

April 19, 1960

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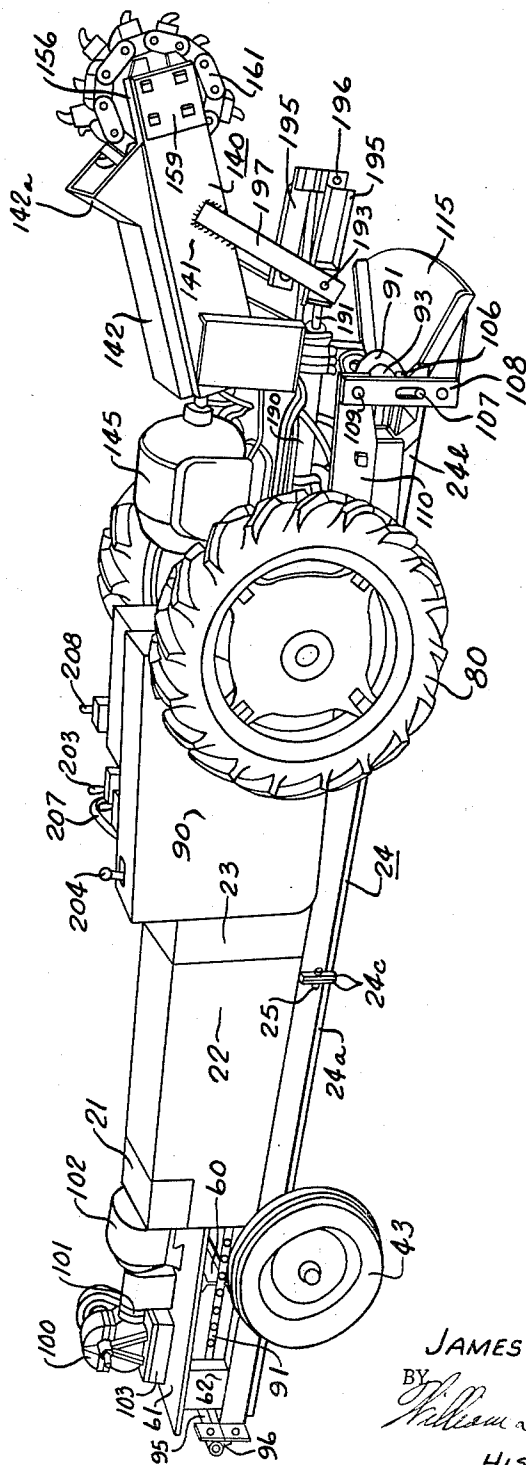
2,933,294

COAL MINING MACHINE OF THE Laterally Cutting Type

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5 Sheets-Sheet 1

Fig. 1



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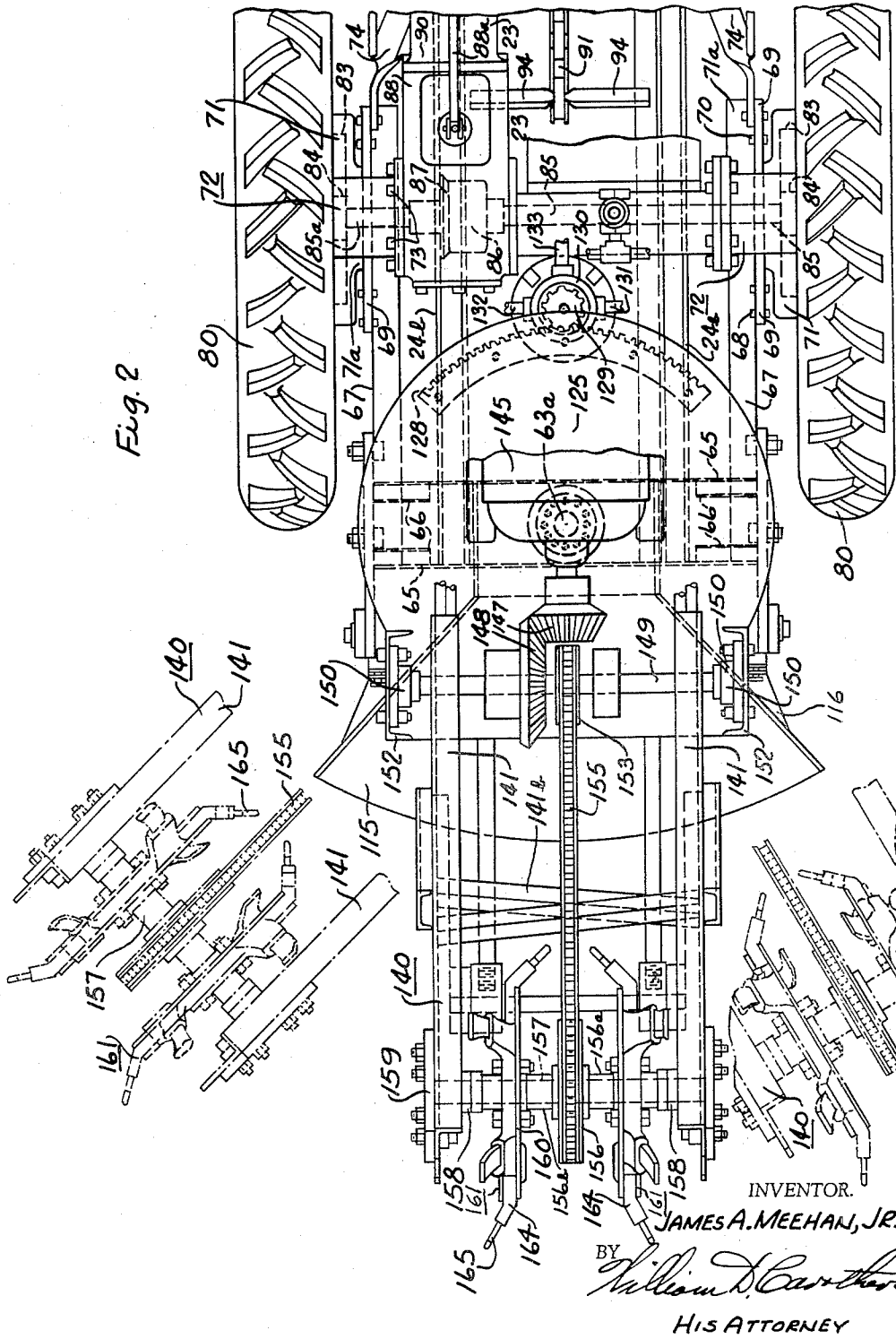
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COAL MINING MACHINE OF THE LATERALLY CUTTING TYPE

