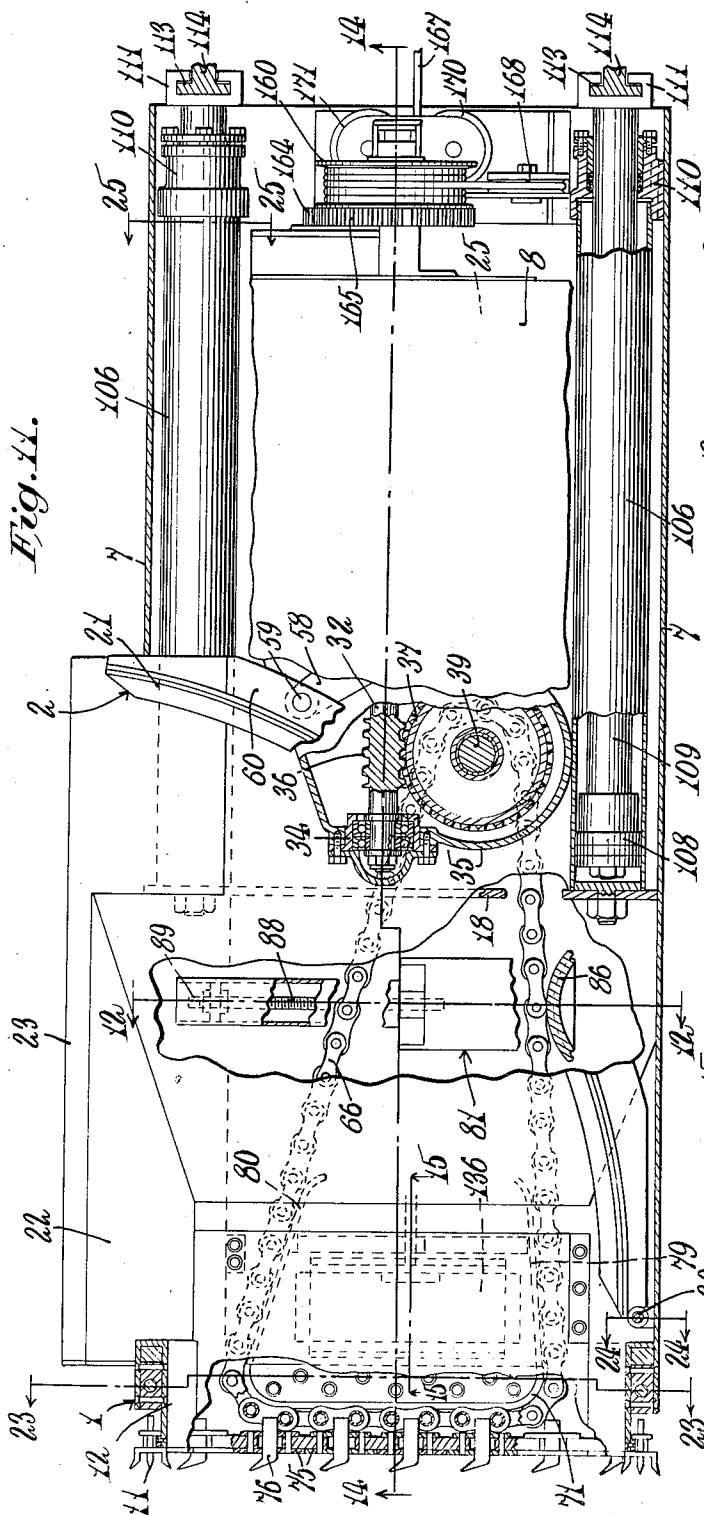


Fig. 12.

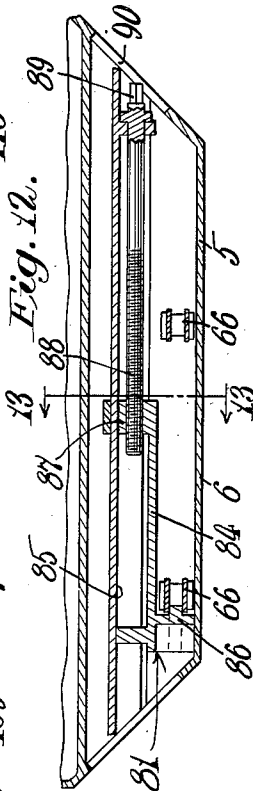
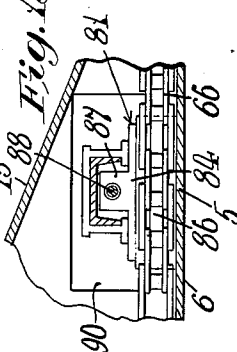


Fig. 13.



Inventor:
Joseph F. Joy.
by
Louis A. Unkorn.
Atty.

Sept. 21, 1937.

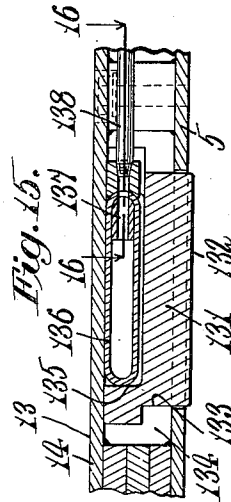
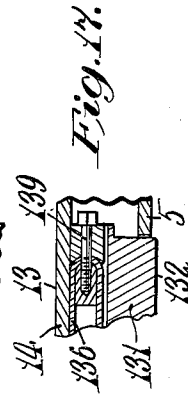
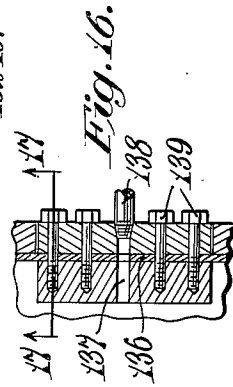
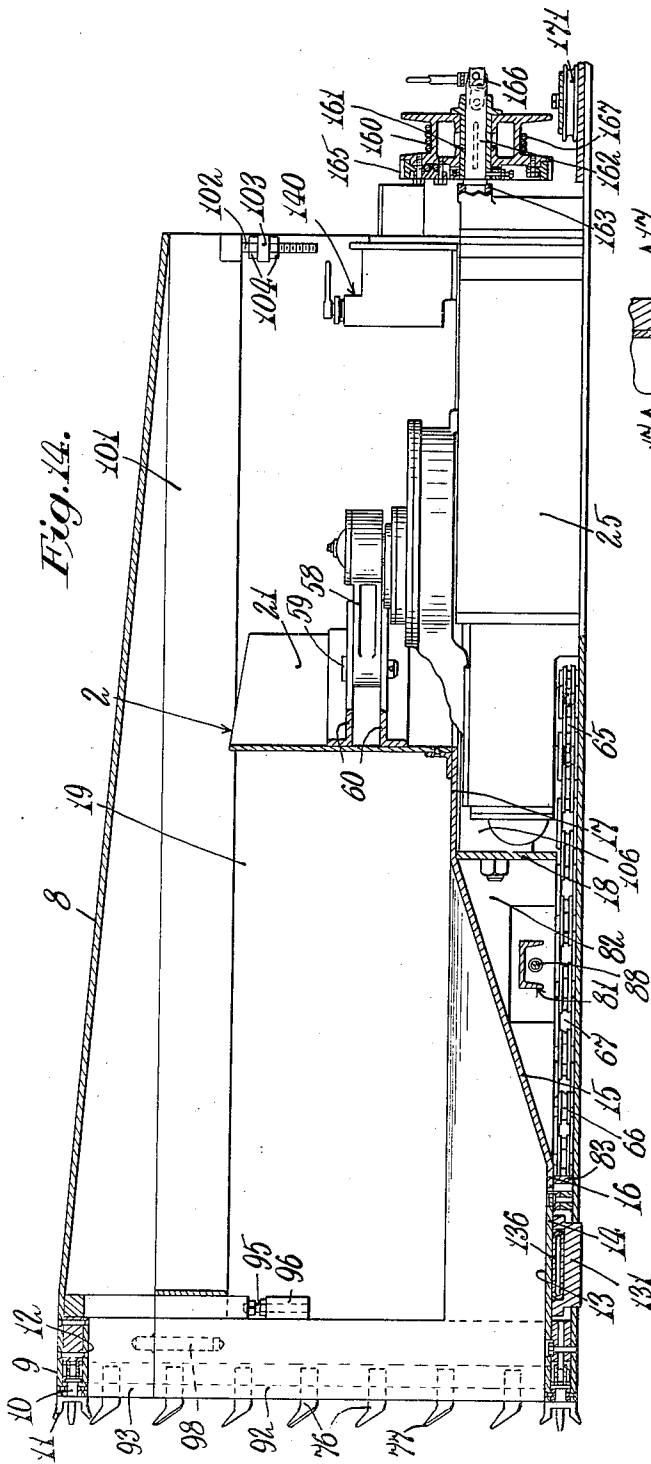
J. F. JOY

