Feb. 11, 1936. M. P. HOLMES 2,030,065

MINING APPARATUS

Filed Feb. 27, 1933 6 Sheets-Sheet 1

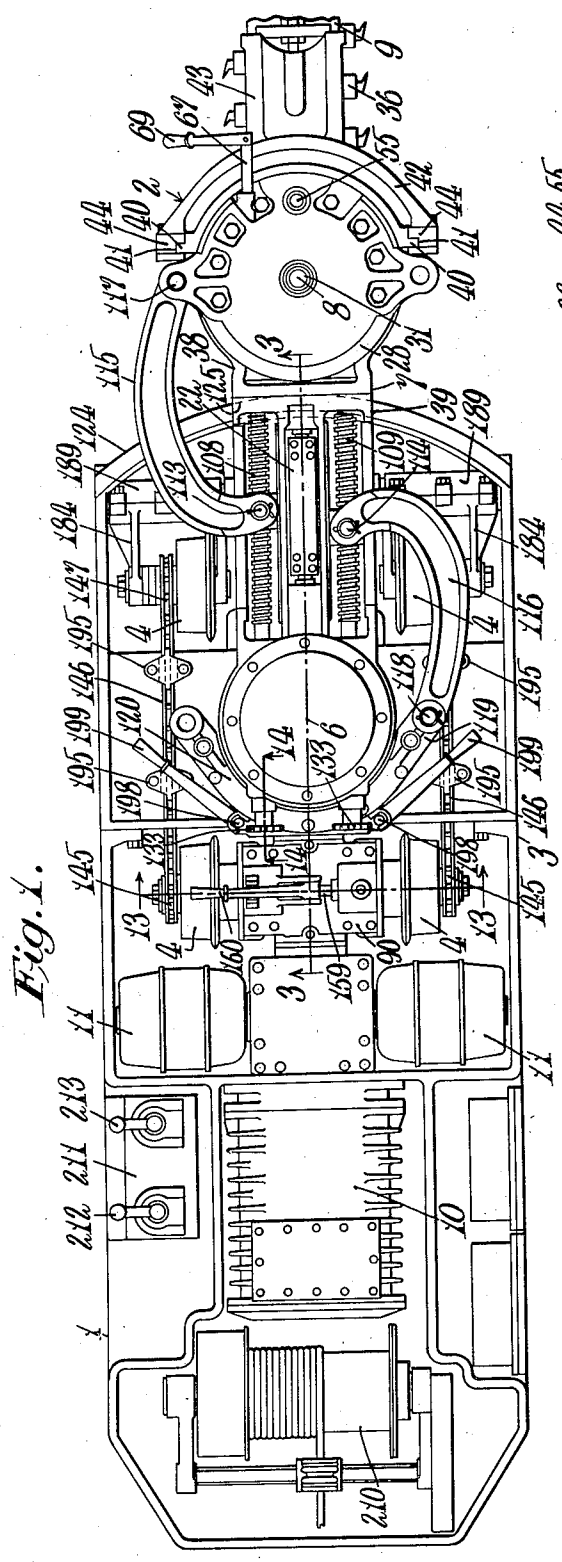


Fig. 1.