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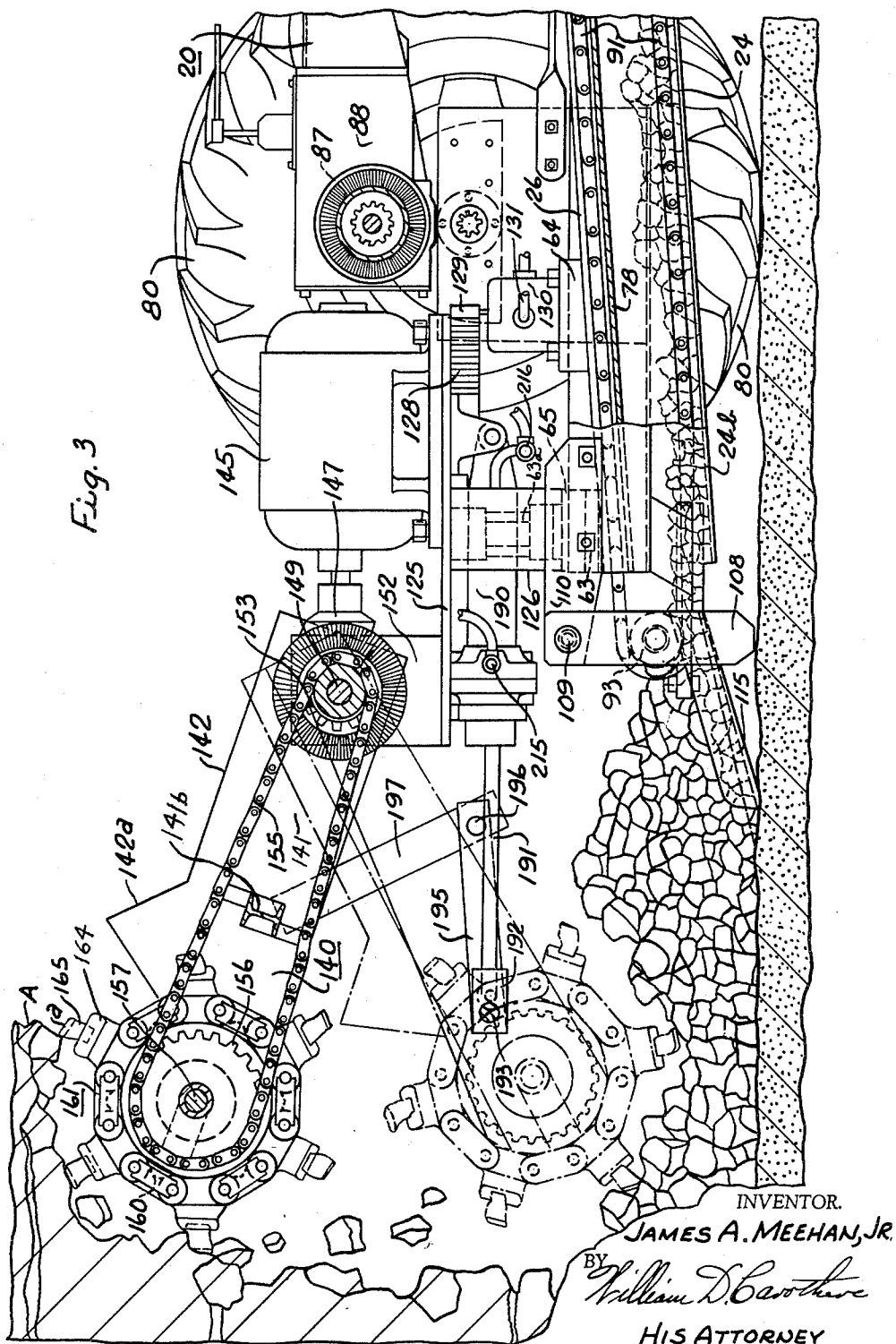
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Filed April 13, 1956