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8 Sheets-Sheet 6



Inventor:
Joseph F. Joy.
by *Louis A. Maxson.*
Atty.

Sept. 21, 1937.

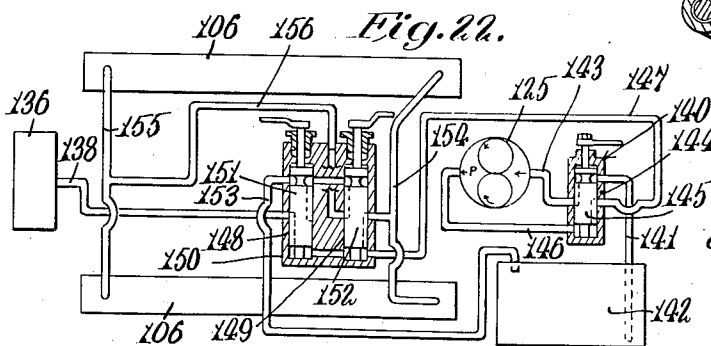
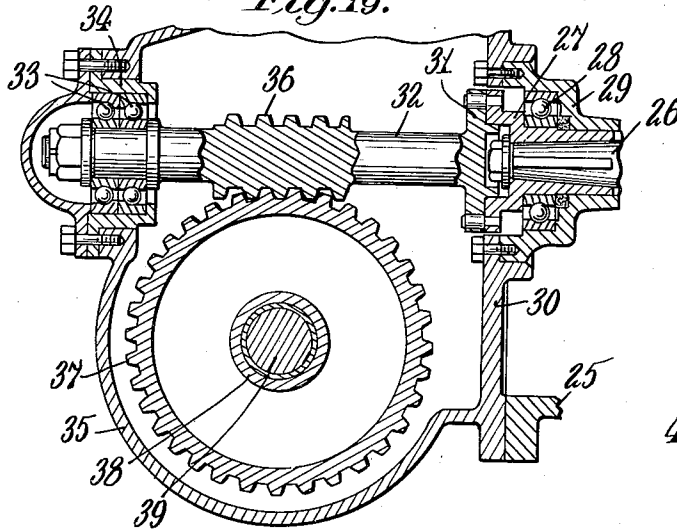
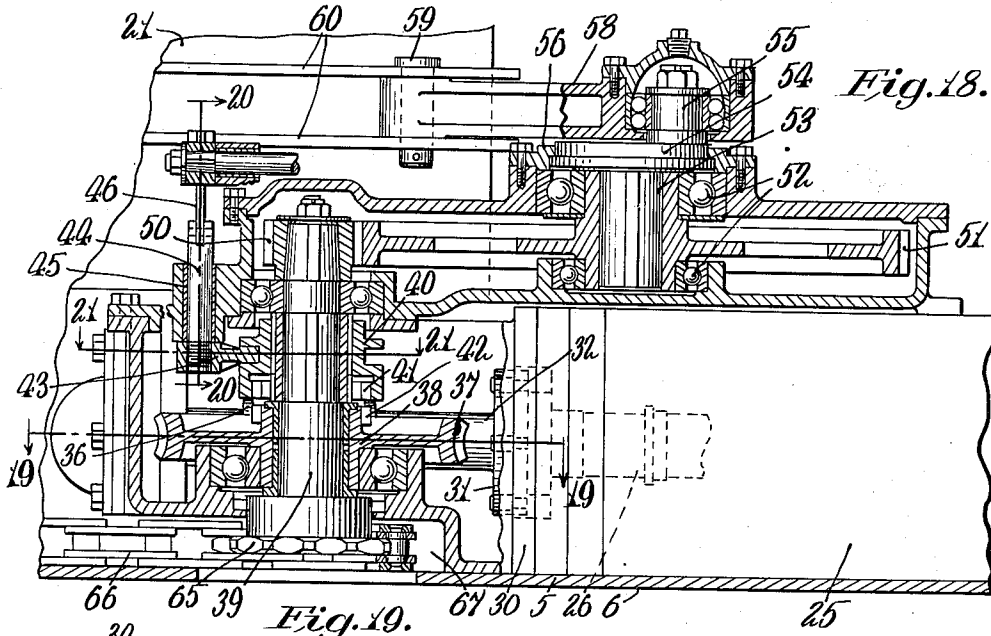
J. F. JOY

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8 Sheets-Sheet 7



Inventor:
Joseph F. Joy.
by
Louis A. Waxman.
Atty.

Sept. 21, 1937.

J. F. JOY

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MINING APPARATUS

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8 Sheets-Sheet 8

Fig. 23.