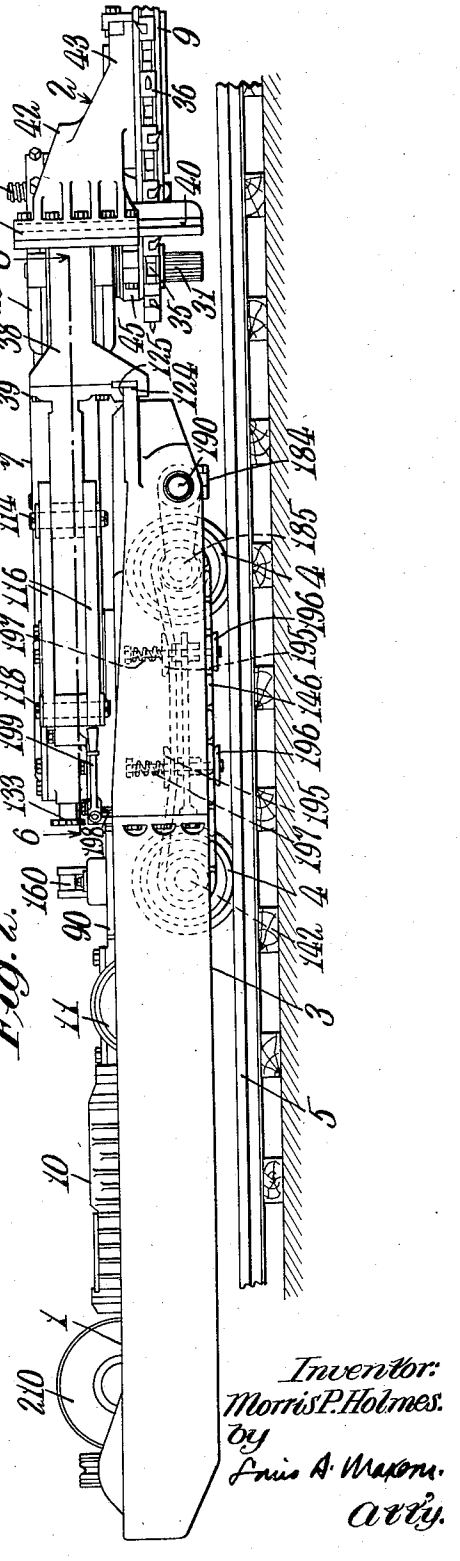


Fig. 2.

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MINING APPARATUS

Filed Feb. 27, 1933 6 Sheets-Sheet 2

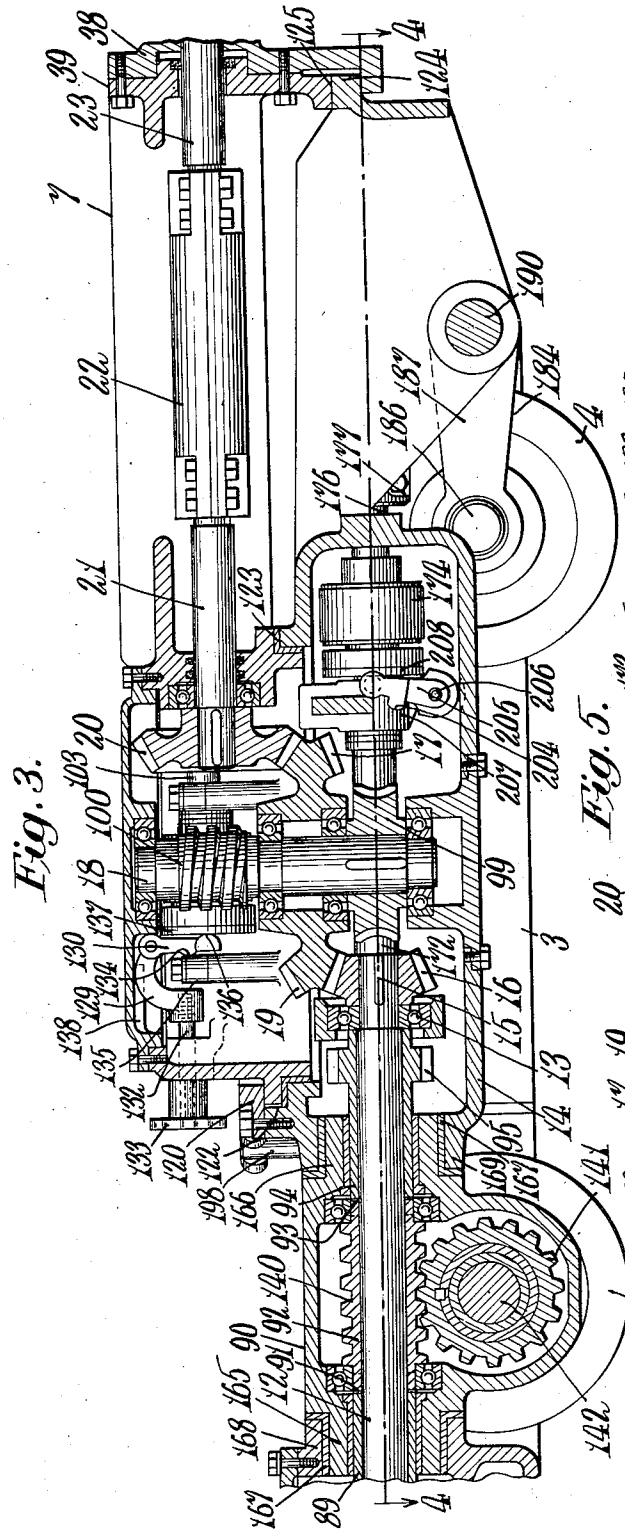


Fig. 3.