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April 19, 1960

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2,933,294

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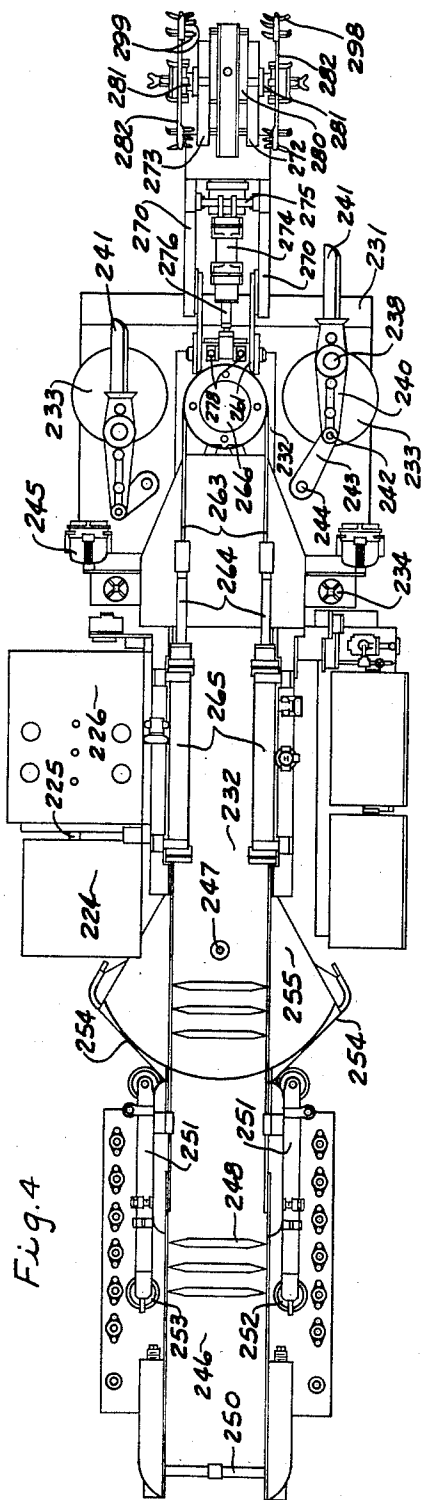


Fig. 4

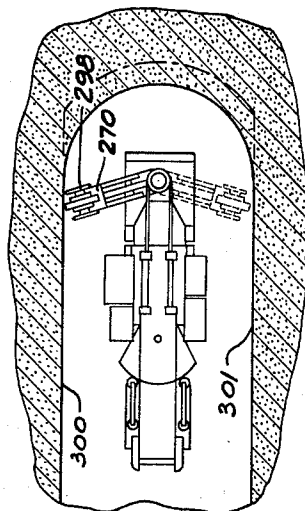


Fig. 6

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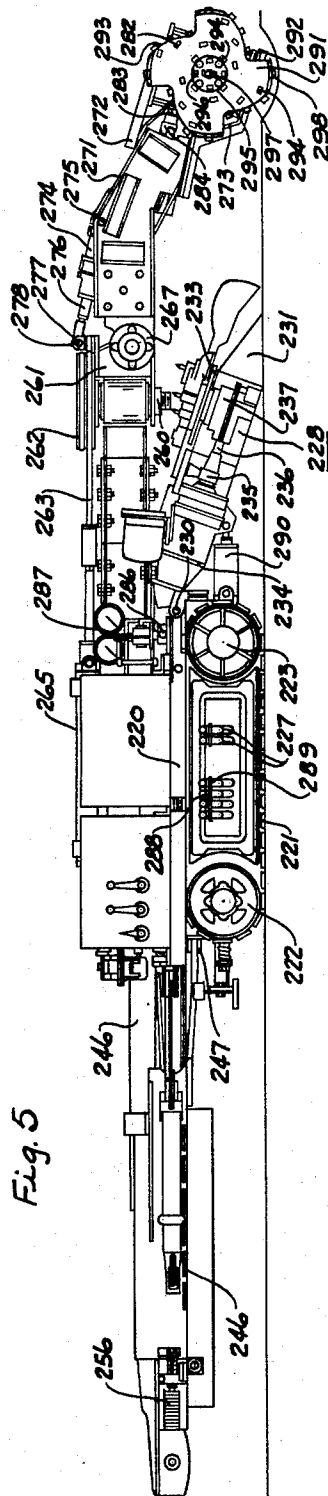
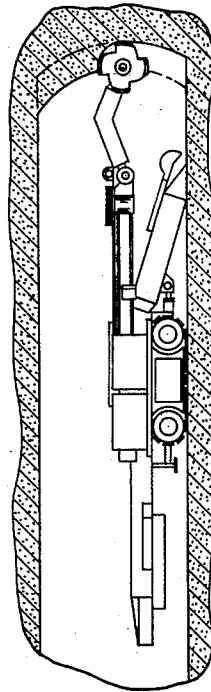
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COAL MINING MACHINE OF THE LATERALLY CUTTING TYPE

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1

2,933,294

COAL MINING MACHINE OF THE LATEROALLY CUTTING TYPE

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Application April 13, 1956, Serial No. 578,119

8 Claims. (Cl. 262—19)

This invention relates generally to an apparatus for mining and more particularly, to a machine for cutting laterally from one side of the tunnel to the other and for delivering the material mined away from the face.