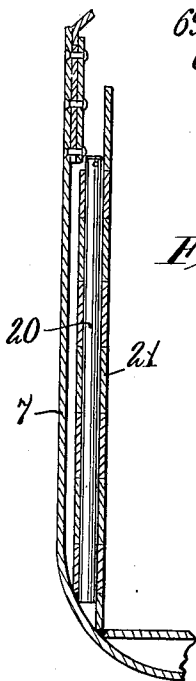
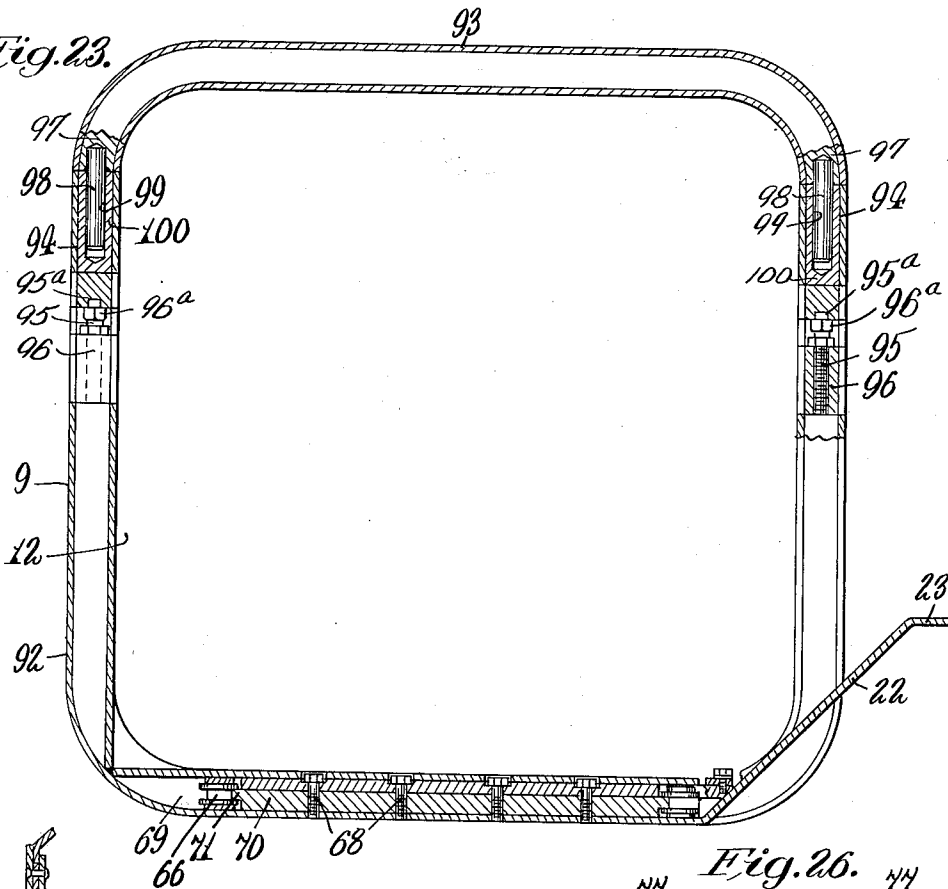


Fig. 24.

Fig. 25.

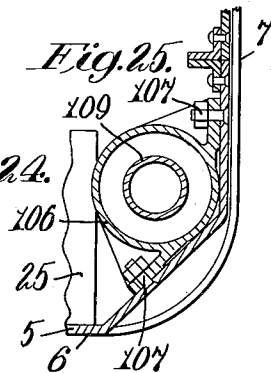


Fig. 26.

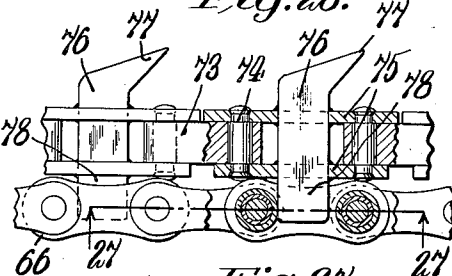


Fig. 27.



Inventor:
Joseph F. Joy.
by Louis A. Waxman.

Atty.

UNITED STATES PATENT OFFICE

2,093,448

MINING APPARATUS

Joseph F. Joy, Claremont, N. H., assignor to
Sullivan Machinery Company, a corporation of
Massachusetts

Application May 23, 1935, Serial No. 23,087

25 Claims. (Cl. 262—28)

This invention relates to mining apparatus, and more particularly relates to improvements in coal mining apparatus of the combined cutting and loading type.

5 An object of this invention is to provide an improved coal mining apparatus of the cutting and loading type whereby the coal may be cut, dislodged and moved from the coal seam in an improved and more effective manner. Yet another
10 object is to provide an improved core cutting mechanism whereby a core of coal may be cut from the mine wall, and having associated therewith improved means for dislodging the core from the face as cutting progresses. A further object
15 is to provide an improved core cutting means for cutting out a core of coal from the coal seam in a direction parallel with the coal face and having associated therewith improved breaking
20 broken down as the kerf cutting means is advanced along the coal face. A still further object is to provide an improved means for driving the cutting mechanism and the dislodging or breaking down means. Another object is to provide an
25 improved coal cutting and loading apparatus movable rectilinearly along the coal face in a direction parallel with the face for cutting, breaking down and loading the coal onto a face conveyor laid parallel with the coal face. Still another
30 object is to provide in an apparatus of the above character improved hydraulic devices for feeding the apparatus rectilinearly along the coal face, together with improved hydraulic leveling devices for maintaining the apparatus substantially level during movement thereof over an
35 uneven mine floor. Still another object is to provide an improved coal mining and loading apparatus having an improved arrangement and combination of parts. These and other objects
40 will, however, hereinafter more fully appear in the course of the following description and as more particularly pointed out in the appended claims.

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

In these drawings,—

Fig. 1 is a plan view of the illustrative form of the improved mining apparatus.

50 Fig. 2 shows the mining apparatus in side elevation as viewed from the mine wall side thereof.

Fig. 3 is a plan view of the improved mining apparatus showing the same in operative cutting and loading position in a mine, parts of the apparatus being shown in horizontal section to illustrate structural details.

Fig. 4 is a cross sectional view taken substantially on line 4—4 of Fig. 1.

Fig. 5 shows the mining apparatus in side elevation as viewed from the face conveyor side
60 thereof and showing the coal breaking and deflecting plate.

thereof and showing the coal breaking and deflecting plate.

Fig. 6 is a rear end elevational view of the improved mining apparatus.

Fig. 7 is a front end elevational view of the improved mining apparatus, showing the core cutting means.

Fig. 8 is a cross sectional view taken on line 8—8 of Fig. 1.

Fig. 9 is a vertical sectional view taken on line 9—9 of Figs. 8 and 10.

Fig. 10 is a cross sectional view taken on line 10—10 of Fig. 1.

Fig. 11 is an enlarged plan view of the improved mining apparatus, with parts broken away in horizontal section to illustrate details of construction.

Fig. 12 is a cross sectional view taken on line 12—12 of Fig. 11.

Fig. 13 is a detail sectional view taken on line 13—13 of Fig. 12.

Fig. 14 is a view in longitudinal section taken substantially on line 14—14 of Fig. 11, with parts shown in side elevation to facilitate illustration.

Fig. 15 is a detail sectional view taken on line 15—15 of Figs. 1 and 11.

Fig. 16 is a detail sectional view taken on line 16—16 of Fig. 15.

Fig. 17 is a detail sectional view taken on line 17—17 of Fig. 16.

Fig. 18 is a view in longitudinal section taken substantially on line 18—18 of Fig. 1.

Fig. 19 is a horizontal sectional view taken on line 19—19 of Fig. 18.

Fig. 20 is a detail sectional view taken on line 20—20 of Fig. 18.

Fig. 21 is a horizontal sectional view taken on line 21—21 of Fig. 18.

Fig. 22 is a diagrammatic view showing the hydraulic system.

Fig. 23 is a cross sectional view taken on line 23—23 of Fig. 11.

Fig. 24 is a detail sectional view taken on line 24—24 of Fig. 11.

Fig. 25 is a detail sectional view taken on line 25—25 of Fig. 11.

Fig. 26 is a detail view showing the cutter chain and its associated driving means.

Fig. 27 is a detail sectional view taken on line 27—27 of Fig. 26.

In this illustrative embodiment of the invention there is shown a cutting and loading apparatus for cutting out a core of coal from the mine wall, breaking down the core as cutting progresses and conveying the broken down coal away from the coal face, this improved apparatus in this instance being of the longwall type and adapted to move rectilinearly along the mine wall in a direction parallel with the coal face during the cutting and loading operation. This improved cut-
60

ting and loading apparatus is herein, for illustrative purposes shown, as the longwall floor cutter type adapted to rest upon and slide over the mine floor during the cutting and loading operation, but it will be evident that if desired improved cutting and loading apparatus may be of the wheel mounted, track supported and guided type adapted to run along a mine trackway laid on the mine floor in a direction parallel with the coal face, or of the crawler tread mounted type, and that features of the invention may be associated with cutting and loading apparatus of various types other than that disclosed.

