Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 13 Sheets-Sheet 1

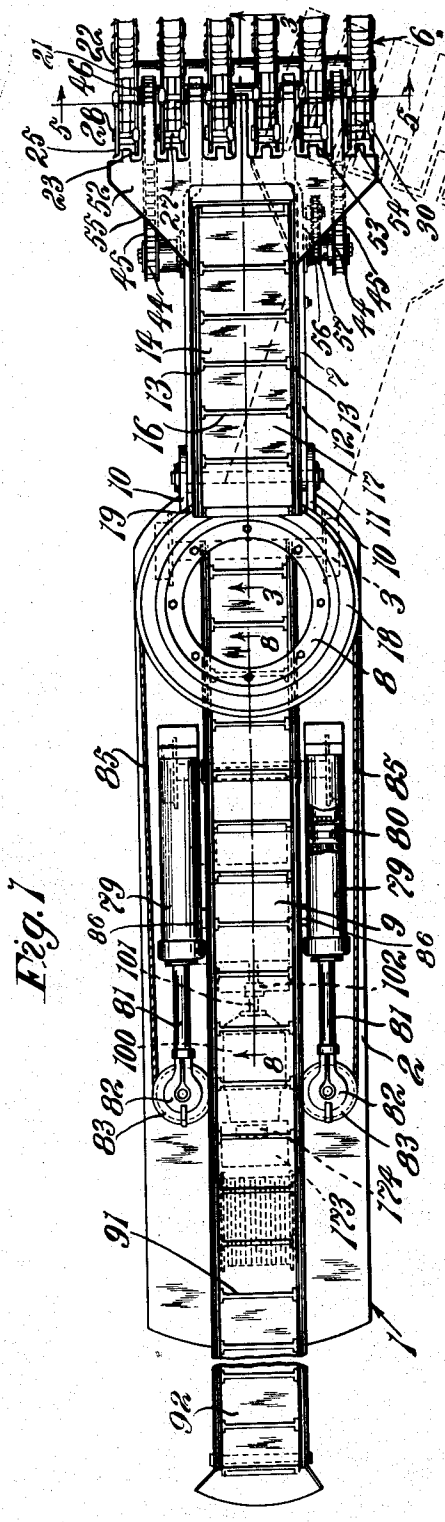


Fig. 1

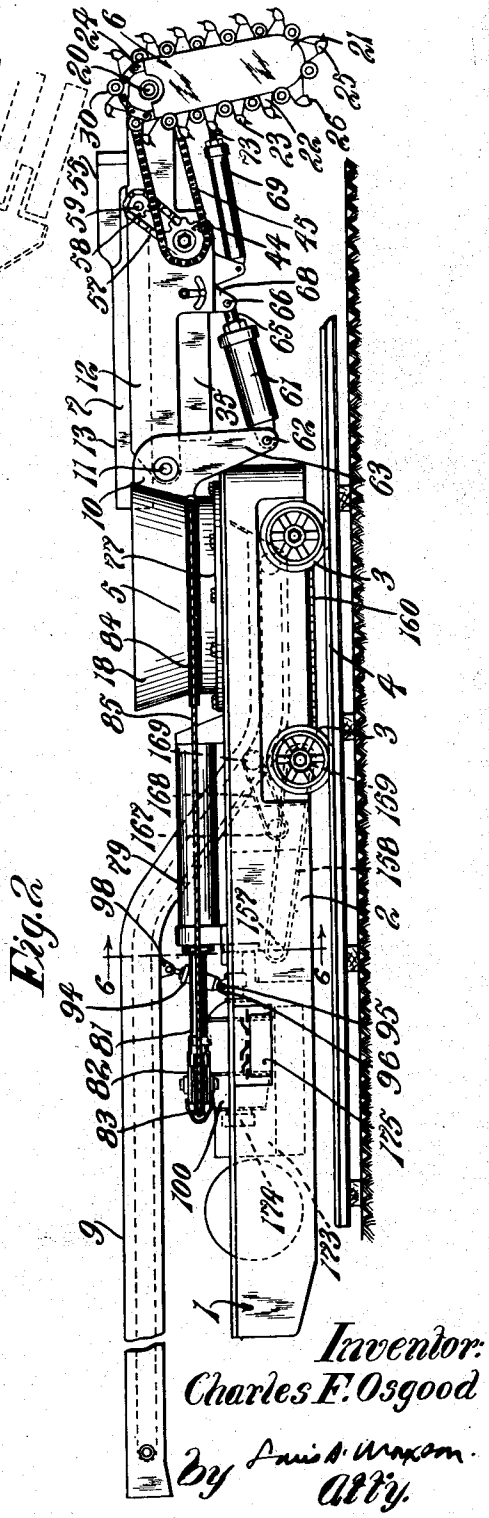


Fig. 2

Inventor:
Charles F. Osgood
By Louis S. Maxson.
Atty.

Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 13 Sheets-Sheet 2

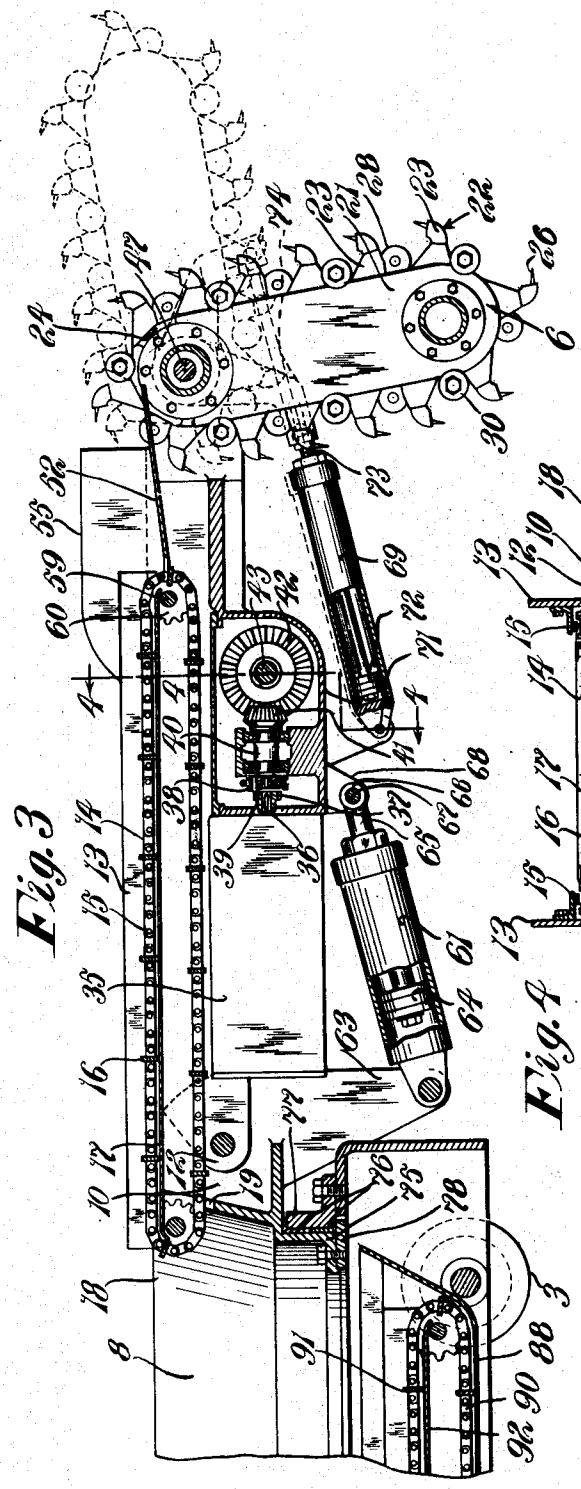


Fig. 3

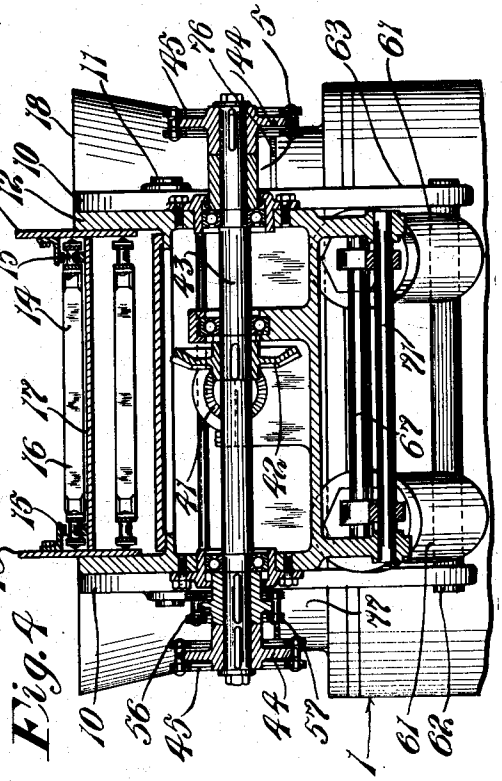


Fig. 4

Inventor:
Charles F. Osgood
By Louis A. Maxson
Atty.

Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 13 Sheets-Sheet 3

Fig. 5

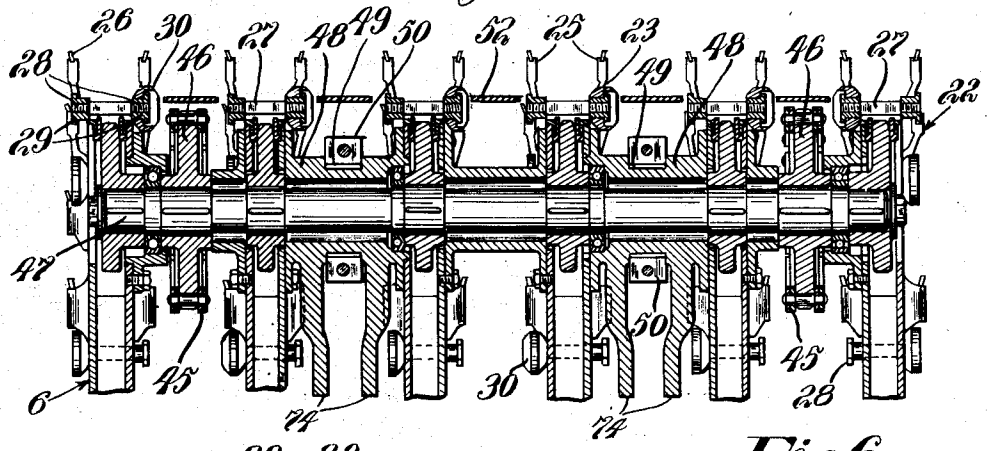
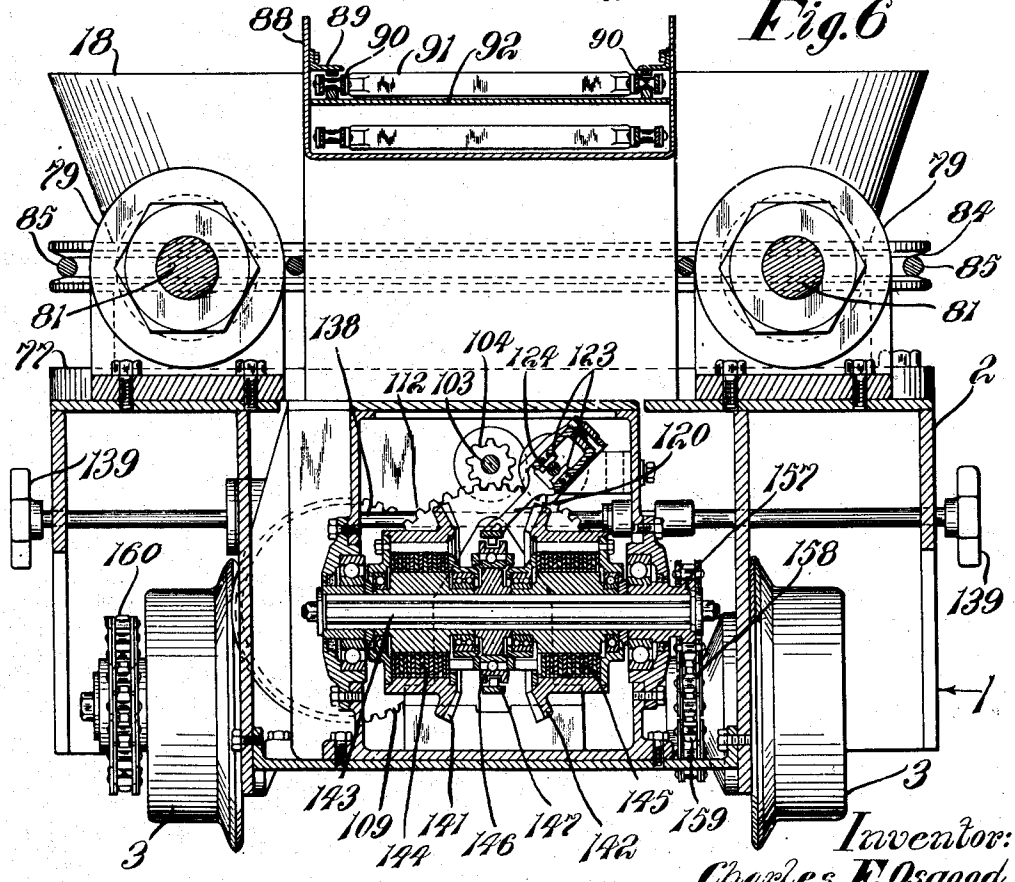


Fig. 6



Inventor:
Charles F. Osgood

By Louis A. Thaxton
Atty.

Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 13 Sheets-Sheet 4

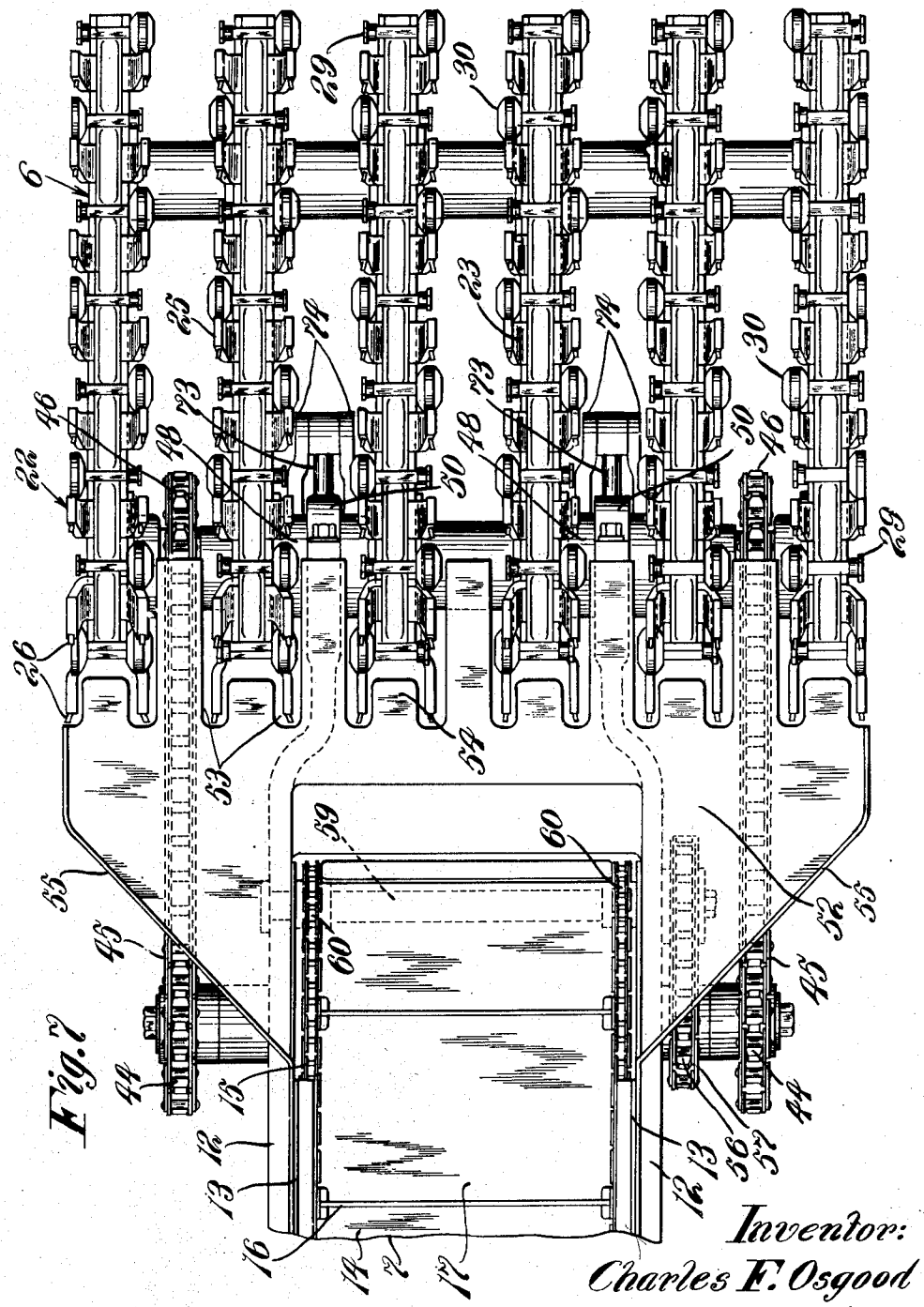


Fig. 7

Inventor:
Charles F. Osgood
By Louis A. Maxson.
Atty.

Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 13 Sheets-Sheet 5

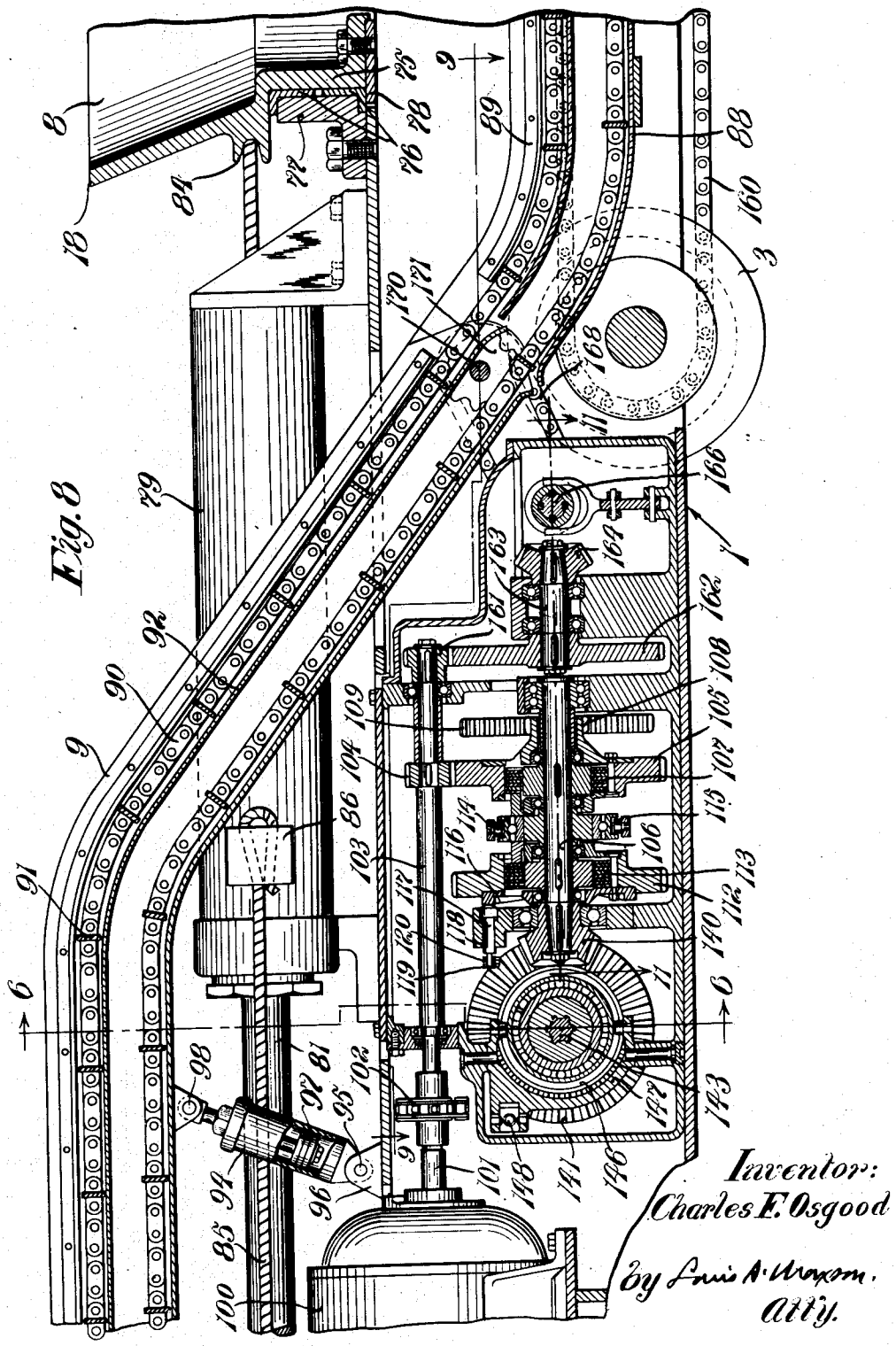


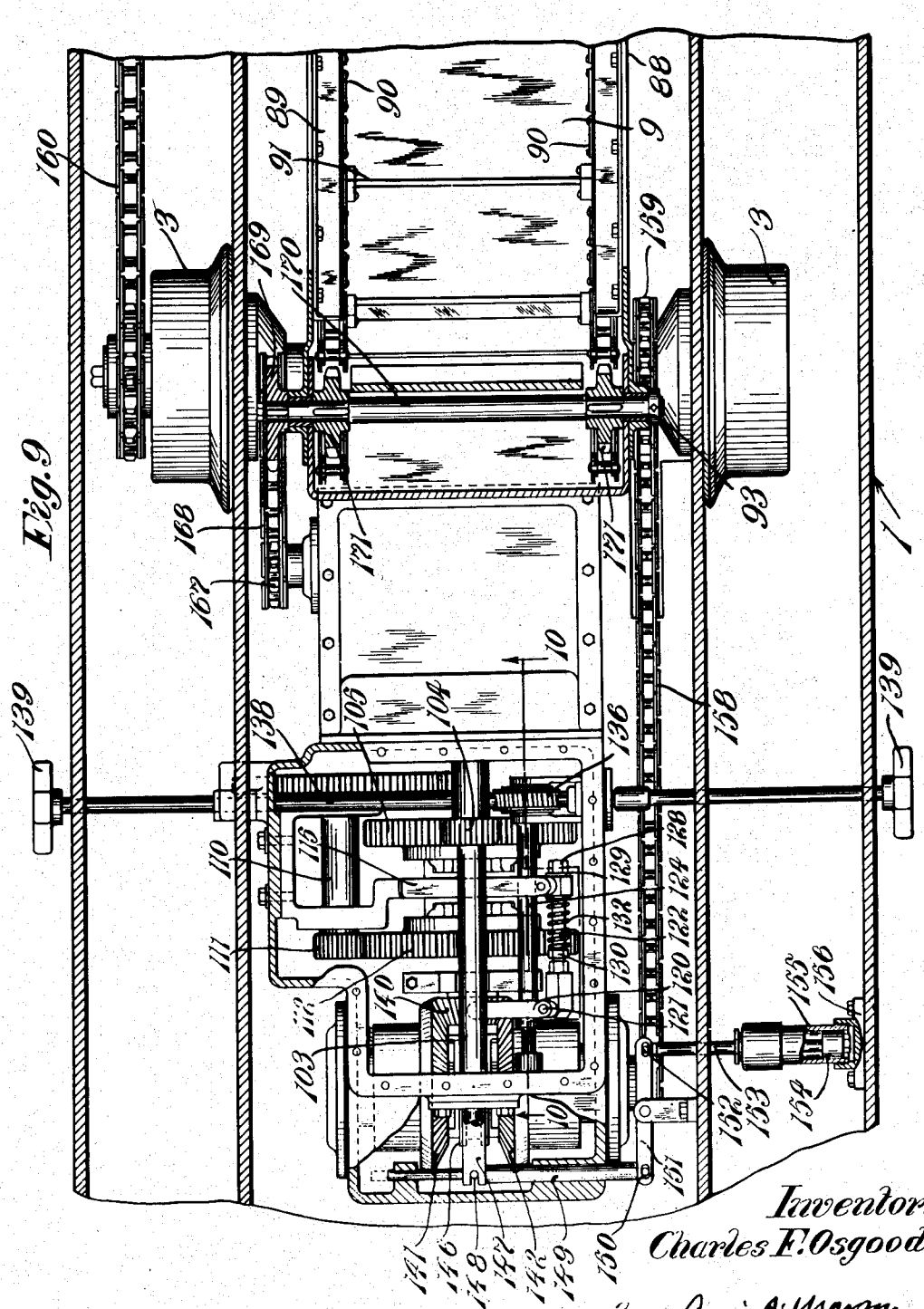
Fig. 8

Inventor:
Charles F. Osgood
By Louis A. Wroxom.
Atty.

Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 13 Sheets-Sheet 6



Inventor:
Charles F. Osgood
By Louis A. Maxon.
Atty.

Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 - 13 Sheets-Sheet 7

Fig. 10

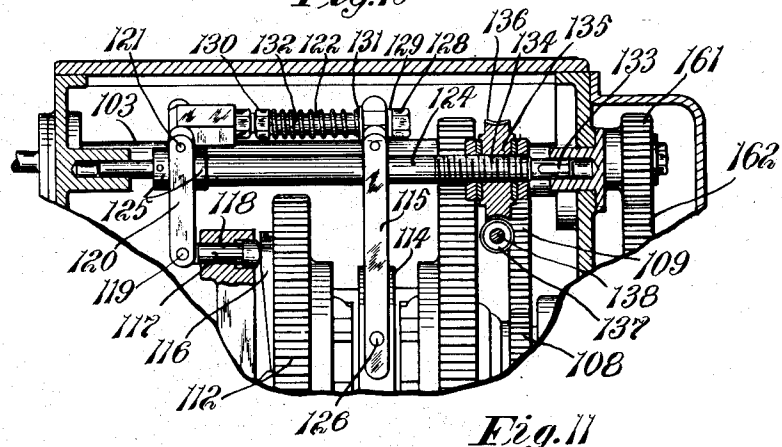


Fig. 11

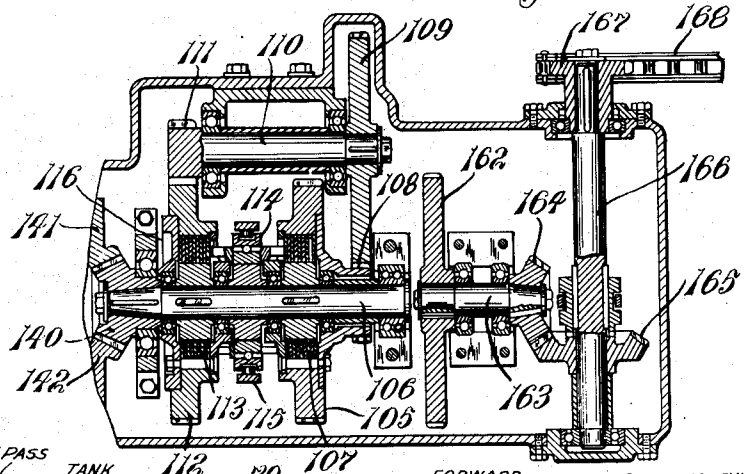
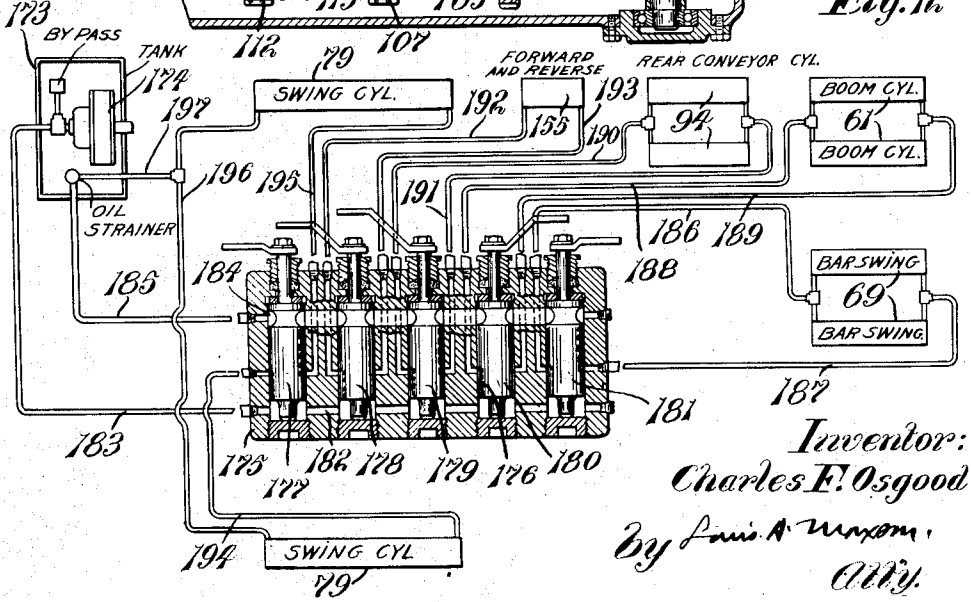


Fig. 12



Inventor:
Charles F. Osgood
By Louis A. Wilson,
Atty.

Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 13 Sheets-Sheet 8

Fig. 13

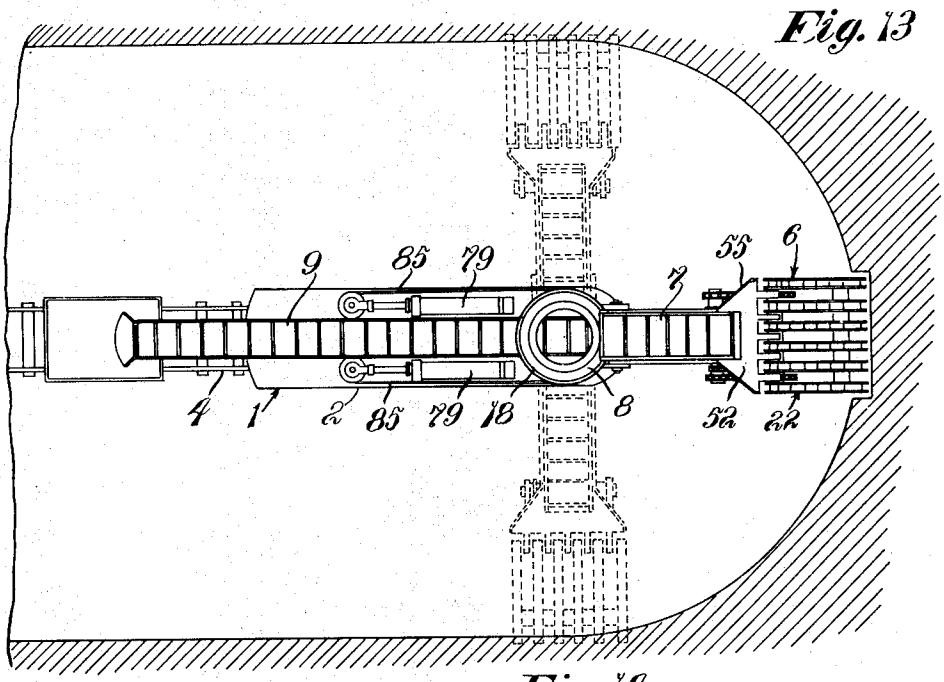


Fig. 14

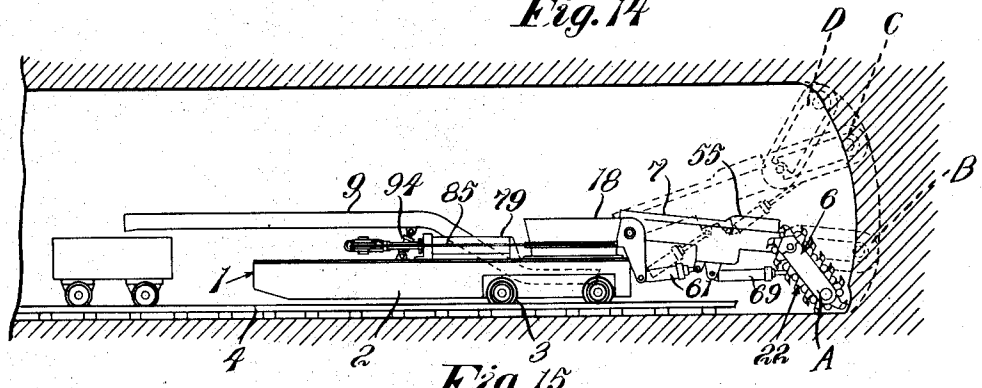
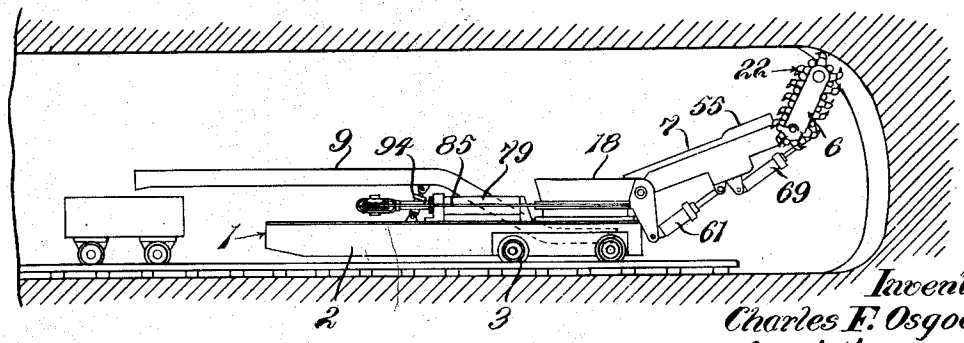


Fig. 15



Inventor:
Charles F. Osgood
By Louis A. Hopson,
Atty.

Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 13 Sheets-Sheet 9

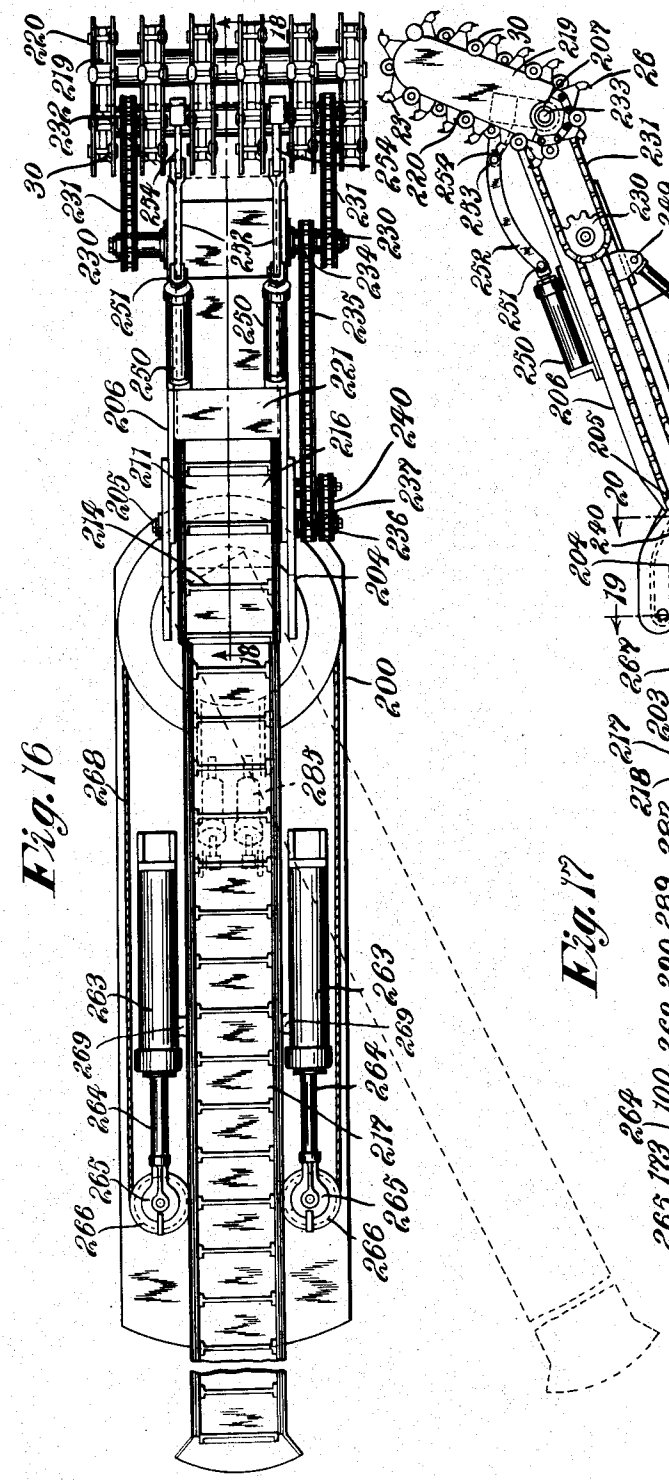


Fig. 16

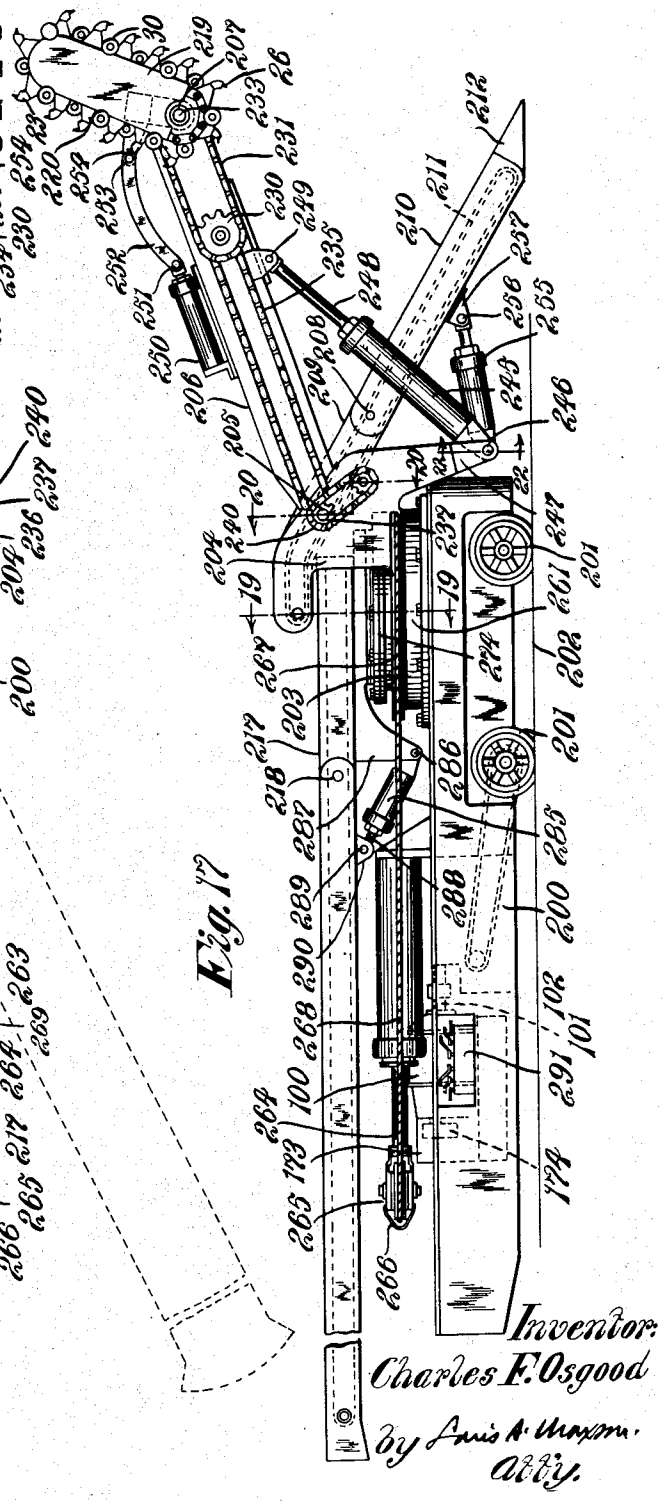


Fig. 17

Inventor:
Charles F. Osgood
by Louis A. Maxson.
Atty.

Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 13 Sheets-Sheet 10

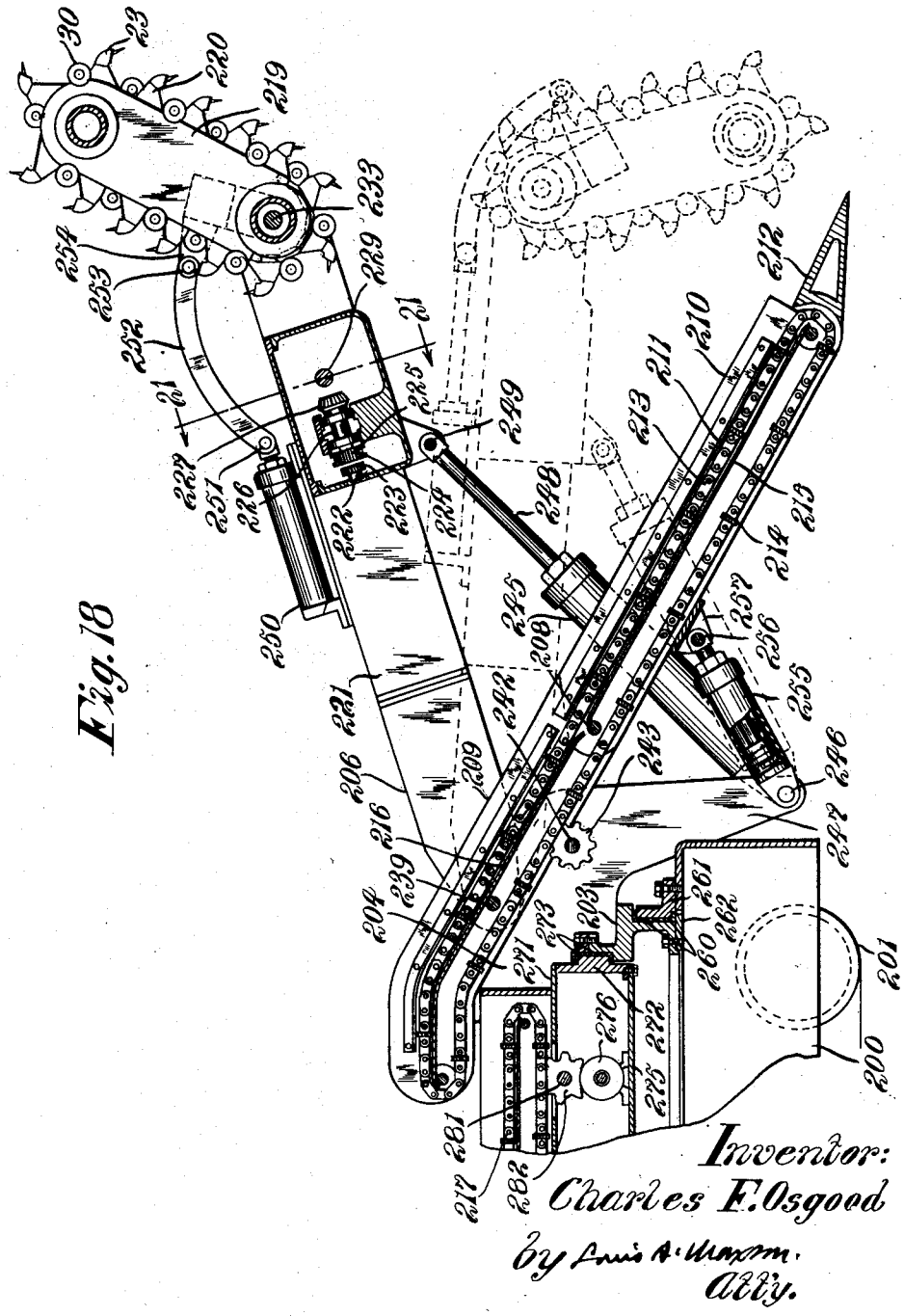


Fig. 18

Inventor:
Charles F. Osgood
by Louis A. Maxon.
Atty.

Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 13 Sheets-Sheet 11

Fig. 19

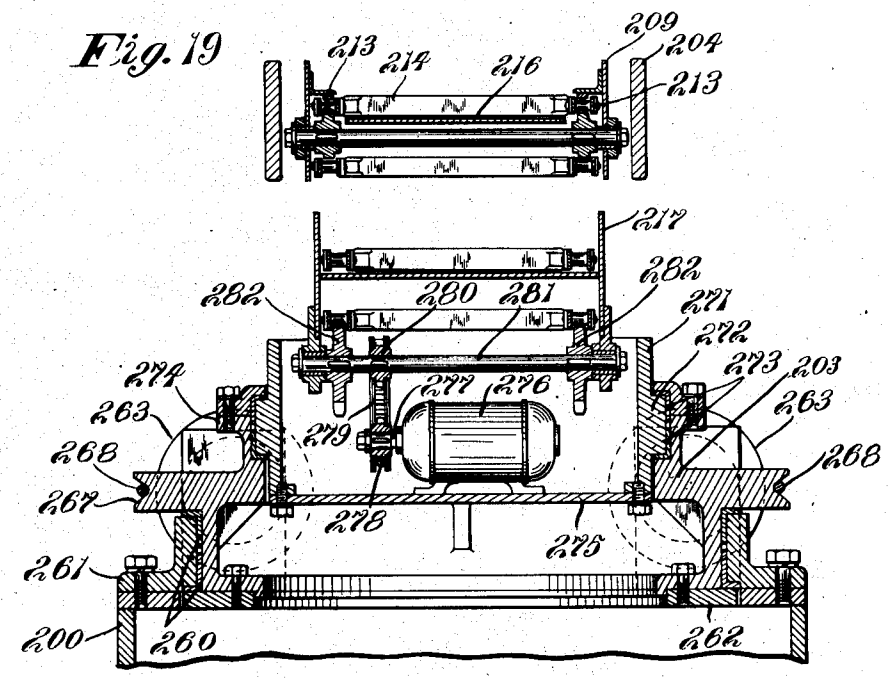
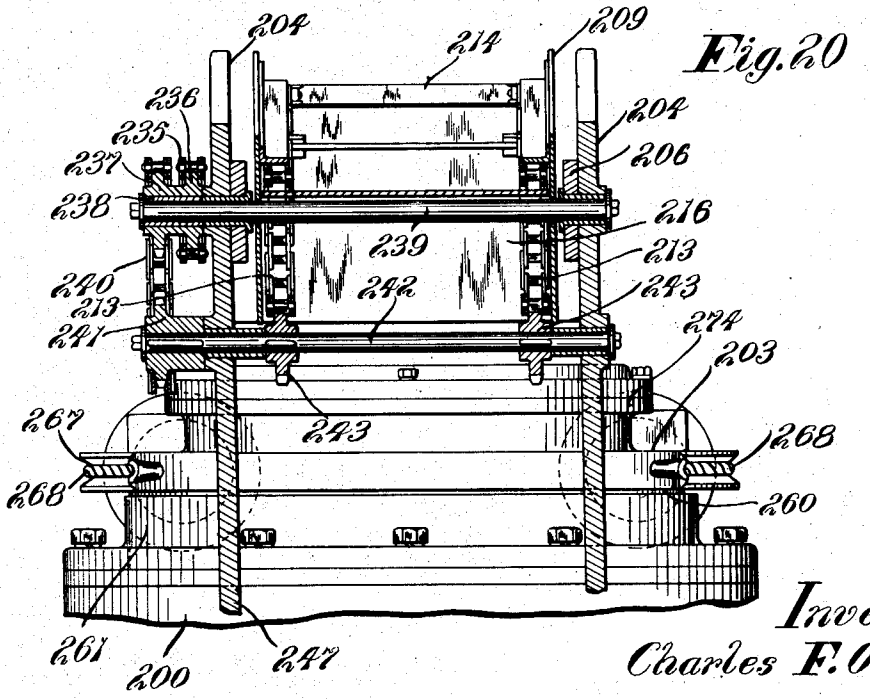


Fig. 20



Inventor:
Charles F. Osgood
by Louis A. Maxson
Atty.

Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 13 Sheets-Sheet 12

Fig. 21

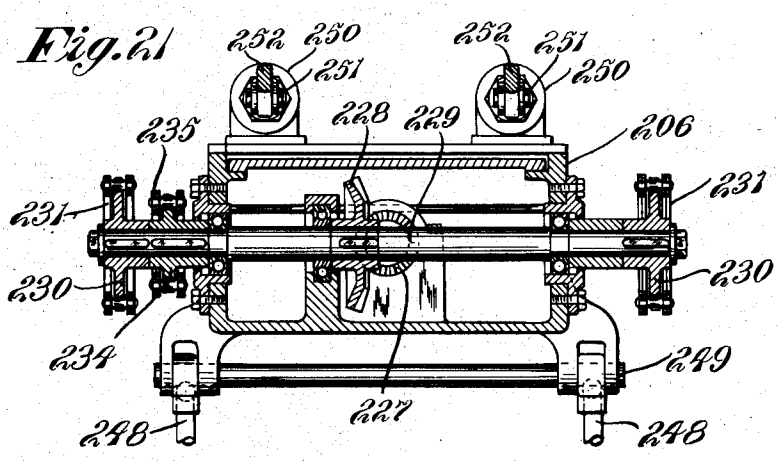


Fig. 22

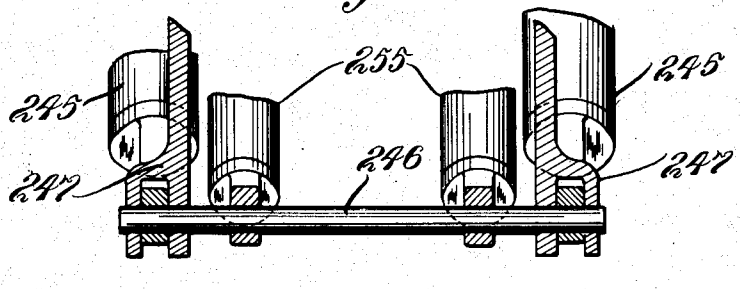
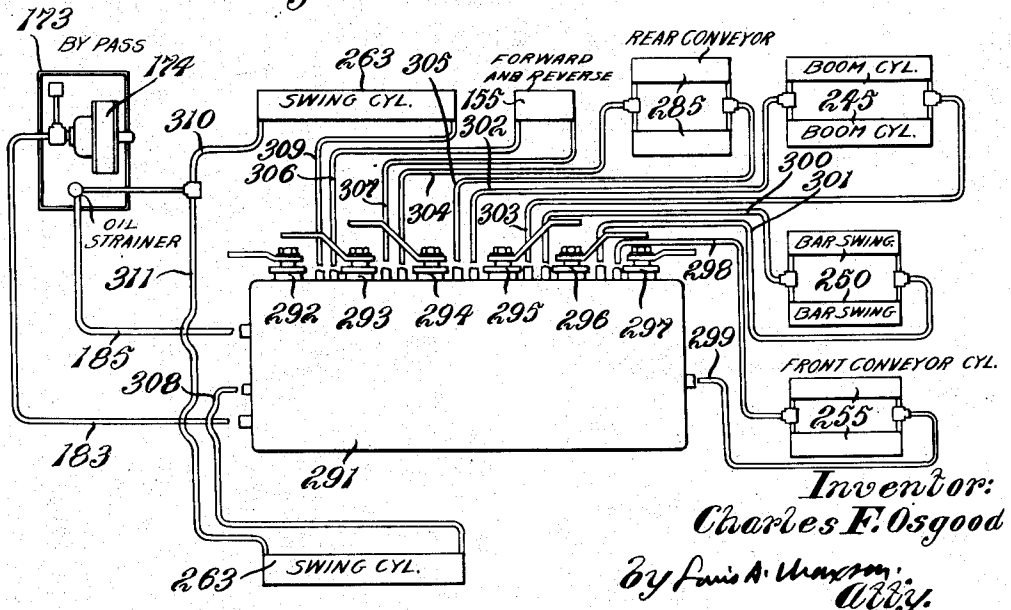


Fig. 23



Inventor:
Charles F. Osgood
By Louis A. Thompson
Atty.

Jan. 13, 1942. C. F. OSGOOD 2,269,781

COAL MINING APPARATUS

Original Filed Dec. 14, 1936 13 Sheets-Sheet 13

Fig. 24

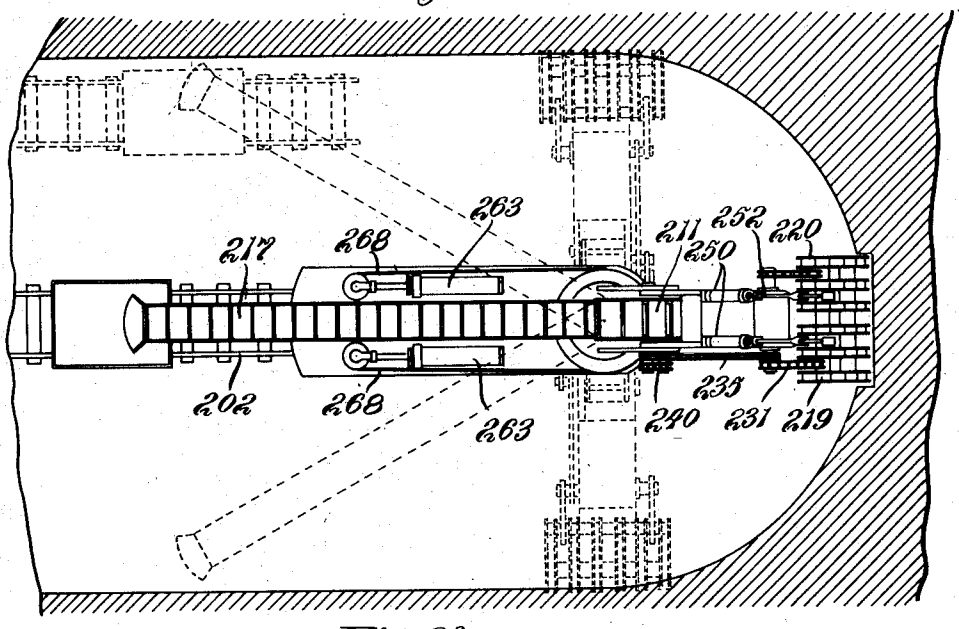


Fig. 25

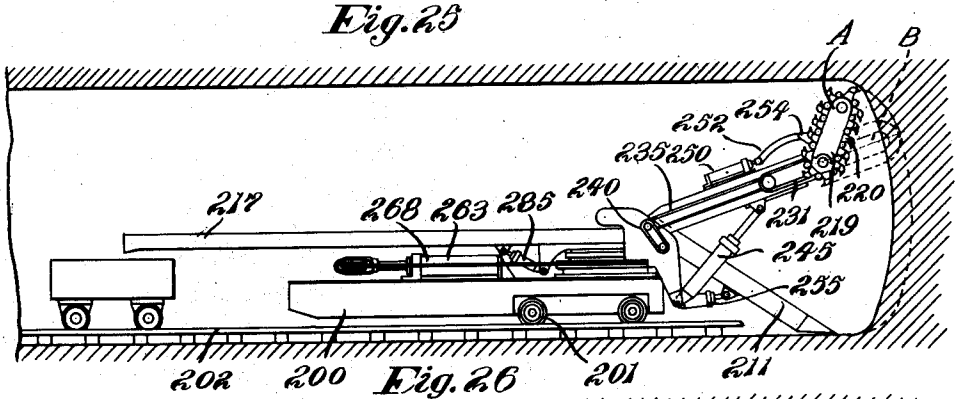
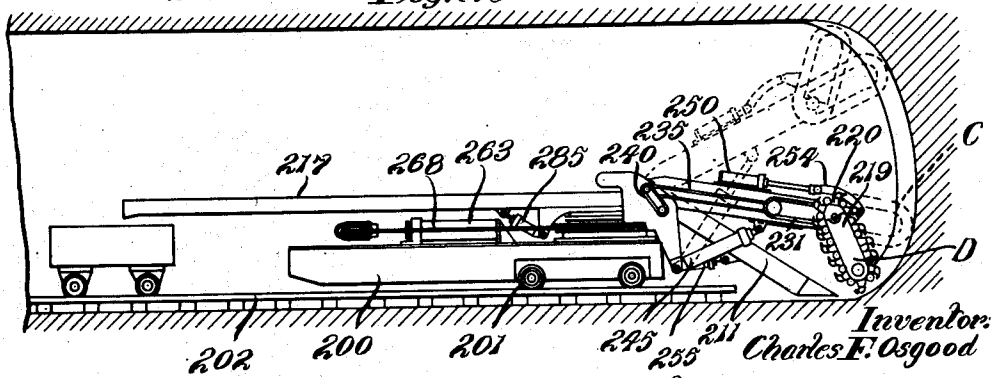


Fig. 26



Inventor:
Charles F. Osgood
By Amis A. Mayson,
Atty.

UNITED STATES PATENT OFFICE

2,269,781

COAL MINING APPARATUS

Charles F. Osgood, Claremont, N. H., assignor to Sullivan Machinery Company, a corporation of Massachusetts

Continuation of application Serial No. 115,687, December 14, 1936. This application March 8, 1940, Serial No. 323,033

3 Claims. (Cl. 262—28)

This invention relates to coal mining apparatus, and more particularly to improvements in apparatus for cutting and dislodging the coal from a mine wall and for loading the broken down coal.

An object of this invention is to provide an improved apparatus of the combined type for cutting, dislodging and loading the coal. Another object is to provide improved instrumentalities for cutting and breaking down the coal and having an improved adjustable supporting structure whereby the cutting and breaking down instrumentalities may be readily adjusted with respect to the mine wall. Another object is to provide an improved core cutting and dislodging mechanism. A further object is to provide an improved combined cutting and loading apparatus having improved means for loading the broken down coal. Another object is to provide an improved cutting and loading apparatus having improved means for cutting and dislodging the coal and improved means for conveying the broken down coal from the coal face to a suitable point of disposal. Still another object is to provide an improved core cutting and core breaking means for cutting cores in a mine wall and breaking down sections of the cores as cutting progresses. A still further object is to provide improved deflector means extending between the conveyor and core cutting and dislodging mechanism, for deflecting the broken coal from the paths of the cutters and directing the broken coal toward the conveyor. Other objects and advantages of the invention will, however, hereinafter more fully appear.

This application is a continuation of my application Serial No. 115,687, filed December 14, 1936.

In the accompanying drawings there are shown for purposes of illustration two forms which the invention may assume in practice.

In these drawings,

Fig. 1 is a plan view of one illustrative embodiment of the improved cutting, dislodging and loading apparatus.

Fig. 2 is a side elevational view of the apparatus shown in Fig. 1.

Fig. 3 is an enlarged view in longitudinal vertical section taken substantially on line 3—3 of Fig. 1.

Fig. 4 is an enlarged cross sectional view taken substantially on line 4—4 of Fig. 3.

Fig. 5 is an enlarged cross sectional view taken substantially on line 5—5 of Fig. 1.

Fig. 6 is an enlarged cross sectional view taken substantially on line 6—6 of Figs. 2 and 8.

Fig. 7 is an enlarged plan view of the improved core cutting and dislodging mechanism.

Fig. 8 is an enlarged view in longitudinal vertical section taken substantially on line 8—8 of Fig. 1.

Fig. 9 is a horizontal sectional view with parts shown in plan, taken substantially on line 9—9 of Fig. 8.

Fig. 10 is a detail vertical sectional view taken substantially on line 10—10 of Fig. 9.

Fig. 11 is a horizontal sectional view taken substantially on line 11—11 of Fig. 8.

Fig. 12 is a diagrammatic view showing the improved hydraulic fluid system and its associated control means.

Fig. 13 is a diagrammatic plan view showing the improved cutting, dislodging and loading apparatus in operative position in a mine entry with the cutting and dislodging means shown in different positions.

Figs. 14 and 15 are diagrammatic elevational views showing the improved apparatus in a mine entry and illustrating several cutting positions of the cutting and dislodging means.

Fig. 16 is a view similar to Fig. 1 showing a modified form of cutting, dislodging and loading apparatus.

Fig. 17 is a side elevational view of the apparatus shown in Fig. 16.

Fig. 18 is an enlarged view in longitudinal vertical section taken substantially on line 18—18 of Fig. 16.

Fig. 19 is an enlarged cross sectional view taken substantially on line 19—19 of Fig. 17.

Fig. 20 is an enlarged cross sectional view taken substantially on line 20—20 of Fig. 17.

Fig. 21 is an enlarged cross sectional view taken substantially on line 21—21 of Fig. 18.

Fig. 22 is a cross sectional view taken substantially on line 22—22 of Fig. 17.

Fig. 23 is a diagrammatic view showing the hydraulic fluid system and its associated controlling means.

Fig. 24 is a diagrammatic plan view showing the improved cutting, dislodging and loading apparatus in operative position in the mine entry with the cutting and dislodging means shown in different positions.

Figs. 25 and 26 are diagrammatic elevational views showing the improved apparatus in a mine entry and illustrating several cutting positions of the cutting and dislodging means.

In the illustrative embodiment of the inven-

tion shown in Figs. 1 to 15, inclusive, the improved cutting, dislodging and loading apparatus, generally designated 1, comprises a portable base 2, herein in the form of a truck frame, mounted on wheels 3 adapted to travel along a mine trackway 4. Mounted on the forward portion of the truck frame above the truck wheels is a horizontal turntable 5 having supported thereon the improved core cutting and dislodging means generally designated 6. Associated with the cutting and dislodging means is a front elevating or loading conveyor means 7 for conveying the broken down coal rearwardly of the apparatus to discharge within a hopper 8 associated with the turntable 5. Receiving the broken down coal discharged from the hopper 8 is a rear discharge conveyor 9 for conveying the broken down coal rearwardly of the apparatus to discharge at a suitable point of disposal, such as a mine car or other suitable receptacle.