This application is a continuation in part of my application, Serial No. 239,903, filed August 2, 1951 for Coal Mining Machine, now abandoned.

There is a definite need for cutting machines which will be essentially relatively inexpensive in cost, so that the average, small mine operator can afford it as a capital investment. Further, it should be economical in its maintenance and power requirements, capable of substantially continuous cutting to output performance, fool-proof in operation, relatively simple in construction, easy to repair and operate, and should facilitate the quick replacement of cutting points. It also should be of a type such that no special shuttle cars or supplemental conveyor equipment are necessary for handling the cut out product.

These machines are devised to meet these and other requirements and which will, for the first time, be practical from the standpoint of a small mine operator. A number of serious problems have been solved by the use of the structure of these machines which will be apparent from the detailed description of the illustrated embodiment as hereinafter set forth.

An important object of this invention is the provision of a new and improved form of mining machine having a lateral swinging cutting action.

Another object has been to provide an inexpensive and practical coal mining machine that will be economical of power and that will deliver cuttings at a slower rate such that they may be removed by employing conventional handling methods and without interrupting the continuous operation of the machine;

A still further object has been to provide an improved form of cutter head and boom construction for a mining machine;

These and many other objects of my invention will appear to those skilled in the art from the description of the illustrated embodiment of my invention.

In the drawings, Figure 1 is a side perspective view in elevation illustrating a complete machine constructed in accordance with my invention;

Figure 2 is an enlarged front plan detail of the machine of Figure 1, particularly illustrating a boom construction, a cutter head and turntable mechanism. In this figure, some of the shielding is removed, right and left-hand positions of the boom are indicated by dot and dash lines, and an axially-longitudinally aligned position of the boom is indicated by full lines;

Figure 3 is a partially sectioned side view in elevation of and on the same scale as Figure 2, but with spraying means omitted; full lines represent an upper working position of the boom, while dot and dash lines represent a lower working position;

Figure 4 is a view in side elevation of a modified form of the mining machine comprising this invention.

2

Figure 5 is a top plan view of the machine shown in Figure 4.

Figure 6 is a reduced plan view of the mining machine in a tunnel.

Figure 7 is a reduced side elevation of the mining machine in a tunnel.

General description

In carrying out my invention, I employ a power driven tractor or unit which as shown particularly in Figures 1 to 3, has a rigid, longitudinally-axially extending chassis or frame 20 mounted for forward and backward movement on a small pair of pneumatic-tired wheels 43 at its rear end and a larger pair 80 at its front end. The larger, front wheels 80 are driven by an electric motor 90 through a transmission. As noted in Figure 1, the frame slopes upwardly-backwardly from its front towards its rear end. The small, rear wheels 43 are provided with a steering gear which allows about a twelve foot turning radius.

A turntable 125 (see Figure 3) is operatively mounted on the front end of the traction unit and on its upper side, carries a cutter boom 140, a cutter head drive motor 145, its gear reduction and driving assembly, and a boom swing shaft 149. On its lower side, it carries a pair of hydraulic cylinders or motors 190 for actuating a raising and lowering linkage or lever system for the boom. The turntable is pivotally mounted on a king pin 63a to swing on a horizontal or transverse plane of the traction unit (see Figures 2 and 3) and to, in turn, swing the boom and the cutter head carried thereby to the right and left of the unit. The turntable is provided with a curved gear rack 128 which is engaged by a pinion 129 for swinging it from side to side in the manner illustrated in Figure 2.

The boom 140 is pivotally mounted on the turntable 125 through its gear driving connections and is connected to the linkage which is actuated by the hydraulic cylinders 190 to raise and lower it on its horizontally-positioned, vertical swing or pivot shaft 149, see Figure 3. The boom carries an operating shaft 157 at its nose which is actuated by a drive chain 155 from its pivot shaft mounting on the turntable, see Figure 3. A pair of cutter heads or wheels are secured in a spaced-apart relationship to the operating shaft and on opposite sides of the chain drive.

Each cutter wheel, as shown in Figures 1 to 3, comprises a support sprocket 160 and a bit carrying chain 161. Each chain carries a series of cutter points or bits 165 that are positioned about the periphery of its associated sprocket and are adapted to engage transversely spaced portions of the mine face A.

A conveyor pan 24 (see Figure 3) is at its loading (front) end, shown about three inches from the ground, and is provided with a yieldably mounted gathering head or duckbill 115 that is hinged to ride on the ground in front of the pan. The discharge end is shown with about fourteen inches clearance from the ground. A continuous flight chain conveyor 91 operates in the pan and has a lower feed-flight and an upper return flight carried on sprockets 92 and 93, see Figure 3. As shown in Figure 2, the conveyor is provided with transversely-extending flight wings or scraper arms 94. The conveyor may be driven by a 2 H.P. motor through a 48 to 1 speed reducer.