In this illustrative construction there is shown kerf cutting means generally designated 1 in the form of a loop core cutter for cutting out a core from the mine wall as the apparatus is moved rectilinearly along the coal face, breaking down and deflecting means generally designated 2 for breaking down the coal and moving the material laterally away from the coal face, and feeding means generally designated 3 for moving the apparatus bodily over the mine floor as cutting, breaking down and loading progresses.

More specifically, as shown in the drawings, the improved apparatus comprises a bottom frame or skid plate structure 5 having a plane bottom surface 6 for slidably supporting the apparatus for movement over the mine floor. This frame or skid plate structure is herein of a fabricated construction composed of metal plates suitably formed and welded together, and has secured thereto vertical side plates 7, 7 and a top plate 8, the top plate being vertically adjustable with respect to the bottom skid structure, as will later be described. It will thus be seen that the skid structure and the side and top plates form a substantially rectangular housing for the various mechanisms of the apparatus. Secured in a suitable manner, as by riveting and welding, to the bottom skid and the side and top plates, is a cutter frame 9 herein of rectangular cross section, as shown in Fig. 23, and having formed thereon, at its forward side, a guideway 10 in which travels a loop type cutter chain 11, the cutter frame being formed with a central opening 12 within which the core of coal passes as the loop cutter chain cuts out a kerf at the top, bottom and inner side of the mine wall. The outer dimensions of the cutters of the loop cutter chain cut out an opening of a size sufficient to permit the apparatus to move within the opening cut by the chain, the various elements of the apparatus being included within the projection of the outline of the chain cutter. Secured to the bottom frame 5 and having its top surface 13 flush with the top surface of the bottom portion of the cutter frame 9 is a horizontal receiving plate 14 extending across the bottom frame, and cooperating with this plate is an upwardly and rearwardly inclined receiving plate 15 having a forward horizontal portion 16 arranged with its top surface flush with the top surface of the plate 14 and a horizontal rearward portion 17 supported by a transverse vertical plate 18 suitably secured to the sides of the frame structure. Pivotally mounted within a chamber 19, with which the core receiving opening 12 in the cutter frame communicates, to swing about a vertical axis at 20, is an upstanding curved breaking down and deflecting plate 21 for progressively breaking down the core of coal as it passes through the core receiving opening 12 in the cutter frame within the receiving chamber 19, the coal being broken down by the plate 21 and

deflected laterally from the outer side of the apparatus through a lateral opening formed in the vertical side plate 7, over an inclined discharge plate 22 secured to the bottom frame structure and having a lateral discharge lip 23. It will thus be seen that as the apparatus is moved rectilinearly along the coal face, the coal is cut away at its top, bottom and inner sides to form a core, and as cutting progresses the core of coal is broken down and deflected laterally from the apparatus.

Now referring to the driving means for the loop chain cutter and the breaker and deflector plate, it will be noted that arranged within the bottom portion of the frame structure at the rearward end of the apparatus is a motor 25 horizontally disposed and having its power shaft 26 extending longitudinally of the apparatus. As shown in Fig. 19, the forward end of the motor power shaft has keyed thereto a coupling element 27 having its hub journaled in a bearing 28 supported within a bearing bracket 29 bolted to a vertical web 30 of the frame structure. The coupling element 27 cooperates with a coupling element 31 to provide a flexible joint between the motor power shaft 26 and the aligned shaft 32. The forward end of the shaft 32 is journaled in suitable bearings 33 supported within a bearing bracket 34 bolted to the vertical web portion of a gear housing 35. Formed on the shaft 32 is a worm 36 meshing with a worm wheel 37 having its hub 38 journaled on bearing sleeves supported by a vertical shaft 39, this shaft being journaled at its opposite ends within suitable bearings supported within the housing 35 of the frame structure. Splined to the shaft 39 is a sliding clutch sleeve 40 having clutch teeth 41 connectible to clutch teeth 42 formed on the hub of the worm wheel 37. Engaging an annular groove formed on the clutch sleeve is a shifter yoke 43 secured to a vertical operating rod 44 guided at 45 within the gear housing. The rod 44 is connected by a link 46 to a crank 47 keyed to an operating rod 48, herein rotatably mounted in and extending longitudinally of the frame structure above the gear housing 35 and having at the rear end of the apparatus an operating handle 49. As shown in Fig. 18 keyed to the upper end of the shaft 39 is a spur gear 50 meshing with a large spur gear 51 journaled in bearings 52 supported within the frame structure. Arranged within the hub of the gear 51 and keyed thereto is a shaft 53 having secured at its upper end a crank disc 54 having a crank pin 55. This crank disc has a peripheral flange with which an annular retaining plate 56 cooperates, this retaining plate being bolted to the frame structure. Connected to the crank pin is a connecting rod 58 pivotally connected at 59 to spaced flanges 60 secured to the breaker and deflector plate 21. It will thus be seen that when the clutch 40 is connected, the crank disc 54 is driven by the motor through the worm gearing 36, 37, shaft 39 and spur gearing 50, 51, and this crank disc effects oscillation through the crank and connecting rod, of the breaker and deflector plate 21, this plate being oscillated slightly about its vertical pivot 20 to effect breaking down and lateral deflection of the coal. As shown in Fig. 18, fixed to the lower end of the shaft 39 is a chain sprocket 65 engaging an endless drive chain 66 arranged in the horizontal chamber 67 formed within the bottom portion of the frame structure. Secured by screws 68 within a recess 69 formed in the cutter frame 9 is a transverse guide block 70 having a guide flange 75

71 around which the forward portion of the drive chain passes, this guide flange having a straight portion extending transversely of the machine in parallelism with the adjacent portions of the cutter chain guide and curved end portions, thereby forming a front chain guide. As shown in Figs. 26 and 27, the loop cutter chain comprises chain blocks 73 pivotally connected by pivot pins 74 to side straps 75, and these straps have secured thereto, as by welding, cutter bits 76, each having a cutting portion 77. The cutter portions 77 of the cutter bits on the series of straps of the loop cutter chain are arranged at different inclinations to provide on the chain a cutting portion of a width sufficient to receive the cutter frame as the chain cutter penetrates the coal, and each cutter bit has a shank portion 78 projecting inwardly from the inner side of the loop chain, and these shank portions are adapted to project between the chain blocks of the drive chain 66, the drive chain engaging the cutter bit shank projections to effect driving of the loop chain within its guide about the forward margin of the loop cutter frame. Secured to the bottom plate of the frame structure and cooperating with the guide flange 71 on the guide block are vertical guide plates 79 and 80 which guide the drive chain toward and from the guide flange 71 on the front guide block. Means is also provided for tightening the guide chain comprising a chain tightening device 81 arranged within a transverse chamber 82 formed between the bottom skid plate, the inclined receiving plate 15, the rear vertical plate 18 and a front vertical plate 83 welded to the bottom skid plate and the plate 15 and extending transversely of the machine between the guide plates 79 and 80. This chain tightening device comprises an adjustable frame 84 mounted in a guideway 85 and having a curved arcuate shoe 86 for engaging the chain. Formed on the frame 84 is a nut 87 with which is threadedly engaged an adjusting screw 88, journaled within the frame structure and having formed at its outer end a polygonal portion 89 adapted for engagement with a suitable turning instrument. The inclined side wall of the skid frame structure is provided with an opening 90 to permit access to the turning portion of the adjusting screw. It will thus be evident that any slackness in the drive chain may be taken up by suitable adjustment of the sliding frame 84.