Now referring to the improved cutting and dislodging means generally designated 6, it will be noted that formed integral with the turntable frame are parallel vertical projections 10, 10 on which is pivotally mounted at 11 a vertically swingable, elongated arm structure or boom 12. Arranged in longitudinal guideways 13, 13 within the upper portion of the arm structure 12 is an endless front elevating or loading conveyor 14 of the conveying means 7 comprising endless side chains 15, 15 having secured thereto transverse scraper bars 16 adapted to move the material to be loaded along a bottom supporting plate 17 over which the scraper bars are dragged. The turntable 5 has an upstanding segmental frame 18 cut away at 19 for receiving the rearward portion of the front loading conveyor, so that as the broken down coal is conveyed rearwardly along the top of the arm structure, it is discharged within the hopper 8 of the turntable frame. Pivotally mounted at 20 on the forward extremity of the vertically swingable arm structure or boom 12 on an axis parallel with the arm structure pivot axis is a series of vertical cutter bars 21 rigidly secured together for vertical swinging movement in unison about the pivotal axis 20, and each of these bars has mounted thereon for circulation thereabout an endless cutter chain 22 carrying parallel rows of cutters for cutting parallel, relatively thin kerfs in the coal to form a relatively wide core between the kerfs. These cutter chains are similar in design, and each comprises a series of chain blocks 23 pivotally connected together by strap links 24. As shown in Figs. 5 and 7, the chain blocks 23 are substantially U-shaped in cross section, and the arms of the U each support a lug 25 for receiving a detachable cutter bit 26. The cutters on the chain blocks are arranged on the arms of the chain blocks at opposite sides of the chain, thereby to provide parallel series of cutters at the opposite sides of each chain, these parallel series of cutters, as the cutter chains are circulated within their guides on the cutter bars, being adapted to cut narrow kerfs or slots in vertical parallel relation in the coal, and the U-shaped portions of the chain blocks being formed to provide a space on the chain between the parallel series of cutters to receive the projecting portion or core of the coal formed between the parallel kerfs. In this illustrative construction, the six vertical cutter chains are operative to cut twelve parallel vertical kerfs or slots in the coal, thereby to form eleven parallel vertical cores between the kerfs, although it will be evident that any desired number of cutter chains may be employed. Mounted within each of the chain blocks 23 is a cross pin 27 having oppositely threaded extremities 28, each having threaded thereon a bearing washer 29. Journaled on a bearing washer of each of the pins, alternately on the opposite ends of the pins of different chain blocks, are wedging rollers 30 in the form of rotary core breakers having inner wedging surfaces for engaging the sides of the cores formed between the kerfs for breaking sections of the cores as cutting progresses. As this cutter chain and core breaker structure is generally similar in design to that disclosed in the patent to one Joseph F. Joy, Patent No. 2,057,684, patented October 20, 1936, further description of the detail structure thereof is herein unnecessary.

The driving means for the cutting and core breaking chains, as shown in Figs. 3, 4, 5 and 7, comprises a relatively powerful motor 35 mounted on the lower portion of the vertically swingable arm structure or boom 12 and preferably having its power shaft 36 extending longitudinally of the arm structure. Keyed to the forward end of the motor power shaft is a clutch element 37 connectible by a sliding clutch element 38 to a clutch element 39 fixed to a longitudinally extending shaft 40, herein arranged in axial alinement with the motor power shaft and suitably journaled within the arm structure frame. The sliding clutch element 38 has any suitable operating means. Keyed to the forward end of the shaft 40 and driven thereby is a bevel gear 41 meshing with a large bevel gear 42 keyed to a horizontal shaft 43, herein extending transversely of and suitably journaled within the frame of the arm structure. Keyed to the shaft 43 at the opposite ends thereof and driven thereby are chain sprockets 44, 44 connected by endless drive chains 45 to chain sprockets 46, 46 keyed to a cutter chain drive shaft 47. This shaft 47 extends transversely of the arm structure and is suitably journaled within the frame thereof and is arranged with its axis coincident with the pivotal axis 20. It will thus be seen that when the clutch 38 is connected, the cutter chains may be simultaneously rapidly circulated within their guideways about the margins of the cutter bars by the motor 35 through the bevel gearing 41, 42 and the chain and sprocket connections 44, 45, 46. The cutter bars are supported on a hanger frame 48 journaled within bearing sleeves 49 in turn supported within vertical projections 50 formed integral with the forward portion of the arm structure frame, and the cutter bars may swing vertically with respect to the arm structure about their pivotal axis 20 within the bearings 49. Mounted on the arm structure is a forward receiving plate 52 slotted at 53 to provide clearance for the cutter chains and having projections 54 extending within the spaces between the rows of cutters, so that as the cores are broken down by the wedging rollers and carried laterally from the mine wall by the endless cutter chains, the projecting plate portions 54 deflect the broken coal from the paths of the cutter chains onto the receiving plate from which the coal is discharged onto the front loading conveyor 7. The receiving plate has at its outer edges upstanding retaining walls 55 for retaining the coal on the plate and for directing the coal onto the front conveyor. Also fixed to the shaft 43 is a chain sprocket 56 which drives through an endless chain 57 a chain sprocket 58 fixed to a transverse shaft 59 journaled within

the arm structure. Fixed to and driven by the shaft 59 are chain sprockets 60 which engage and drive the endless side chains 15 of the front conveyor.

The means for swinging the arm structure 12 vertically about its pivot relative to the turntable, in this instance, comprises a pair of hydraulic cylinders 61 pivotally mounted at 62 on depending frame portions 63 integral with the vertical projections 10, 10, and each of these cylinders contains a reciprocable piston 64 having the forward extremity of its piston rod 65 pivotally connected at 66 to a transverse rod 67 supported at its ends within depending bosses 68 integral with the lower portion of the arm structure frame. The means for swinging the series of cutter bars vertically with respect to the arm structure comprises a pair of hydraulic cylinders 69 pivotally connected at 70 through a transverse rod 71 supported at its ends within depending bosses formed integral with the lower portion of the arm structure frame. Each of the cylinders 69 contains a reciprocable piston 72 having its piston rod 73 pivotally connected to projecting arms 74 formed integral with the bar hanger frame 48. It will thus be seen that when hydraulic pressure is supplied to the cylinders 61 and 69, the arm structure may be swung vertically about its pivot with respect to the turntable, and the series of cutter bars may be swung vertically about their pivots with respect to the arm structure. By trapping the liquid within the cylinders, the arm structure and cutter bars may be locked against movement on their respective pivotal axes.

The turntable 5 comprises an annular bottom frame 75 journaled within bearing sleeves 76 supported within a bearing annulus 77 secured to the top of the truck frame. The annular portion 75 of the turntable has secured thereto an annular retaining plate 78 underlying the lower bearing sleeve and supporting ring for retaining the turntable in position within its bearing annulus. The means for rotating the turntable relative to the truck frame, in this instance, comprises a pair of hydraulic cylinders 79, 79 mounted on the top of the truck frame at the opposite sides of the discharge conveyor 9, in the manner shown in Fig. 1, and each containing a reciprocable piston 80 having its piston rod 81 extending rearwardly through the packed rear head of the cylinder. Journaled within brackets 82 secured at the rear ends of the piston rods are sheaves 83. Attached to the turntable frame and guided within an arcuate rope guiding groove 84 formed on the turntable periphery is a rope 85 having its ends passing around the guide sheaves 83 and attached at 86 to the inner sides of the cylinders. It will thus be seen that when hydraulic pressure is supplied to one or the other of the cylinders 79, 79 one piston may be moved rearwardly to deflect its associated end portion of the cable so that the turntable may be rotated in one direction or the other with respect to the truck frame. By trapping the liquid within the cylinders 79, 79, the turntable may be locked in its adjusted position.

Supported within the forward portion of the truck frame between the truck wheels is the frame 88 of the rear discharge conveyor 9, and this frame has guideways 89 in which are mounted for circulation the endless side chains 90 of the discharge conveyor. Secured to these side chains are transverse scraper bars 91 adapted to move along a bottom supporting plate 92, and when the broken down coal is discharged through the center of the turntable onto the discharge conveyor, these scraper bars 91 move the coal rearwardly along the plate 92. The rearward portion of the frame of the rear discharge conveyor 9 is pivoted at 93 to swing in a vertical direction relative to the truck frame so that the rear discharge end of the conveyor may be disposed at different elevations, and the means for vertically swinging the rear conveyor frame portion comprises a pair of hydraulic cylinders 94 pivotally mounted at 95 at the opposite sides of the conveyor frame on brackets 96 supported on the top of the truck frame. Each of the cylinders contains a reciprocable piston 97 having the upper extremity of its piston rod pivotally connected at 98 to the lower portion of the conveyor frame. When hydraulic pressure is supplied to the cylinders 94, the pistons 97 may be moved to swing the rear end of the conveyor either upwardly or downwardly, as desired. By trapping the liquid within the cylinders 94 the rear conveyor portion may be held in its adjusted position.

Now referring to the mechanism for driving the truck wheels for propelling the apparatus along the mine trackway through a wide range of low speeds appropriate for cutting and at a high transport speed, it will be noted that supported within the rearward portion of the truck frame beneath the rear conveyor is a motor 100 having its power shaft 101 horizontally disposed and extending longitudinally of the truck frame. The motor power shaft is connected by a conventional coupling 102 to an alined shaft 103 suitably journaled within a portion of the truck frame providing a gear housing. Keyed to the shaft 103 and driven thereby is a spur gear 104 meshing with a large spur gear 105 having its hub journaled on bearings supported by a horizontal transmission shaft 106 herein arranged parallel with and below the shaft 103 in the manner shown in Fig. 8. The gear 105 is connectible to the shaft 106 by a multiple disc clutch 107 of a usual design. Formed on the hub of the gear 105 is a spur gear 108 meshing with a spur gear 109 (see Fig. 11) fixed to a countershaft 110 arranged parallel with the shaft 106 and likewise suitably journaled within the truck frame. Secured to and driven by the shaft 110 is a spur gear 111 meshing with a large spur gear 112 herein arranged coaxial with the gear 105 and likewise having its hub journaled on the shaft 106. The gear 112 is connectible to the shaft 106 by a multiple disc clutch 113 of a usual design. The gear 105 constitutes a high speed terminal driving gear for the shaft 106, while the spur gear 112 constitutes a low speed terminal driving gear for the shaft. Operating means for the clutches 107 and 113 is provided, whereby the clutches may be selectively applied, comprising a clutch shipper ring 114 surrounding the shaft between the clutches and operated by a shipper yoke lever 115. Means, to be now described, are provided for actuating the shipper yoke to effect application of the clutches, embodying means for effecting variable intermittent application and release of the low speed clutch 113 to attain a variable low speed drive of the truck wheels.

The mechanism for operating the high and low speed clutches, and more particularly, the mechanism for effecting variable intermittent application and release of the low speed clutch, comprises a cam 116 secured to the rear face

of the low speed terminal gear 112, and a plunger 117, guided in a bore 118 formed in the gear housing, engages the cam face. The rear end of this plunger (see Figs. 8 and 10) is pivotally connected at 119 to a lever 120, in turn pivotally connected at 121 to a plunger-like rod 122. The lever 120 is pivotally mounted by trunnion blocks 123 (see Fig. 6) on an adjusting rod 124, the trunnion blocks having convex surfaces slidingly engaging the cylindrical periphery of the rod 124 and, when in the position shown in Fig. 10, abutting spaced collars 125 fixed to the rod 124. The shipper yoke lever 115 is pivotally mounted at 126 and is pivotally connected by trunnion blocks, similar to the trunnion blocks shown in Fig. 6, to the rod 122, these trunnion blocks having convex surfaces slidably engaging the cylindrical rod surface. Threaded on the forward end of the rod 122 is a nut 128, and encircling the rod and engaging the nut is a washer 129. Surrounding the rod 122 and acting between a nut 130 threaded to the rod and a washer 131 is a coil spring 132, this spring holding the trunnion blocks of the yoke lever 115 against the washer 129. The operating rod 124 is mounted for axial movement within the gear housing and is splined at 133 against rotation, and the rearward portion of this rod is threaded at 134 for threaded engagement with a nut 135 formed within the hub of a worm wheel 136. Meshing with this worm wheel is a worm 137 fixed to an operating shaft 138 having at its opposite ends, at the opposite sides of the truck, operating handles 139. It will thus be seen that when the worm gearing 136, 137 is rotated, the rod 124, through the nut and threads, is moved axially to vary the location of the fulcrum pivot of the lever 120. When the gear 112 is rotated, the cam 116 thereon effects reciprocation of the plunger 117, thereby oscillating the lever 120 about its fulcrum, reciprocating axially the rod 122, and, through the coil spring 132, yieldingly loading the clutch shipper lever 115 to effect application of the low speed clutch 113 at timed intervals. By adjusting the rod 124 axially to vary the fulcrum point of the lever 120, the time intervals of application and release of the low speed clutch 113 may be varied, as desired, it being possible to so adjust the parts as to effect continuous loading of the low speed clutch, no clutch loading, or any desired intermediate loading of the clutch between full load and no load. By moving the adjusting rod 124 axially rearwardly, the low speed clutch 113 may be entirely released from the influence of the cam operated mechanism, and the high speed clutch 107 loaded. When the high speed clutch 107 is loaded, the shaft 106 may be driven at a relatively high speed from the motor 100 through the gearing 104, 105, and when the low speed clutch 113 is loaded, the shaft 106 may be driven at a relatively low speed from the motor 100 through the gearing 104, 105, 108, 109, 111 and 112. By adjusting the rod 124 to vary the fulcrum point of the lever 120 to vary the intervals of application and release of the low speed clutch 113, the transmission shaft 106 may be driven through a wide range of low speeds between zero and a predetermined maximum low speed. This high and low speed transmission mechanism is similar to that described in a copending Joseph F. Joy application, Ser. No. 20,826, filed May 10, 1935, now matured into Patent No. 2,229,087, granted January 21, 1941.