In operation, I prefer to set the pair of cutter wheels in motion at a low level to produce an undercut, while slowly advancing the chassis of the machine towards the mine face A. Since the cutters rotate downwardly in relation to the mine face, an undercut facilitates subsequent cutting at higher levels by providing plenty of clearance. The loose coal is worked towards the loading end of the conveyor, at least to some extent, by the cutter head

and is pushed over its duckbill by the advance of the chassis towards the mine face. Since the chassis is driven by a reversible transmission, the operator can very flexibly control the operation of the apparatus.

The chassis or frame structure 20 of my apparatus has a rear casting 21 which is bolted to an intermediate motor box 22 and a front housing 23 which is also bolted to the motor box 22 to provide a longitudinal-axial support structure. The chassis 20 also has a longitudinally-extending, underslung, conveyor pan 24 made up of two sections 24a and 24b which are flanged at 24c and secured by bolts 25 to provide a unitary construction. Each pan section 24a and 24b is of channel or U-shape and is positioned to present an upwardly-open mouth. The pan 24 is covered at its center and part-way back by a lid or cover plate member 26.

As shown in Figures 1 and 2, a transversely extending I-beam 60 is welded at its bottom flange to the side flanges of the rear pan section 24a and to the bottom of a back platform plate member 61. A pair of blocks 62 are also welded to the bottom of the platform or plate member 61 and to the side rails or flanges of the rear pan section 24a.

As shown in Figures 2 and 3, the front pan section 24b is also provided with a chassis support. In this connection, a transversely-extending, front support channel 65 is welded at its opposite ends to a pair of longitudinal side channel members 67 that extend backwardly from the channel 65 and are secured by bolts 68 to a pair of vertical plate members 69. The plate members 69 are secured by bolts 70 to threaded bosses 71a of end flanges 71 of a front axle housing assembly 72 that is secured by bolts 73 to the front casting 23. A transverse yoke or cross member 74 is bolted at its ends to the vertical plate members 69. It will be noted that the transverse channel 65 is reinforced or bolstered at its ends by short lengths of narrower channels 66, see Figure 2.

As shown particularly in Figures 2 and 3, the pair of front (chassis-drive) wheels 80 are secured to a gear 83 actuated by a driving pinion 84 of which one is keyed on a differential shaft 85 and another on a differential shaft 85a that are contained in housings provided by the front casting 23. An electric motor 90 drives the front wheels 80 through a slip coupling clutch, a standard type of tractor transmission gear unit 88 that is controlled by hand lever 88a, to drive bevel gears 87 (see Figure 3), and differential 86 (see Figure 2), shaft 85, and the pair of driving pinions 84.

At the back end of the chassis, the flight rails 78 are also welded to the I-beam 60 and to the blocks 62.

A conveyor chain 91 interleaves at its back end with a sprocket 92 and at its front end with a sprocket 93 and rides on its lower flight along the bottom of the pan 24 and on its upper or return flight, along the flight rails 78. A series of transversely extending and longitudinally spaced-apart flight wing members or scraper arms 94 are carried integrally by the blocks of the chain 91 (which is of a block type).

The back sprocket wheel 92 is keyed to a transverse drive shaft 95 which is rotatably journaled at its opposite ends within a pair of bearing housings 96. The bearing housings 96 are bolted to brackets which are welded to side flanges of the pan section 24a. A second chain sprocket wheel keyed to the shaft 95 is connected through a drive chain to another sprocket wheel of a gear reduction unit 100 and through a coupling 101 to a driving motor 102. It will be noted that the motor 102 is bolted to the platform 61 and that the gear reduction unit 100 is bolted to blocks 103 that are welded to the platform 61.

The front sprocket wheel 93 for the conveyor chain is keyed centrally on a front shaft that is journaled within end bearings that fit within rectangular slots of a crank member 106 (of rectangular plate) and is fastened therein by upsetting its end. Each crank member 106 carries a

pin or roller 107 that slidably engages arm members 108. Each member 108 is pivoted at its top end by a shouldered pin 109 that is fixed on a longitudinally-forwardly extending support arm 110 secured to the side channel members 67.

A duckbill 115, see Figures 1, 2, and 3 has a channel shaped, rectangular back portion adapted to rest within the front end of the front section 24b of the pan and a front fan-shaped channel shaped portion that is adapted to rest upon the mine floor to scoop up the cuttings. As shown in Figures 1 and 3, a backwardly-extending, front, transverse plate member 116 is welded at its front end to an underside of the fan-shaped front or scoop portion of the pan 115.

At the front end of the chassis or apparatus, there is provided a turntable support block 63 (see Figures 2 and 3) which is securely welded to the underside of the transverse channel member 65 which is welded at its ends to the side channels 67. The block 63 is bored out to receive a bottom end portion member of a vertical support or kingpin 63a to which it is welded. A turntable 125 has a support housing 126 welded to extend downwardly from its underside over the pin 63a. Roller bearings 127 journal the housing 126 for rotative movement on the pin 63a.

As shown particularly in Figures 1, 2 and 3, the front end of the chassis carries the turntable 125 from which a boom 140 is operatively suspended. The housing 126 positions the turntable 125, so that it can be turned or swung horizontally from right to left about the pin 63a. A curved rack 128 is also secured to the underside of the turntable 125 near its back end portion and meshes with a pinion 129, see Figures 2 and 3. In this way the turntable 125 can be rotated through about 45° to either side of its dead center, taken longitudinally-axially of the chassis.