Referring more particularly to the cutter frame structure of the loop cutter chain, it will be noted that the same is preferably of a fabricated construction composed of sheet metal plates suitably formed and welded together, the plates cooperating to form the chain guideway 10. As shown in Fig. 23, the bottom portion 92 of the cutter frame is rigidly secured as by bolts and welding to the skid frame structure, while the upper portion 93 of the cutter chain is slidably guided at 94 on the bottom cutter frame portion 92. Means is provided for adjusting the upper cutter frame portion 93 vertically with respect to the lower rigid frame portion 92 for tightening the cutter chain, and this adjusting means comprises screws 95, threadedly engaging nuts 96 fixed to the cutter frame portion 92, these screws rotatably engaging at 95a the adjustable cutter frame portion 93 and having formed thereon suitable turning heads 96a. For guiding the top cutter frame portion 93 with respect to the bottom frame portion, there are secured within blocks 97 fixed to the frame portion 93 as by dowel pins 98 slidably received in vertical openings 99 formed in

guide blocks 100 fixed to the rigid frame portion 92. The forward portion of the top plate 8 is riveted to and forms a portion of the adjustable top portion 93 of the cutter frame, and the rear end of this top plate is welded to a frame 101 secured to the cutter frame portion 93 and adjustable vertically therewith. For adjusting the frame 101 and top plate in unison with the upper portion of the cutter frame there are provided at the rear corners of the frame adjusting screws 102 passing through openings formed in lugs 103 secured to the side plates 7 and 8 of the skid frame structure, and these screws are provided with suitable adjusting nuts 104. It will thus be seen that the entire top frame structure of the apparatus may be adjusted vertically with respect to the bottom frame structure.

The means for feeding the apparatus rectilinearly along the coal face as cutting progresses comprises hydraulic cylinders 106, 106 arranged in longitudinal parallel relation at the opposite sides of the bottom frame structure and, as shown in Fig. 25, secured to the bottom frame structure by bolts 107. These cylinders contain pistons 108 having rearwardly extending piston rods 109, these piston rods extending rearwardly through the packed rear heads 110 of the feed cylinders. Suitably secured to the rear ends of the feed piston rods are guide blocks 111 having vertical guideways 112 receiving vertical guides 113 formed on jack shoes 114, these shoes having feet 115 engaging the mine floor. Projecting upwardly from the shoes 114 are jacks 116 having adjustable portions 117 pointed at their upper end for engagement with the mine roof. As shown in Fig. 2, the guide blocks 111 are provided with lateral lugs 118 to which are pivotally connected eye bolts 119, these bolts having threaded thereon adjusting elements 120, and interposed between the elements 120 and the upper surfaces of the shoes 114 are coil springs 121. These coil springs act on the upper portions of the jack shoes for holding the feet thereof yieldingly in engagement with the mine floor. It is accordingly evident that when the jack shoes are held in engagement with the mine floor by the jacks 116 engaging the mine roof, and hydraulic pressure is supplied to the feed cylinders, the latter are moved forwardly with respect to the stationary feed pistons to move the apparatus forwardly rectilinearly over the mine floor. The means for supplying hydraulic pressure to the feed cylinders comprises a gear pump 125 mounted on the frame structure and having its drive shaft 126 driven from a pinion 127 fixed to the motor power shaft 25, through spur gearing 128, 129. The hydraulic system will be later described.

Improved hydraulic levelling means is provided for maintaining the apparatus substantially level as the same moves over an undulating mine floor comprising, as shown in Figs. 14, 15, 16 and 17, a levelling pad 131 in the form of a rectangular plunger having a wide bottom surface 132 engageable with the mine floor, and this plunger is guided in a chamber 133 formed in a rectangular block 134 secured within the forward portion of the bottom frame structure, as by welding, to the bottom skid plate and the upper plate 14. For moving the levelling pad plunger within its chamber, to vary the elevation of the forward cutting end of the apparatus, there is formed within the upper surface of the plunger 131 a chamber 135 having arranged therein an expandible member 136 acting between the plunger and

the bottom surface of the frame plate 14, and hydraulic pressure is adapted to be conducted to this expansible member through a passage 137 in turn connected to a pressure supply pipe 138. The expansible member 136 is herein preferably in the form of a flexible bag, and the passage 137 is formed fluid tight by clamping the portion of the bag surrounding the opening therein between a pair of blocks (see Figs. 16 and 17) held together by bolts 139, and the supply pipe 138 is threaded within the outer block, while a passage in the inner block connects this pipe with the interior of the expansible bag. It will thus be seen that by varying the pressure in the expansible member 136 the levelling pad may be moved within its cylinder into any desired position and held there.

The hydraulic system for supplying liquid under pressure to the feed cylinders and the levelling pad comprises, as shown in Fig. 22, a master control valve device 140 connected by a pipe 141 to a liquid reservoir 142 and by a pipe 143 to the intake of the gear pump 125. This valve comprises a valve casing 144 having mounted therein a rotary control valve 145. The discharge of the pump 125 is connected through a pipe 146 to the valve chamber at the lower end of the valve 145, and this pipe is connectible through a passage formed on the valve to a pipe 147 communicating with the lower ends of parallel valve bores 148 and 149 formed in a valve casing 150. These valve bores have arranged therein rotary control valves 151 and 152, respectively, the valve 151 controlling the feed cylinders and the valve 152 controlling the levelling pad. The upper ends of the valve bores are connected through suitable passages and a discharge pipe 153 to the reservoir 142. The lower end of the valve bore 149 is connectible through branched pipes 154 to the rear ends of the feed cylinders, while the forward ends of the feed cylinders are connectible through branched pipes 155 and a pipe 156 through a passage on the valve with the discharge pipe 153. The pipe 138 for the levelling pad communicates through a passage on the valve 151 with the lower end of the valve bore 148. When the master control valve 145 is in the position shown in Fig. 22, liquid may flow from the reservoir through pipe 141 past the valve 145 through pipe 147 to the lower ends of the valve bores 148, 149. When the feed control valve 151 is in the position shown, liquid under pressure may flow from the lower end of the valve bore 149 through the passage on the valve and through the branched pipe 154 to the rear ends of the feed cylinders, while the forward ends of the feed cylinders are connected to discharge through pipes 155, 156, passages on the valve and in the valve casing and through discharge pipe 153 to the reservoir 142. When the feed control valve 152 is turned into its reverse position, liquid under pressure may flow through pipe 147 past the valve 152 and through pipes 156, 155 to the forward ends of the feed cylinders, while the rear ends of the feed cylinders are connected to discharge through pipes 154, passages on the valve and in the valve chest and through discharge pipe 153 communicating with the reservoir. When the levelling pad controlling valve 151 is in the position shown in Fig. 22, liquid under pressure may flow from the lower end of the valve chamber 148 through a passage on the valve 151 and through the pipe 138. When the valve 151 is turned into its reverse position, the levelling pad supply pipe 138 may be