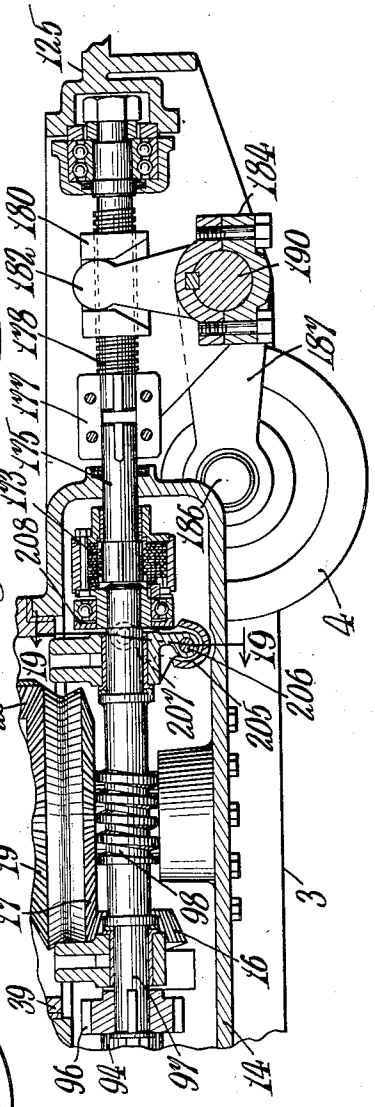


Fig. 5.