The pinion 129 is secured on the shaft of a vertically positioned, reversible fluid motor 130. The motor 130 (see Figure 2) is secured to a transverse cover plate 64 which extends across and is secured to the side flight rail members 78. The fluid motor 130 is energized by a hydraulic pump and its operation is controlled by a hand-operated, three-way valve. The pump is driven by an electrical motor by means of a V-belt. The fluid motor 130 is reversible, being positively operated in one direction by fluid line 131 and in an opposite direction by the fluid line 132. An exhaust line 133 leads from the motor 130 to a fluid reservoir having a fluid-tight filler cap.

The dot and dash, right hand, position of the boom 140 in the plan view of Figure 2, represents the maximum swing that may be effected by the turntable 125 to this side, while the left hand, dot and dash position indicates an intermediate position of the boom.

The boom 140 is made up of a pair of spaced-apart longitudinally-forwardly extending side channel members 141 and a top closure hood or channel member 142 which are secured together. The hood member 142, at its forward end, has an upwardly-extending and open hood or shield portion 142a. As shown particularly in Figure 2, the boom 140 is reinforced adjacent the shield portion 142a by criss-crossing, transverse channel members 141b that are welded back-to-back, and to the side channel members 141.

A cutter drive motor 145 is secured on the turntable 125 and its shaft drives a beveled pinion 147 which meshes with a beveled gear 148. The bevel gear 148, as shown particularly in Figures 2 and 3, is journaled on a primary drive or a swing shaft 149. The primary shaft 149 extends through and is secured to opposite sides of the pair of longitudinal side channel members 141 and is journaled at its ends within bearings 150 that are secured to a pair of short-length, upwardly-extending mounting channels 152. The mounting channels 152 are welded to the upper face of the turntable 125.

The bevel gear 148 is integrally secured to a chain

5

driving sprocket wheel 153 and they are rotatably mounted as a unit by roller bearings on the shaft 149. A roller and link type drive chain 155 meshes with the sprocket 153 and extends forwardly of the boom 140 to mesh with and drive a front sprocket 156 that is keyed to or secured on a secondary shaft 157.

The secondary or front shaft 157 is actuated by the sprocket 156 and is journaled within end bearing mounts 158 which are secured to the side channel members 141 and a pair of reinforcing plate pieces 159, see Figures 1 and 2.

A pair of cutter sprockets 160 are mounted in a spaced-apart relationship on opposite sides of the centrally mounted sprocket 156 and are also keyed or feathered to the secondary shaft 157 for rotation therewith. Spacer sleeves and collars 156a and 156b are mounted on the secondary shaft 157 as shown in Figure 2.

Referring particularly to Figures 1 to 3, inclusive, there is provided a cutter chain 161 for each cutter sprocket 160 which chain is of a block and link type which carry integral holders or mounts 164 for cutting bits or pick points 165. Set bolts or screws removably hold each of the pick points 165 in position within an end slot of its mount 164 and keyways or holes (for a drift tool) extend through each mount to facilitate the removal of the pick points or cutter elements 165 when they are worn down.

The boom 140 is raised and lowered about the swing and pinion or primary shaft 149 by a pair of reciprocating fluid cylinders or motors 190. Each of these fluid cylinders or motors 190 is secured to the underside of the turntable 125, see Figures 2 and 3, and have reciprocating piston rods 191 which extend forwardly of the chassis and underneath the boom 140. Referring particularly to Figures 1 and 2, each plunger rod 191 has a head 192 which is pivoted by a transverse shaft 193 to an outwardly-extending mounting head portion of a link arm 195. It will be noted that the mounting head portion is welded to the link arm 195 and that the shaft 193 is welded to this head portion. The link arm 195 is of channel shape, and at its upper end, is pivotally connected by a pin 196 to a stationary arm 197 of the same channel construction. The upper, stationary arm 197 on each side of the machine is welded to extend backwardly from one side channel 141 of the boom 140.

It will be noted that this linkage construction is the same on both sides of the boom 140 and that both of the fluid cylinders or motors 190 are operated simultaneously to move or swing the boom 140 up and down on its supporting swing shaft 149, as indicated on Figure 3. A D.C. energized circuit for the motors employed is of the D.C. splash-proof, non-sparking type. It will be noted that a two-way, "on" and "off," hand-operated electrical control switch 203 (such as a double pole, single throw switch), see Figure 1, is connected to the motor 102 which drives the conveyor mechanism to feed cuttings backwardly underneath the chassis of the machine and from its rear end.

A second two-way, hand-operated, electrical control switch 204 is connected to the tractor drive motor 90 to actuate the chassis and through transmission 20, to move it forwardly and backwardly in the mine. A slip clutch which has no control aside from a preliminarily, proportioned setting, based upon the power which is to be transmitted couples the motor 90 to the drive mechanism. Thus, if the cutting load is too great or increases suddenly, for example, if the cutters should engage solid rock, the clutch slips, causing the mechanism to stop the advance of the truck and prevents damage. This acts as a safety means against shock, etc.