connected to the discharge pipe 153 through a passage on the valve 151. When the desired pressure is supplied to the levelling pad, the valve 151 may be turned to cut off the pipe 138, thereby to lock the liquid pressure within the levelling pad to hold the pad in the desired adjusted position. When hydraulic pressure is supplied to the forward ends of the feed cylinders, the latter may be fed forwardly with respect to the relatively stationary feed pistons, and when liquid pressure is supplied to the rear ends of the feed cylinders and the jacks 116 are released, the feed pistons 108 may be fed forwardly relative to the feed cylinders for a purpose to be later described. Means is provided independent of the hydraulic feeding devices for moving the apparatus rapidly over the mine floor from one working place to another. This fast feeding means comprises a feed drum 160 journaled on a bearing sleeve 161 slidably supported on a shaft 162 suitably mounted at 163 within the frame structure. This drum is adapted to be driven at a high speed from the motor 25 through a spur pinion 164 driven by the gear 128 and meshing with a large spur gear 165 connected to the drum 160. A suitable lever operated eccentric 166 is provided connected by a link to the sleeve 161 for sliding the drum 160 outwardly relative to the shaft 162 to bring the teeth of the gear 165 out of meshing engagement with the teeth of the pinion 164. Wound on the drum 160 is a feed cable 167 passing around a vertical guide sheave 168 journaled on a bracket 169 secured to the bottom skid plate and around horizontal guide sheaves 170 and 171 journaled on vertical studs secured to the bottom skid plate, and the feed cable may be extended from the drum around these sheaves longitudinally rearwardly of the machine to a suitable anchor. When the sleeve 165 and drum 160 are slid inwardly to bring the gear 164 into meshing engagement with the pinion 164, the drum may be driven in a direction to wind in the feed cable 167 to move rapidly the machine bodily over the mine floor.

The mode of operation of the improved cutting and loading apparatus is as follows: Referring more particularly to Figs. 3 and 4, it will be observed that the cutting and loading apparatus is in cutting and loading position with respect to a seam of coal to be cut and loaded. The apparatus is arranged parallel with the coal face and moves rectilinearly along the face as cutting and loading progresses. Arranged parallel with the face and laid on the mine floor outside and adjacent to the face is a face conveyor 170, while arranged at the opposite side of the face conveyor with respect to the coal face is a series of appropriately located roof props 171. As shown in Fig. 2, the inclined discharge plate over which the broken coal is discharged from receiving chamber 19 of the apparatus has its discharge lip 23 overhanging the face conveyor so that as the broken coal is discharged laterally from the apparatus it drops from the discharge plate onto the face conveyor. The apparatus is initially positioned in a mine chamber at the end of the mine wall, and as the apparatus is advanced along the coal face, the core cutting means acts to cut out a core of coal in a direction parallel with the face, and as the apparatus advances, the breaker plate 21 acts on the inner side of the core to break down the core and move the broken coal laterally over the inclined discharge plate through the open side of the apparatus, the broken coal discharging onto the face conveyor whereby it

is conveyed away from the face. When the apparatus is in the position to effect cutting and loading, as shown in Fig. 1, the jacks 116 are adjusted to jack the shoes 114 securely in position against the mine floor, thereby to provide stationary reaction means for the feed pistons. The clutch 40 controlling the drive of the loop cutter chain 10 is then thrown in, and the motor 25 started, and as a result, the cutter chain is rapidly circulated within its guide about the forward edge of the loop cutter frame, while the breaker plate 21 is rapidly oscillated about its pivot 20 through the crank and connecting rod connection. Hydraulic pressure is then supplied by the pump 125 to the forward ends of the feed cylinders 106 to effect forward feed of the apparatus over the mine floor in the direction parallel with the coal face. As the apparatus is advanced along the coal face the loop chain cutter cuts the coal seam at its top, bottom and inner vertical side to form a projecting core of coal which enters the breaking and discharging chamber 19 through the core receiving opening 12 in the loop cutter frame, and as the core is engaged by the oscillating breaker plate 21, it is broken down or dislodged into the discharge chamber from which it is shoved laterally by the crowding action of the breaker plate over the inclined discharge plate onto the face conveyor. When the feed cylinders have reached their limit of forward feed, the jacks are released and the forward cylinder ends are connected to discharge while liquid pressure is supplied to the rear ends of the feed cylinders, thereby to effect movement of the feed pistons, together with the jacks, to a new feeding position. The jacks are then again set and hydraulic pressure is again supplied to the front ends of the feed cylinders to effect forward feed of the apparatus. As the apparatus moves over an undulating mine floor, it may be maintained substantially level, or, if desired, the forward cutting end of the apparatus may be tilted upwardly and downwardly by suitably controlling the supply of liquid pressure to the leveling pad 136. When it is desired to move the apparatus rapidly over the mine floor during maneuvering of the apparatus, this may be readily accomplished by the fast speed feed drum and cable mechanism. It will be evident that when it is desired to cut and load in coal seams of varying height, the chain tightening means may be utilized as a height adjusting means and that cutter chains of different lengths may be employed, thereby to accommodate for variations in the seam height. Also, if desired, the adjusting screws disclosed may be replaced by screws of somewhat greater length, thereby to enable cutting and loading of coal seams of even greater height, it of course then being necessary to utilize a loop cutter chain of even greater length.

As a result of this invention, it will be noted that an improved cutting and loading apparatus is provided having improved kerf cutting means for cutting out a core of coal from the coal seam and having associated therewith improved dislodging means for breaking down the core as cutting progresses, and discharging the broken coal laterally from the apparatus. It will further be noted that by the provision of the loop chain core cutting means encircling a central core receiving opening communicating with a breaking down and discharge chamber, and by the provision of the oscillatory breaker and deflecting plate arranged in the breaking and discharge chamber,

it is possible to cut, dislodge and eject the coal from the apparatus in an extremely effective manner, the apparatus operating along the coal face substantially entirely within the coal seam, thereby enabling roof propping at points extremely close to the working face. It will still further be evident that by the provision of the improved levelling means for maintaining the apparatus substantially level during movement thereof over an uneven mine floor, it is possible to control the direction of movement of the cutting end of the apparatus, the levelling means preventing the cutting head from following the uneven contour of the mine floor. These and other uses and advantages of the improved cutting and loading apparatus 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 cutting and loading apparatus, a body, a core cutting head carried at the forward end of said body for cutting out a core from the mine wall to form an opening for receiving said body, the outer limits of said body arranged wholly within the outer limits of said cutting head, said cutting head comprising a guide frame having a guideway extending about its margin, a central core receiving opening and an endless loop cutter chain guided in said guideway for circulation thereabout, means within said body providing a chamber for receiving the core, the latter passing through said core receiving opening into said chamber as the cutting head and body are advanced rectilinearly along the mine wall in a direction parallel with the coal face, and a single means movably mounted within said chamber for engaging the core to break down the latter as cutting progresses and for moving the broken down coal from said chamber.

2. In a cutting and loading apparatus, a body, a core cutting head carried at the forward end of said body for cutting out a core from the mine wall to form an opening for receiving said body, the outer limits of said body arranged wholly within the outer limits of said cutting head, said cutting head comprising a guide frame having a guideway extending about its margin, a central core receiving opening and an endless loop cutter chain guided in said guideway for circulation thereabout, means within said body providing a chamber for receiving the core, the latter passing through said core receiving opening into said chamber as the cutting head and body are advanced rectilinearly along the mine wall in a direction parallel with the coal face, and means movably mounted within said chamber for engaging the core to break down the latter as cutting progresses and for deflecting the broken coal laterally from the outer side of said body.