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MINING APPARATUS

Filed Feb. 27, 1933 6 Sheets-Sheet 3

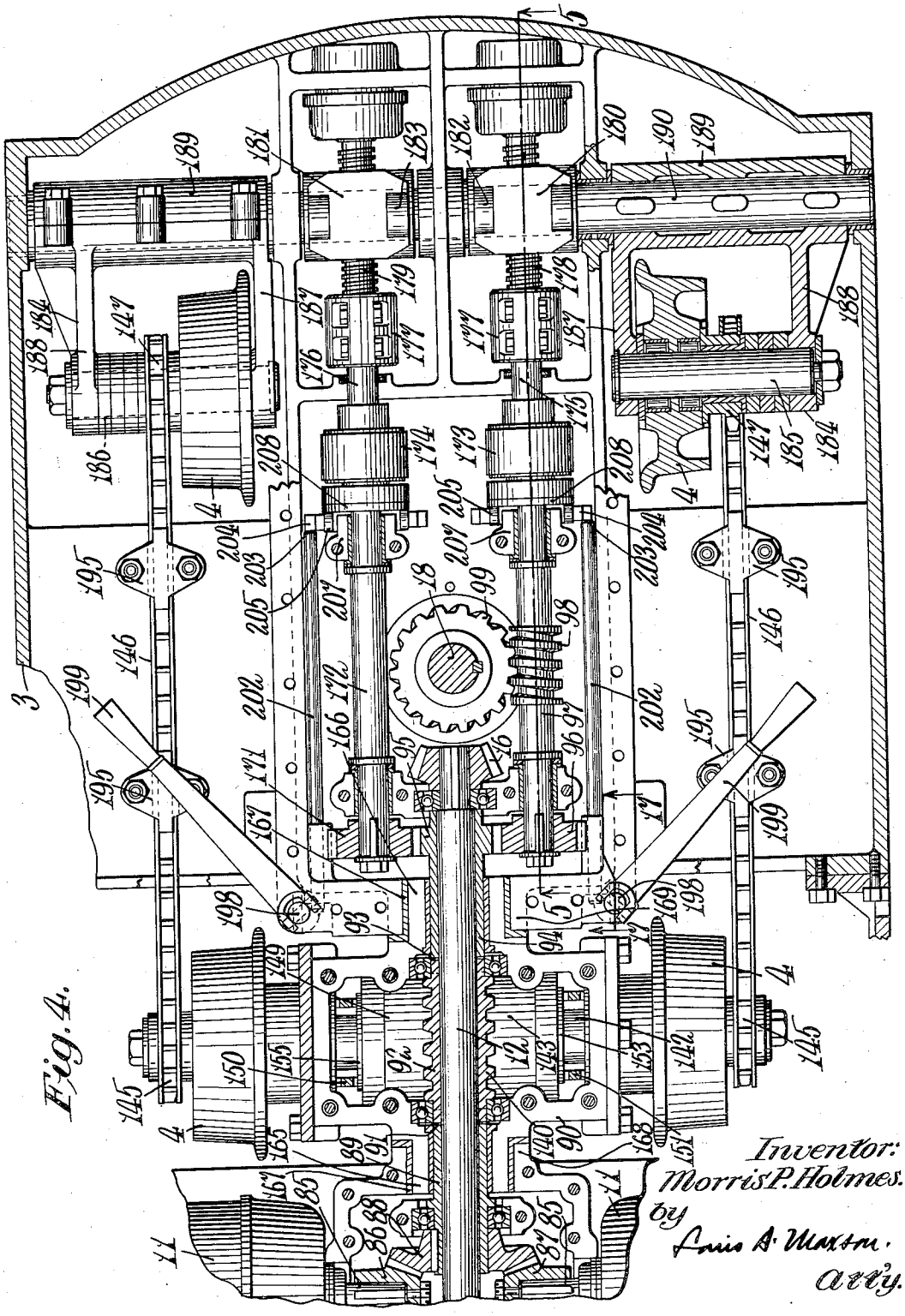


Fig. 4.