A fourth two-way, hand-operated electrical control switch 207 is connected to a motor which operates a hydraulic pump. A fifth two-way hand-operated electrical control switch 208 is connected to a cutter-driving

6

motor 145 which operates the cutter pick points 165 through the pinion 147, gear 148, and chain driving sprocket 153.

A three-way control valve is connected through lines 215 and 216 to opposite ends of the reciprocating fluid cylinders 190. The cylinders 190, as previously explained, are employed to raise and lower the boom 140 on the turntable 125.

Referring to Figures 4 to 7 showing a modified form of the mining machine which is built upon a machine that now exists in the art and is known as a loading machine, the loading machine comprises the frame structure 220 made mobile by the endless tracks 221 threaded on the idler sprocket 222 and the drive sprocket 223. The endless tracks are driven by fluid motor energized from the fluid pump 224 operated through the shaft 225 by the electric motor 226. The fluid motors driving the endless tracks 221 are not shown but are controlled by the individual control levers 227.

The forward end of the frame carries the gathering head 228 pivotally mounted to the frame on the horizontal pivot member 230. This gathering head comprises the blade member 231 which leads to the conveyor section 232 and has on either side thereof the rotary disc 233. Each disc 233 is driven by its own motor 234. These discs are driven from concentric shafts by the motor 234 through the slip clutch 235, the shaft 236 and the reduction gears 237. A vertical shaft extends from the reduction gear 237 and is concentric with the disc 233 and the latter is secured thereon. Each disc is provided with a crank pin 238 on which is pivotally secured the gathering arm 240 having a paddle 241 on its outer end and is connected through the wrist pin 242 at its other end to the crank 243. The crank 243 is an idler crank rotatably mounted on the shaft 244. A light 245 is mounted in back of each gathering arm.

The rear of the machine is provided with a conveyor boom 246 which is pivotally secured to the frame as indicated at 247 and is mounted to swing laterally through an arc of approximately 75°.

This conveyor boom carries the conveyor flight 248 in the conveyor pan 232 and which is in the form of a chain having a series of universal flights connected therewith. The rear of the boom is provided with a shaft 250 over which the conveyor flight travels in making its circuit. The hydraulic cylinders 251 on each side of the conveyor boom 246 are provided with the expanding pistons 252 having the pulleys 253 at their outer ends or alternately moving the cable or rope 254 that is connected with the sides of the conveyor pan 255. Thus by alternately extending the pistons 252 the boom is caused to swing about its pivot 247 through an angle of approximately 75°.

A conveyor take-up mechanism 256 is shown in Figure 5 and is provided with a spring and adjusting screw for the purpose of maintaining the conveyor flight taut at all times and under all conditions.

The front of the frame 220 is provided with a boom support structure 257 that extends out over the gathering machine and is provided at its outer end with a centrally disposed bearing 258 that has mounted therein the vertical swing pin 260. The upper and lower portions of the swing pin 260 have pivotally attached thereto the arms of the horizontal swing frame 261 of the boom. This frame has the swing chive 262 attached to its upper face and around which is wound the cable 263, the opposite ends of which are attached to the pistons 264 and operating its cylinders 265 for the purpose of swinging the frame 261 horizontally about the pivot point 266 of the swing pin 260.

The horizontal swing frame 261 carries at its forward end the horizontal boom pivot 267 in bearings. This boom pivot has pivotally mounted thereon the boom member 270 which has a rectangular frame member that is provided with a dropped front section 271 formed by

the upper and lower extensions 272 and 273. This boom has the hoist cylinder 274 pivotally mounted thereon as indicated at 275 and piston 276 operating within the cylinder 274 is pivotally connected to the horizontal boom frame 261 by a hoist pivot pin 277 which extends through spaced lugs 278. The boom extensions 272 and 273 carry therebetween the gear reducer 280 which is provided with a horizontally disposed shaft 281 that projects through the sides of the boom extension for the purpose of mounting the rotary cutting elements 282, one being mounted on each end of the shaft 281 that extends beyond the boom on both sides thereof.

The shaft 281 is carried in suitable bearings within the boom and gear reduction mechanism and the latter is driven by the shaft 283 through the coupling 284 by the hydraulic motor 285. The motor 285 is likewise driven from liquid under pressure delivered by the pump 224. These hydraulic control mechanisms are located in the hydraulic control box between the endless track on the right side of the machine and by the lever 286 in front of the electric control box on the right side of the machine. The lever 287 controls the swing cylinders 265 for swinging the boom laterally and the lever 288 controls the raising and lowering of the boom in actuating the hydraulic motor or cylinder 274. The lever 289 controls the hydraulic hoist motor 290 for raising and lowering the gathering mechanism 228.