3. In a cutting and loading apparatus, a body, a core cutting head carried at the forward end of said body for cutting out a core from the mine wall to form an opening for receiving the body, the outer limits of the body arranged wholly within the outer limits of said cutting head, said cutting head comprising a guide frame having a guideway extending about its margin, a central

core receiving opening and an endless loop cutter chain guided in said guideway for circulation thereabout, core breaking means within the body for engaging and breaking down the core as the apparatus is advanced rectilinearly along the mine wall in a direction parallel with the coal face, and a lateral chute for receiving the broken down coal and for conveying the latter laterally from the outer side of the body, said core breaking means acting on the broken coal to move the latter onto said chute.

4. In a cutting and loading apparatus, a body, a loop chain core cutting head carried at the forward end of said body for cutting out a core from the mine wall to form an opening for receiving the body, the outer limits of the body arranged wholly within the outer limits of said cutting head, an oscillatory breaker plate mounted within said body for engaging the core and breaking down the latter as cutting progresses, and lateral discharge means for the broken down coal for discharging the latter laterally from the outer side of the body, said breaker plate acting on the broken down coal to move the latter onto said lateral discharge means.

5. In a cutting and loading apparatus, a substantially rectangular frame formed to provide a central core receiving chamber, an endless loop core cutter arranged at the forward end of said frame and guided about the margin of said cutter frame, the outer limits of said frame arranged wholly within the outer limits of said loop cutter, said loop cutter cutting out a core from the mine wall to form an opening for receiving said frame as said loop cutter and frame are advanced rectilinearly along the mine wall in a direction parallel with the coal face, a core receiving chamber arranged within said frame at the rear of said loop cutter, and means movably mounted in said core receiving chamber for engaging and breaking down the core as cutting progresses and for moving the broken down coal laterally from the apparatus.

6. In a cutting and loading apparatus, a frame adapted to rest upon and slide over the mine floor, a loop chain core cutting head carried by said frame at the forward end thereof, the outer limits of said frame arranged wholly within the outer limits of said cutting head, said cutting head cutting out a core of coal from the mine wall to form an opening for receiving said frame as said cutting head and frame are advanced rectilinearly along the mine wall in a direction parallel with the coal face, and a single means for breaking down the core as cutting progresses and for moving the broken down coal laterally from the frame.

7. In a cutting and loading machine, a body, kerf cutting means carried at the forward end of said body for cutting out a core of coal from the mine wall to form an opening for receiving said body, the outer limits of said body arranged wholly within the outer limits of said kerf cutting means, said kerf cutting means comprising a guide frame having a guideway extending about its margin, a central core receiving opening and an endless loop cutter chain guided in said guideway for circulation thereabout, core receiving means within said body at the rear of said cutting means for receiving the core, the latter passing through said core receiving opening onto said receiving means as the cutting means and body are advanced rectilinearly along the mine wall in a direction parallel with the coal face, and means movably mounted in said core receiving

means for engaging and breaking down the core as cutting progresses and for discharging the broken down coal laterally from the body.

8. In a cutting and loading apparatus, a body, kerf cutting means carried at the forward end of said body for cutting out a core in the mine wall to form an opening for receiving said body, the outer limits of said body arranged wholly within the outer limits of said kerf cutting means, said kerf cutting means comprising a guide frame having a guideway extending about its margin, a central core receiving opening and an endless loop cutter chain guided in said guideway for circulation thereabout, core receiving means within said body at the rear of said cutting means for receiving the core, the latter passing through said core receiving opening onto said receiving means as said cutting means and said body are advanced rectilinearly along a mine wall in a direction parallel with the coal face, a lateral discharge plate at the outer side of said body, and means movably mounted in said core receiving means for engaging and breaking down the core as cutting progresses and for moving the broken down coal laterally from the body over said discharge plate.

9. In a cutting and loading apparatus, a body, core cutting means carried at the forward end of said body for cutting parallel superimposed bottom and top kerfs and parallel vertical kerfs intersecting said horizontal kerfs for cutting out a core of coal from the mine wall to form an opening for receiving said body, the outer limits of said body arranged wholly within the outer limits of said core cutting means, means for advancing said core cutting means and body rectilinearly along the mine wall in a direction parallel with the coal face, and laterally acting means engageable with the core for breaking down the core as cutting progresses and for ejecting the broken down coal laterally from the outer side of the body.

10. In a mining apparatus, a loop chain cutter, an open-center guide frame for said chain cutter, said guide frame comprising relatively adjustable parts, each part having formed thereon transverse guiding means for said chain cutter, and means respectively arranged at the opposite sides of said guide frame for adjusting one part of said guide frame with respect to the other part to effect relative adjustment between said different transverse guiding means to vary the vertical dimension of said guide frame thereby to provide tightening means for said chain cutter.

11. In a cutting and loading apparatus, a frame having a plane bottom surface adapted to rest upon and slide over the mine floor, a core cutter head carried at the forward end of said frame for cutting out a core from a mine wall to form an opening for receiving said frame, said cutting head comprising a guide having a guideway extending about its margin, a central core receiving opening and an endless loop cutter chain guided in said guideway for circulation thereabout and said frame having its outer limits arranged wholly within the outer limits of said cutter head and having formed therein a core receiving chamber at the rear of said cutter head for receiving the core cut by said cutter head as the core passes through said core receiving opening, means for feeding said cutter head and frame rectilinearly along the mine wall in a direction parallel with the coal face, and means arranged within said body and mounted for horizontal movement relative thereto for engaging

and breaking down the core within said chamber as cutting progresses.

12. In a cutting and loading apparatus, a frame having a plane bottom surface adapted to rest upon and slide over the mine floor, a core cutter head carried at the forward end of said frame for cutting out a core from a mine wall to form an opening for receiving said frame, said cutting head comprising a guide having a guideway extending about its margin, a central core receiving opening and an endless loop cutter chain guided in said guideway for circulation thereabout and said frame having its outer limits arranged wholly within the outer limits of said cutter head and having formed therein a core receiving chamber at the rear of said cutter head for receiving the core cut by said cutter head as the core passes through said core receiving opening, means for feeding said cutter head and frame rectilinearly along the mine wall in a direction parallel with the coal face, and means arranged within said body for engaging and breaking down the core within said chamber as cutting progresses and for discharging the broken down coal from the outer side of said body.

13. In a cutting and loading apparatus, a support, a core cutting head carried at the forward end of said support and having a central core receiving opening and an endless loop cutter chain guided for circulation about said opening, said support arranged with its outer limits wholly within the outer limits of said cutting head, means for feeding said cutting head rectilinearly along the mine wall in a direction parallel with the coal face to cut out a core from the mine wall to form an opening for receiving said support, a core receiving chamber formed within said support at the rear of said cutting head for receiving the core as it passes through the opening in said core cutting head as the cutting head and support are advanced along the mine wall, and means horizontally movably mounted in said chamber for engaging the core to break down the core as cutting progresses.

14. In a cutting and loading apparatus, a support, a core cutting head carried at the forward end of said support and having a central core receiving opening and an endless loop cutter chain guided for circulation about said opening, said support arranged with its outer limits wholly within the outer limits of said cutting head, means for feeding said cutting head rectilinearly along the mine wall in a direction parallel with the coal face to cut out a core from the mine wall to form an opening for receiving said support, a core receiving chamber formed within said support at the rear of said cutting head for receiving the core as it passes through the opening in said core cutting head as the cutting head and support are advanced along the mine wall, and means movably mounted in said chamber for engaging the core to break down the core as cutting progresses and for discharging the broken down coal laterally from the outer side of said support.