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MINING APPARATUS

Filed Feb. 27, 1933 6 Sheets-Sheet 4

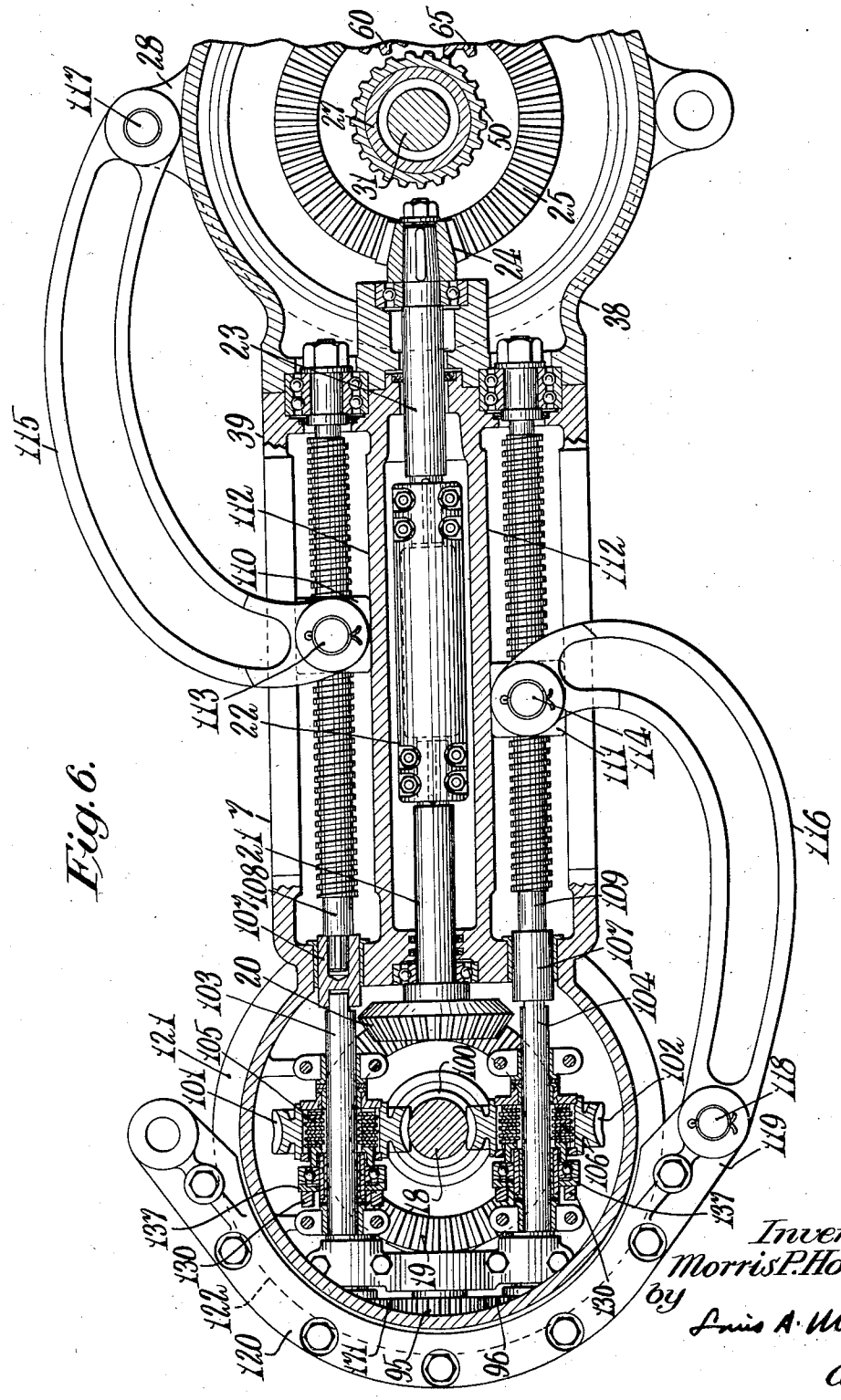


Fig. 6.

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Feb. 11, 1936. M. P. HOLMES 2,030,065

MINING APPARATUS

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Fig. 7.

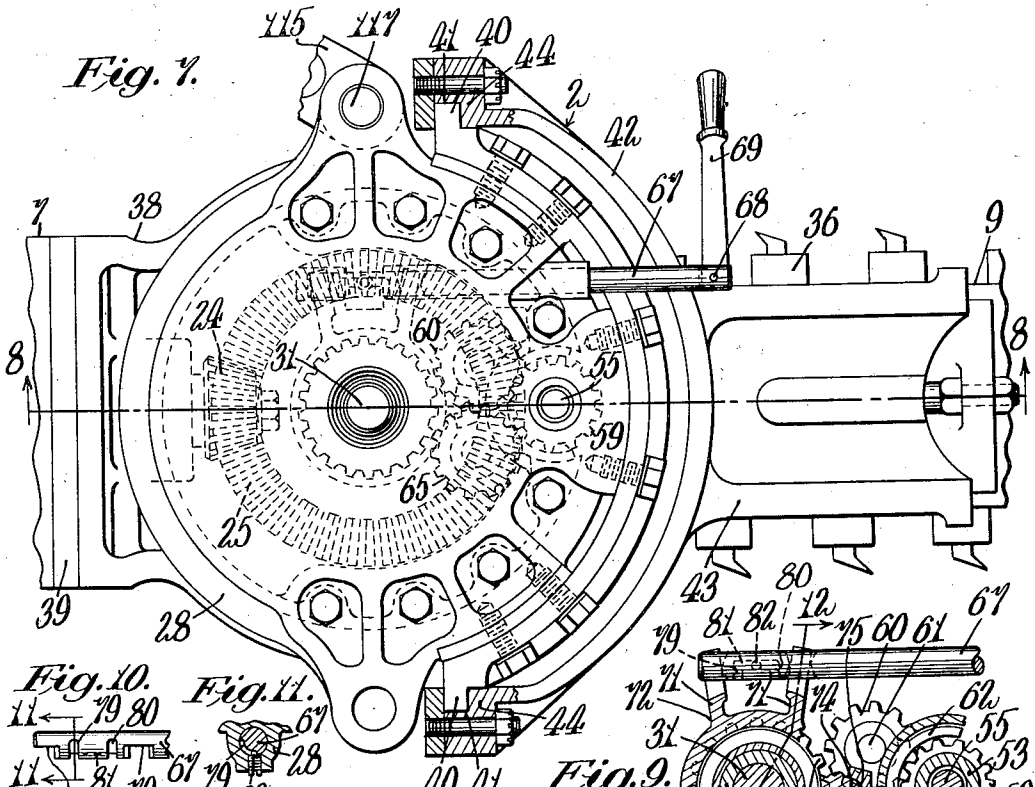


Fig. 10.

Fig. 11.

Fig. 9.

Fig. 8.