In this construction, keyed to and driven by the transmission shaft 106, as shown in Fig. 11, is a bevel gear 140 meshing with reverse bevels 141 and 142 journaled on a horizontal transversely extending shaft 143, herein arranged at right angles to the shaft 106 and suitably journaled within the gear housing. The bevel gears 141, 142 are connectible by multiple disc clutches 144, 145, respectively, to the shaft 143. The operating means for the clutches 144, 145 comprises a clutch applying collar 146 surrounding the shaft 143 between the bevel gears 141, 142, and engaging this collar is a pivoted shipper yoke 147 connected at 148 an operating rod 149. The outer end of this operating rod is pivotally connected at 150 to a lever 151 in turn pivotally connected at 152 to a piston rod 153 of an operating piston 154 contained in the horizontal cylinder 155. This cylinder has its outer head 156 attached to the adjacent side of the truck frame. When hydraulic pressure is supplied to the cylinder 155, the piston 154 may be moved in one direction or the other to apply one or the other of the disc clutches 144, 145, thereby to effect rotation of the drive shaft 143 selectively in either of opposite directions. Fixed to one end of the shaft 143 is a chain sprocket 157 connected by an endless chain 158 to a chain sprocket 159 fixed to the rear truck wheel axle. The front and rear truck wheel axles are connected in driving relation by means of a chain and sprocket connection 160. It will thus be seen that the truck wheels may be driven in either of opposite directions through a wide range of relatively low cutting speeds or at a predetermined high transport speed.

The mechanism for driving the rear discharge conveyor 9, in this instance, comprises a spur gear 161 keyed to an elongation of the transmission shaft 103 and meshing with a large spur gear 162 fixed to a shaft 163 and herein arranged in alinement with the shaft 106. The shaft 163 is suitably journaled within bearings supported within the gear housing, and has keyed thereto and driven thereby a bevel gear 164 keyed to the forward end of the shaft 163 and meshing with a bevel gear 165 connectible by a conventional jaw clutch to a horizontal transmission shaft 166. This transmission shaft, as shown in Fig. 11, extends transversely of the gear housing and is suitably journaled therein and has keyed thereto a chain sprocket 167 driving, through an endless chain connection 168, a sprocket 169 (see Fig. 9) keyed to a shaft 170. This shaft extends horizontally of the discharge conveyor frame and has fixed thereto and driven thereby chain sprockets 171, 171 engaging and driving the endless side chains of the rear discharge conveyor.

Now referring to the hydraulic pump and associated control means, it will be observed that arranged within the truck frame at the rear end of the motor 100 is a tank 173 for containing a liquid, preferably oil, and arranged in this tank is a conventional pump 174 driven by the power shaft of the motor 100. As shown in Fig. 2, mounted on one side of the truck frame is a horizontal valve box 175 having formed therein, as shown in Fig. 12, a series of vertical valve bores 176 containing, respectively, rotary control valves 177, 178, 179, 180 and 181 for controlling the flow of hydraulic pressure to the various hydraulic devices. The lower ends of the valve bores are connected by a horizontal supply passage 182 extending substantially across the valve box and communicating with a supply conduit

183 in turn communicating with the discharge side of the pump 174. Arranged parallel with the passage 182 and likewise extending substantially across the valve box at the upper ends of the valve bores is a horizontal discharge passage 184 connected through a discharge conduit 185 to the oil tank 173. The valve 181, which controls the supply of liquid pressure to the swinging cylinders 69 for the series of parallel cutter bars, has its bore connected through a conduit 186 with the lower ends of the cylinders 69. The bore for the valve 181 is also connected through a conduit 187 to the upper ends of the cylinders 69. The valve 180, which controls the supply of liquid pressure to the cylinders 61 for swinging the arm structure, has its bore connected through a conduit 188 with the rear ends of the cylinders 61 and through a conduit 189 with the forward ends of the cylinders. The valve 179, which controls the supply of liquid pressure to the cylinders 94 for vertically swinging the rearward portion of the discharge conveyor, has its bore connected through a conduit 190 to the lower ends of the cylinders 94. The bore of the valve 179 is also connected through a conduit 191 with the upper ends of the cylinders 94. The valve 178, which controls the supply of liquid pressure to the cylinder 155 of the reverse clutch operating means, has its bore connected through a conduit 192 to one end of the cylinder 155 and through a conduit 193 to the opposite end of the cylinder. The valve 177, which controls the supply of liquid pressure to the cylinders 79 for rotating the turntable, has its bore connected through a conduit 194 with the forward end of one cylinder 79 and through a conduit 195 to the forward end of the other cylinder 79. The rear ends of the cylinders 79 are connected through conduits 196, 196 and a conduit 197 to the tank 173, so that any leakage past the pistons may be conducted back to the oil tank. From the foregoing description, it will be evident that the cutter bars and arm structure may be independently swung about their respective pivotal axes either upwardly or downwardly under the control of the control valves 180 and 181 and that the turntable may be rotated, the rear end of the rear discharge conveyor elevated and the reverse clutches operated under the control of the control valves 177, 179 and 178.

The general mode of operation of this illustrative embodiment of the improved mining and loading apparatus is as follows: The apparatus may be propelled about the mine at a high transport speed by the motor 100 under the control of the high speed friction clutch 107. When the working place is reached and it is desired to cut and break down the coal from the mine wall and to load the broken down coal, the cutting and dislodging bars are moved into the sumping position shown in Fig. 2, with the lower ends of the bars in adjacency to the mine floor at the coal face. Hydraulic pressure is then supplied to the cylinders 69 and the cutting and dislodging bars are swung about their pivotal axis with respect to the arm structure or boom from the full line position indicated at A in Fig. 14 to the dotted line position indicated at B in that figure, the cutter bars assuming at that time a position in substantial alinement with the longitudinal axis of the arm structure. When the bars have been sumped into the coal, hydraulic pressure is supplied to the cylinders 61 to effect swinging of the arm structure upwardly about its pivotal axis relative to the turntable to move the cutting and dislodging bars upwardly in a vertical direction in an arcuate path about the pivotal axis of the arm structure until the bars assume the dotted line position indicated at C in Fig. 14. Hydraulic pressure is then supplied to the cylinders 69 to effect swinging of the bars about their pivot relative to the arm structure until the bars assume the dotted line position indicated at D in Fig. 14, and as shown in full lines in Fig. 15, thereby withdrawing the bars from the coal face. As the cutting and dislodging bars are sumped in, swung upwardly and withdrawn from the coal face, a series of relatively thin parallel vertical kerfs or slots are cut in the mine wall to form a series of vertical cores, and as cutting progresses the wedging rollers on the cutter chains act on the sides of the cores between the kerfs to break down sections of the cores. The dislodged coal is thrown rearwardly by the rapidly moving cutter chains over the receiving plate and onto the front conveyor 14 by which it is conveyed rearwardly into the turntable hopper. The coal discharged through the bottom of the turntable hopper is received by the rear discharge conveyor, by which it is conveyed rearwardly longitudinally of the apparatus to a suitable point of disposal, such as a mine car or other suitable receptacle. In other words, as the bars are sumped in, swung vertically and withdrawn from the coal face, the cutter chains cut parallel vertical kerfs in the coal to form parallel cores, and as cutting progresses the wedging rollers on the cutter chains periodically break down sections of the cores and the cutter chains act to move with a sweeping action the broken down coal onto the front conveyor. By supplying hydraulic pressure to the cylinders 79, the turntable may be rotated to move the cutting and dislodging bars horizontally into various angular positions relative to the base, it being possible to swing the cutting and dislodging bars to a right angle position at either side of the trackway, as indicated in dotted lines in Fig. 13. By supplying hydraulic pressure to the cylinders 94, the rear end of the rear discharge conveyor 9 may be elevated as desired.

In the modified form of the invention shown in Figs. 16 to 26, inclusive, the mining and loading apparatus is generally the same as that described above, with the main exceptions that the cutting and dislodging bars are mounted to swing downwardly during the cutting and dislodging operation, and that the front conveyor is supported and adjustable independently of the arm structure or boom, and the turntable hopper is omitted. This form of the invention comprises a portable base 200, herein in the form of a truck frame supported on wheels 201 adapted to travel along a mine trackway 202. Mounted on the upper front portion of the truck frame above the truck wheels is a horizontal turntable 203 having supported thereon an upstanding frame structure 204. Pivotally mounted at 205 on this frame structure is a vertically swingable elongated arm structure or boom 206, in turn having pivotally mounted thereon at 207, for vertical swinging movement with respect thereto, a series of parallel core cutting and core breaking bars. Pivotally mounted at 208 on depending portions 209 of the upstanding frame structure 204 is a vertically swingable frame 210, on which the forward portion of the front elevating conveyor 211 is guided, having a front material receiving nose 212. The rearward portion of the front elevating conveyor 211 is guided on the

upstanding frame structure 204, and the support 210 and the frame structure 204 have guideways for the endless side chains 213 of the front elevating or loading conveyor. Fixed to these side chains are transverse scraper bars 214 adapted to move the material over a bottom supporting plate 215 on the support 210 and a bottom supporting plate 216 on the frame structure 204. Supported on the turntable for horizontal swinging movement with respect thereto is a rear discharge conveyor 217 for receiving the coal discharged from the front elevating conveyor. The rearward portion of the discharge conveyor is pivoted at 218 for vertical swinging movement with respect to the non-tiltable forward portion thereof.

The core cutting and dislodging bars 219 and the endless cutting and core breaking chains 220 guided thereon are the same as those in the form of the invention above described. The driving means for the endless chains comprises a relatively powerful motor 221 (Fig. 18), the casing of which forms an intermediate portion of the arm structure 206, and the power shaft 222 of this motor is preferably arranged with its axis extending longitudinally of the arm structure. Fixed to the forward end of the motor power shaft is a clutch member 223 connectible by a sliding clutch member 224 to a clutch member 225 fixed to a shaft 226, herein arranged with its axis alined with the motor power shaft axis. The sliding clutch member 224 has any suitable operating means. Fixed to and driven by the shaft 226 is a bevel gear 227 meshing with a large bevel gear 228 (Fig. 21) keyed to a horizontal shaft 229. The shaft 229 extends transversely of the arm structure and is suitably journaled therein. Keyed to the opposite ends of the shaft 229 and driven thereby are chain sprockets 230, which drive, through endless chains 231, chain sprockets 232 fixed to a drive shaft 233 for the cutter chains. Also fixed to the shaft 229 and driven thereby is a chain sprocket 234, which drives, through an endless chain 235, a sprocket 236 (see Fig. 20). Formed integral with and driven by the sprocket 236 is a chain sprocket 237, and the sprockets 236, 237 are journaled on a bearing sleeve 238 supported by a transverse shaft 239, in turn supported by the upstanding frame structure 204. The chain sprocket 237 drives, through an endless chain 240, a chain sprocket 241 keyed to a horizontal transversely extending shaft 242, herein arranged parallel with and below the shaft 239 and likewise journaled within the upstanding frame structure 204. Keyed to the shaft 242 are chain sprockets 243, 243 which engage and drive the endless side chains 213 of the front elevating conveyor.

The means for swinging the arm structure or boom 206 vertically about its pivot with respect to the turntable comprises a pair of hydraulic cylinders 245 pivotally mounted on a cross bar 246 supported by depending portions 247 of the upstanding frame structure 204, and these cylinders each contain a reciprocable piston having its piston rod 248 pivotally connected at 249 to depending brackets attached in the bottom of the arm structure. The cylinders 245 extend upwardly along the outer sides of the front conveyor support 210. For swinging the cutting and dislodging bars about their pivotal axis with respect to the arm structure, there is provided a pair of hydraulic cylinders 250 supported on the top of the arm structure and each containing a reciprocable piston having the forward ends of their piston rods pivotally connected at 251 to links 252 in turn pivotally connected at 253 to brackets 254 attached to the cutter bar hanger frames. The means for swinging the front conveyor support 210 vertically about its pivot comprises a pair of hydraulic cylinders 255 likewise pivotally mounted on the cross bar 246 and arranged between the hydraulic cylinders 245 beneath the front conveyor support 210. These cylinders 255 contain reciprocable pistons having the forward extremities of their piston rods pivotally connected at 256 to brackets 257 attached to the bottom of the front conveyor support 210. It will thus be seen that by supplying hydraulic pressure to the cylinders 245, 250 and 255, the arm structure or boom may be swung vertically relative to the turntable, the cutting and dislodging bars may be swung vertically about their pivot relative to the arm structure, and the front conveyor support may be swung vertically about its pivot. By trapping the liquid within these cylinders, the parts may be maintained in their adjusted position.