15. In a cutting and loading apparatus, a support, a loop cutter frame supported at the forward end of said support and having a central core receiving opening, a loop core cutting cutter chain mounted for circulation about the forward margin of said loop frame for cutting out a core of coal from the mine wall as said cutter frame and support are advanced rectilinearly along the mine wall in a direction parallel with the coal face, a core receiving chamber in said support at

the rear of said cutter frame for receiving the core as it passes through the central opening in said cutter frame as the latter is advanced along the mine wall, and means movably mounted in said core receiving chamber for breaking down the core as cutting progresses and for discharging the broken down coal laterally from the outer side of said support.

16. In a mining apparatus, a cutter chain, a frame for guiding said cutter chain, cutters carried by said cutter chain and having projecting shanks, and means for driving said cutter chain including an endless drive chain engaging said cutter shanks.

17. In a cutting and loading apparatus, a low compact body of generally rectangular shape movable over the mine floor, a core cutting head carried at the front end of said body for cutting out a core from the mine wall to form an opening for receiving the body as said cutting head and body are advanced along the mine wall, the outer limits of said body arranged wholly within the outer limits of said cutting head, said cutter head comprising a rectangular guide frame mounted at the forward end of said body and having a continuous guideway extending about its margin and an endless loop cutter chain guided in said guideway for circulation thereabout, said cutter chain constituting the sole cutting element of the cutting head, and said body having a chamber for receiving the core cut by said cutter chain as the cutting head and body are moved along the mine wall, and means for feeding the cutting head and body rectilinearly along the mine wall along a path parallel with the coal face substantially inside the latter.

18. In a cutting and loading apparatus, a body having a plane bottom surface adapted to rest upon and slide over the mine floor, a core cutting head carried at the front end of said body for cutting out a core from the mine wall to form an opening for receiving the body as the cutting head and body are advanced along the mine wall, the outer limits of the body arranged wholly within the outer limits of said cutting head, said cutting head comprising a guide frame having a guideway extending about its margin, a central core receiving opening and an endless loop cutter chain guided in said guideway for circulation thereabout for cutting a kerf for receiving said guide frame as the apparatus advances, means for driving said cutter chain comprising a driving element engaging said chain and disposed wholly outside of said core receiving opening, said driving element movable within said kerf with said guide frame, and means for feeding the cutting head and body rectilinearly along the mine wall along a path parallel with the coal face substantially inside the latter.

19. In a cutting and loading apparatus, a body, a core cutting head carried at the front end of said body for cutting out a core from the mine wall to form an opening for receiving the body as the cutting head and body are advanced along the mine wall, the outer limits of said body arranged wholly within the outer limits of said cutting head, and said head having a central opening through which the core passes as cutting progresses and a guide frame surrounding said opening and having a guideway extending about its margin and an endless loop cutter chain guided in said guideway for circulation thereabout, said cutter chain constituting the sole cutting element of the cutting head, said body having a central chamber formed within said body at the

rear of said cutting head for receiving the core as it passes through said central cutter head opening, and means for feeding said cutter head and body rectilinearly along the mine wall in a direction parallel with the coal face substantially inside the latter.

20. In a cutting and loading apparatus, a body, a core cutting head carried at the front end of said body for cutting out a core from the mine wall to form an opening for receiving the body as the cutting head and body are advanced along the mine wall, the outer limits of said body arranged wholly within the outer limits of said cutting head and said head having a central opening through which the core passes as cutting progresses and a guide frame surrounding said opening and having a guideway extending about its margin and an endless loop cutter chain guided in said guideway for circulation thereabout, said body having a central chamber formed within said body at the rear of said cutting head for receiving the core as it passes through said central cutter head opening, and means for feeding said cutter head and body rectilinearly along the mine wall in a direction parallel with the coal face substantially inside the latter, said chamber opening laterally through the outer side of said body, and means within said chamber for engaging and breaking down the core as cutting progresses and for deflecting the broken coal laterally from the outer side of the body.

21. In a cutting and loading apparatus, a body, a core cutting head carried at the front end of said body for cutting out a core from the mine wall to form an opening for receiving the body as the cutting head and body are advanced along the mine wall, the outer limits of said body arranged wholly within the outer limits of said cutting head, and said head having a central opening through which the core passes as cutting progresses and a guide frame surrounding said opening and having a guideway extending about its margin and an endless loop cutter chain guided in said guideway for circulation thereabout, said cutter chain constituting the sole cutting element of the cutting head, said body having a central chamber formed within said body at the rear of said cutting head for receiving the core as it passes through said central cutter head opening, means for feeding said cutter head and body rectilinearly along the mine wall in a direction parallel with the coal face, and a motor arranged within said body at the rear of said core receiving chamber for driving said cutting head.

22. In a cutting and loading apparatus, a body, a core cutting head carried at the front end of said body for cutting out a core from the mine wall to form an opening for receiving the body as the cutting head and body are advanced along the mine wall, the outer limits of said body arranged wholly within the outer limits of said cutting head and said head having a central opening through which the core passes as cutting progresses and a guide frame surrounding said opening and having a guideway extending about its margin and an endless loop cutter chain guided in said guideway for circulation thereabout, said body having a central chamber formed within said body at the rear of said cutting head

for receiving the core as it passes through said central cutter head opening, and means for feeding said cutter head and body rectilinearly along the mine wall in a direction parallel with the coal face, said chamber opening laterally through the outer side of said body, means within said chamber for engaging and breaking down the core as cutting progresses and for deflecting the broken coal laterally from the outer side of the body, and a motor arranged within said body at the rear of said core receiving chamber for driving said cutting head and for actuating said breaking down and deflecting means.

23. In a cutting and loading apparatus, an elongated rectangular body slidable on its bottom over the mine floor, a core cutting head carried at the front end of said body and having a rectangular open-center guide frame and an endless loop core cutting chain guided for circulation about said rectangular guide frame, said cutting chain constituting the sole cutting element of the cutting head, the outer limits of the body arranged wholly within the outer limits of said loop cutter chain, the cutter chain cutting out a core from the mine wall as said cutting head and body are advanced along the mine wall to form an opening in the mine wall for receiving said body, and means for feeding said cutting head and body rectilinearly along the mine wall in a direction parallel with the coal face.

24. In a cutting and dislodging apparatus, a cutter head comprising a guide frame having a guideway extending about its margin, a central core receiving opening and an endless loop cutter chain guided in said guideway for circulation thereabout, said cutter chain upon circulation about said guideway cutting a kerf in the coal to form a core of coal, a body on the forward end of which said cutter head is carried, said body having a chamber at the rear of said cutter guide frame for receiving the core of coal as it passes through the core receiving opening as the apparatus is advanced along the mine wall, and means in said chamber for breaking down the core as cutting progresses, said breaking down means acting laterally on the core to break down the core and to move the broken down coal from said chamber laterally from the side of said body.

25. In a cutting and dislodging apparatus, a cutter head comprising a guide frame having a guideway extending about its margin, a central core receiving opening and an endless loop cutter chain guided in said guideway for circulation thereabout, said cutter chain upon circulation about said guideway cutting a kerf in the coal to form a core of coal, a body on the forward end of which said cutter head is carried, said body having a chamber at the rear of said cutter guide frame for receiving the core of coal as it passes through the core receiving opening as the apparatus is advanced along the mine wall, and means in said chamber for breaking down the core as cutting progresses, said breaking down means including a deflector plate pivotally mounted in said chamber to swing horizontally, said plate engaging one side of the core to break down the coal and to move the broken down coal from said chamber laterally from the side of the body.