The rotary cutting elements or discs 282 rotate downwardly into the mining face and as illustrated in Figure 5 are provided with four arms 291. These arms provide a relief 292 and gradually build up in the form of a cam surface 293 to its greatest diameter. A series of removable bits start adjacent the hub 295 and follow a spiral band which starts at the relief of the preceding arm and overlaps said arm before it approaches the cam surface 293. Thus the teeth 294 cover the whole of the side face of the cutting disc and project laterally therefrom. The cam face of the rotating discs presents a spiral cutting leading edge when the rotating cutter head is moved downward to a new cutting position. The reliefs on the trailing edges of the discs which are abrupt provide an opening for the accumulation of the coal to be readily ejected. When the cutter head is moved laterally in a horizontal plane these same relief spaces provide space wherein the coal being gouged out of position by the teeth in the spiral edge thereby provides a recess in which the loose coal is moved and discharged to the conveyor when the cutter is moving laterally in cutting the swath across the face of the coal face. The hub member 295 is provided with teeth 296 and a central pilot bit 297. The perimeter of the rotary cutting element is provided with removable bits 298 and as shown in Figure 4 the inner face of the cutting disc 282 is provided with the cutting bits 299. The cutting bits 299 do not extend any deeper than the extent of the speed reducer 280, as these teeth are required to cut only that amount of coal that would occur between the two cutting discs when the machine is sumped into the coal face and the cutter boom is in a position less than 180° or a plane transverse to the front of the machine.

As shown the boom 270 may swing through an arc of 210°. Thus the trailing cutter disc at the end of the swing has its peripheral bits 298 in a tangent to the plane 300 that forms the left wall of the tunnel being cut as shown in Figure 6. In this position the machine is sumped until the cutter head is substantially half covered as indicated in Figure 6. The traction of the machine is then stopped and the boom 270 is then caused to swing by the cylinders 265 in a clockwise direction and the right cutting disc then cuts a swath across the front of the machine to the coal face to the opposite wall 301 as shown in Figure 6. When the boom 270 reaches the centermost position as illustrated in Figure 4, the swath cut in the coal face will be substantially three-fourths the full face of the cutter disc or approximately

eighteen inches when the cutter disc measures twenty-four inches. As the boom continues to swing to the wall 301, the depth of the arcuate cutting face formed by the cutter reduces until the right cutter is completely free of the wall 301 and the left cutter is then approximately 180° in transverse plane in which position the machine may be again moved forward to sump the left cutter disc into the coal or the boom may be raised to require the left cutter disc to cut the next succeeding lateral swath through the coal face as it swings from the wall 301 to the side wall 300. This is illustrated in Figure 8 wherein the bottom swath was cut when the boom swung from wall 300 to wall 301 and was then raised to make the second cut when the boom swings from wall 300 to wall 301 as shown in Figure 8. The coal seam requires at least three swings of the boom and because of its height will require the right hand cutter to be sumped up by raising the boom and then swinging the same to the right or the wall 301 to complete the cutting cycle before the machine is moved forward to again sump the head end of the coal for the next cutting cycle. If the coal seam is not as high as that shown in Figure 7, it may only take two swings of the boom to completely form the cutting cycle since the diameter of the rotary cutting discs is smaller than the height of the machine as shown. This particular design of machine will require at least two swings of the boom to form a complete cutting cycle. However the diameter of the cutting discs may be changed so as to be larger or smaller as the case requires.

I claim:

1. A mining machine comprising a mobile body, a boom, support means on the forward end of said body to pivot said boom on vertical and horizontal axes, power means to swing said boom on said horizontal and vertical axes in front of said body, a cutting head on the end of said boom having spaced cutting discs mounted on a horizontal rotary axis with drive means therebetween, bits studding the perimeter and each side of said cutting discs to cut a path substantially the greatest diameter of said cutting discs as the boom swings laterally in one plane on said vertical axis.

2. The mining machine of claim 1 characterized in that said bits extend from the center to the perimeter on the outer side of each cutting disc.

3. The mining machine of claim 1 characterized in that the perimeter of each cutting disc has a plurality of relief spaces forming arms.

4. The mining machine of claim 3 characterized in that the leading edge of each arm formed by said relief spaces follows a spiral curve and the trailing edge of each arm is abrupt.

5. A mining machine comprising a mobile body, pivot means on a vertical axis on the forward end of said body, second pivot means on a horizontal axis supported by said first pivot, a boom mounted on said second pivot means, power means carried by said body to swing said boom from one side of said body to the other, second power means between said boom and said first pivot means to swing said boom vertically, a cutting head on the end of said boom having spaced cutting discs mounted on a horizontal rotary axis with a drive means therebetween, bits mounted laterally on both sides of said discs to cut an arcuate face parallel with said boom when said power means swings said boom laterally in a horizontal plane and is held against vertical movement by said second power means.

6. The mining machine of claim 5 characterized in that said boom is mounted to swing horizontally through an arc of at least 180° to permit said laterally cutting bits to start a horizontal cut from the tunnel side and of minimum depth.

7. The mining machine of claim 5 characterized in that the outer face of each of said discs having their laterally mounted bits extend to the central axis of the cutter to

produce a lateral cut, the maximum cutting depth being substantially the full diameter of the cutter.

8. A mining machine having a mobile body carrying a forward projecting boom pivotally mounted on vertical and horizontal pivots to swing laterally and vertically, spaced rotary driven cutter discs mounted on a transverse horizontally disposed axis carried on the outer end of the boom, drive means to swing said boom laterally in a horizontal plane, and a conveyor on the body to move the mined material rearwardly, bits mounted laterally on the outer side of each of said rotary cutter discs to cut an arcuate face parallel with the boom when said boom drive means swings said boom laterally in a horizontal plane while holding said boom against vertical

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10

movement, and other lateral bits on the inner face of each rotary disc.

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