The turntable 203 is journaled in bearing sleeves 260 supported within a bearing annulus 261 secured to the top of the truck frame. A retaining annulus 262 secured to the turntable frame underlies the bottom bearing sleeve and the bearing annulus 261 to retain the turntable in position. The means for rotating the turntable within its bearing annulus with respect to the truck frame comprises a pair of hydraulic cylinders 263, 263 mounted on the top of the truck frame at the opposite sides of the latter and beneath the rear discharge conveyor in the manner shown in Figs. 16 and 17, and each cylinder contains a reciprocable piston having its piston rod 264 extending rearwardly through the rear packed head of the cylinder. Journaled within brackets 265 secured to the rear ends of the piston rods are sheaves 266. Attached to the turntable frame and guided within an arcuate rope guiding groove 267 formed on the turntable periphery is a rope 268 having its ends passing around the guide sheaves 266 and attached at 269 to the inner sides of the cylinders. It will thus be seen that when hydraulic pressure is supplied to one or the other of the cylinders 263, 263, one piston may be moved rearwardly to deflect its associated end portion of the cable so that the turntable may be rotated in one direction or the other with respect to the truck frame. By trapping the liquid within the cylinders the turntable may be locked in its adjusted position. The discharge conveyor 217, as previously stated, is, in this embodiment of the invention, mounted for horizontal swinging movement with respect to the turntable, and the pivotal mounting structure therefor comprises a swivel frame 271 having a peripheral flange 272 journaled in bearing sleeves 273 supported by a bearing annulus 274 attached to the top of the turntable frame. Secured to the bottom of the swivel frame 271 is a plate 275 on which is supported a motor 276. The motor power shaft 277 has keyed thereto a chain sprocket 278, which drives, through an endless chain 279, a chain sprocket 280 keyed to a horizontal shaft 281. The shaft 281 extends transversely of the conveyor frame and is suitably journaled thereon, and keyed to and driven by the shaft are chain sprockets 282 which engage and drive the endless side chains of the rear conveyor. It will thus be seen that the motor 276 is capable of driving the rear conveyor irrespective of its horizontally swiveled position

with respect to the turntable. Any suitable locking means may be employed for locking the swivel frame against movement relative to the turntable frame, as for instance a locking pin receivable in locking apertures formed in the swivel frame flange 272. The means for vertically tilting the rearward portion of the rear conveyor comprises a pair of hydraulic cylinders 285 pivotally mounted at 286 on depending brackets 287 formed integral with the lower portion of the non-tiltable forward end of the rear conveyor frame. Each of these cylinders contains a reciprocable piston having its piston rod 288 pivotally connected at 289 to depending brackets 290 formed on the bottom of the tiltable portion of the rear conveyor frame. It will thus be seen that hydraulic pressure may be supplied to the cylinders 285 to vary the elevation of the rear discharge end of the discharge conveyor. If desired, a hydraulically operated swinging mechanism, similar to the rotating mechanism for the turntable, may be mounted on the turntable frame to effect swinging of the discharge conveyor horizontally relative to the turntable.

The truck wheel driving mechanism driven by the motor 100 mounted on the rearward portion of the truck frame is the same as that described above, and, in a similar manner, this motor 100 drives a pump arranged within an oil tank for supplying hydraulic pressure to the various hydraulically operated devices of the apparatus. As shown in Fig. 17, mounted on the side of the truck frame is a horizontal valve box 291 (see also Fig. 23) having formed therein a series of vertical valve bores containing, respectively, rotary control valves 292, 293, 294, 295, 296 and 297. This valve box is similar in design to that disclosed in Fig. 12 and has similar liquid pressure intake and discharge passages, the intake passage connected, as above described, by a conduit 183 to the intake of the pump 174, and the discharge passage connected by a conduit 185 to the oil tank. The valve 297 has its bore connected by conduits 298 and 299 to the opposite ends of the cylinders 255 for elevating and depressing the front conveyor support. The valve 296 has its bore connected through conduits 300 and 301 to the opposite ends of the cylinders 250 for swinging the series of parallel core cutting and dislodging bars about their pivotal axes relative to the arm structure or boom. The bore for the valve 295 is connected by conduits 302 and 303 to the opposite ends of the cylinders 245 for swinging the arm structure or boom vertically relative to the turntable. The bore of the valve 294 is connected by conduits 304 and 305 to the opposite ends of the cylinders 285 for vertically swinging the rearward portion of the rear discharge conveyor. The bore of the valve 293 is connected by conduits 306 and 307 to the opposite ends of the operating cylinder 155 for the truck drive reverse clutches, and the bore of the valve 292 is connected by conduits 308 and 309 to the forward ends of the cylinders 263 for rotating the turntable. As in the form of the invention above described, the rear ends of the cylinders 263 are connected to the oil tank through conduits 310, 311, so that any oil leaking past the pistons may flow back to the oil tank.

The general mode of operation of the modified form of the improved mining and loading apparatus is as follows: As in the form of the invention above described, the apparatus may be propelled about the mine at a high transport speed by the motor 100 under the control of the high speed friction clutch 107. When the working place is reached, and it is desired to cut and dislodge the coal from the mine wall and to load the broken down coal, the cutting and dislodging bars are moved into the sumping position as shown in Figs. 24 and 25, with the upper ends of the bars in adjacency to the mine roof at the coal face. Hydraulic pressure is then supplied to the cylinders 250 and the cutting and dislodging bars are swung downwardly about their pivotal axis with respect to the arm structure or boom from the full line position indicated at A in Fig. 25 to the dotted line position indicated at B in that figure, the cutter bars assuming at that time a position in substantial alinement with the longitudinal axis of the arm structure. When the bars have been sumped into the coal, hydraulic pressure is supplied to the cylinders 245 to effect swinging of the arm structure downwardly about its pivotal axis relative to the turntable to move the cutting and dislodging bars downwardly in a vertical direction in an arcuate path about the pivotal axis of the arm structure until the bars assume the dotted line position indicated at C in Fig. 26. Hydraulic pressure is then supplied to the cylinders 250 to effect swinging of the bars about their pivot relative to the arm structure until the bars assume the full line position indicated at D in Fig. 26, thereby effecting the withdrawal cut. As the cutting and dislodging bars are sumped in, swung downwardly and withdrawn from the coal face, a series of relatively thin, parallel vertical kerfs are cut in the mine wall to form a series of vertical cores, and as cutting progresses, the wedging rollers on the cutter chains act on the sides of the cores between the kerfs to break down sections of the cores. The dislodged coal is moved rearwardly by the rapidly moving cutter chains onto the receiving nose of the front conveyor by which it is fed rearwardly onto the rear discharge conveyor, the coal being moved by the latter rearwardly longitudinally of the apparatus to a suitable point of disposal, such as a mine car or other suitable receptacle. It is accordingly evident that as the core cutting and core breaking bars are sumped in, swung vertically and withdrawn from the coal face, the cutter chains cut parallel vertical kerfs in the coal to form parallel cores, and as cutting progresses the wedging rollers on the cutter chains periodically break down sections of the cores and the cutter chains act to move, with a sweeping action, the broken down coal onto the front conveyor. By supplying hydraulic pressure to the cylinders 255 the receiving nose of the front conveyor may be elevated from the mine floor, and by supplying hydraulic pressure to the cylinders 263 the turntable may be rotated to move the cutting and dislodging bars horizontally into various angular positions relative to the base, it being possible to swing the cutting and dislodging bars to a right angle position at either side of the trackway, as indicated in dotted lines in Fig. 24. By supplying hydraulic pressure to the cylinders 285 the rear end of the rear discharge conveyor may be elevated as desired, and the rear discharge conveyor may be swung horizontally relative to the turntable into the dotted line positions indicated at 24 or any desired intermediate positions.

In both embodiments of the invention, when the cutting and dislodging bars are in their intermediate position, as indicated in full lines in Figs. 13 and 24, the cutting and dislodging bars may

be sumped into and withdrawn from the coal face under the propulsion of the truck wheel driving mechanism. Of course when the cutting and gathering bars are in an angular position at either side of their central position, it is not possible to utilize the truck wheel propulsion mechanism to effect feeding movement of the bars. Also in both forms of the invention, instead of mounting the core cutting and dislodging mechanism on a portable base of the track supported and guided type, it may be mounted on a portable base of the crawler tread type or on a base of the type slidable directly on its bottom on the mine bottom under the propulsion of flexible feeding elements. It will further be noted that the core cutting and core breaking mechanism is of such width as to cut an opening in the coal face of a size sufficient to receive the body of the apparatus so that as cutting progresses the apparatus may be fed within the opening cut thereby so that the apparatus may at that time act as an entry driver or tunneling machine.

As a result of this invention, it will be noted that an improved cutting and loading apparatus is provided having improved means for cutting and dislodging the coal in a coal seam and for loading the broken down coal. It will further be noted that an improved cutting and dislodging means is provided for cutting simultaneously a series of vertical kerfs in the coal to form a series of vertical cores between the kerfs, having embodied therein improved means for breaking down sections of the cores as cutting progresses, together with an improved adjustable supporting structure for the cutting and dislodging means whereby a wide range of operations is possible. It will further be evident that by mounting the cutting and dislodging means on a vertically swingable boom structure to swing vertically with respect to the boom structure, the coal is cut and dislodged in an improved manner and the broken down coal is moved with a sweeping action by the cutter chains onto the front conveyor in an improved manner. Other uses and advantages of the improved cutting and dislodging apparatus will be clearly apparent to those skilled in the art.

While there are in this application specifically described two embodiments which the invention may assume in practice, it will be understood that these embodiments are shown for purposes of illustration and that the invention may be further 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 dislodging apparatus, in combination, a series of parallel vertical cutters for cutting simultaneously parallel vertical slots in the solid coal to form vertical projections of coal between the slots and for dislodging fragments of said coal projections as cutting progresses, and a deflector plate associated with said cutters and including portions projecting within the spaces between said cutter for deflecting the dislodged coal out of the paths of the cutters, said deflector plate receiving the deflected coal and the deflected coal moving over said plate toward its discharge position with respect to said plate.

2. In a cutting and dislodging apparatus, in combination, a conveyor, a series of parallel vertical cutters for cutting simultaneously parallel vertical slots in the solid coal to form vertical projections of coal between the slots and for dislodging fragments of said coal projections as cutting progresses, and a deflector plate associated with said cutters and having portions projecting within the spaces between the latter for deflecting the dislodged coal out of the paths of said cutters and for receiving the deflected coal, said deflector plate directing the deflected coal toward the receiving end of said conveyor, the deflected coal moving over said plate onto the receiving end of said conveyor.

3. In a mining and loading apparatus, in combination, a portable base, a conveyor on said base, cutting and dislodging means mounted on said base for cutting the solid coal, dislodging the cut coal from the solid as cutting progresses and for moving the dislodged coal towards said conveyor comprising a plurality of cutters, and deflector means extending between said conveyor and said cutting and dislodging means and having deflector portions projecting between said cutters for deflecting the broken coal out of the paths of said cutters and receiving the deflected coal for directing the broken coal toward the receiving end of said conveyor.

CHARLES F. OSGOOD.

CERTIFICATE OF CORRECTION.

Patent No. 2,269,781. January 13, 1942.

CHARLES F. OSGOOD.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 13, before "an" insert --to--; page 6, first column, line 67, for "in" read --to--; page 8, second column, line 16, claim 1, for "cutter" read --cutters--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of June, A. D. 1942.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

CERTIFICATE OF CORRECTION.

Patent No. 2,269,781. January 13, 1942.

CHARLES F. OSGOOD.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 13, before "an" insert --to--; page 6, first column, line 67, for "in" read --to--; page 8, second column, line 16, claim 1, for "cutter" read --cutters--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of June, A. D. 1942.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

CERTIFICATE OF CORRECTION.

Patent No. 2,269,781. January 13, 1942.

CHARLES F. OSGOOD.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 13, before "an" insert --to--; page 6, first column, line 67, for "in" read --to--; page 8, second column, line 16, claim 1, for "cutter" read --cutters--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of June, A. D. 1942.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)