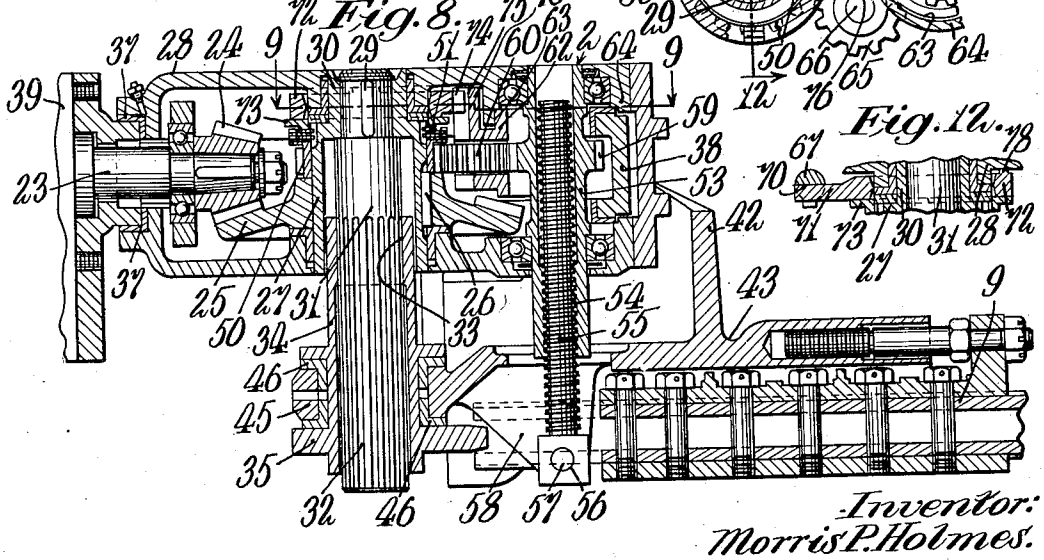


Fig. 12.

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MINING APPARATUS

Filed Feb. 27, 1933 6 Sheets-Sheet 6

Fig. 13.

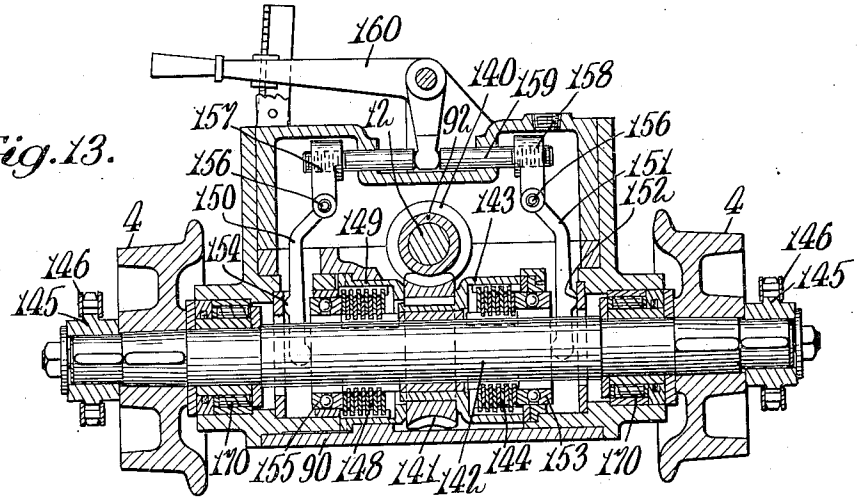


Fig. 14.

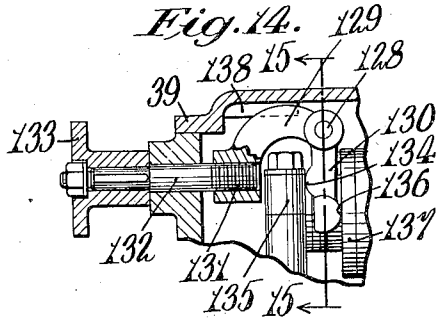


Fig. 15.

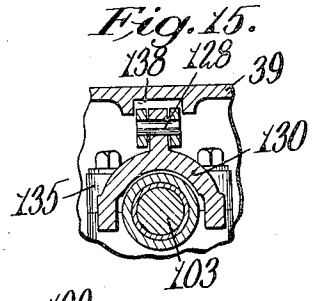


Fig. 16.

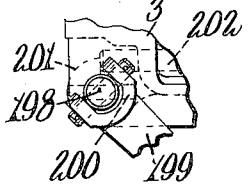


Fig. 17.

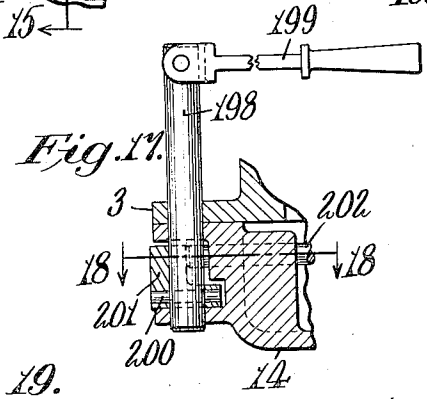


Fig. 18.

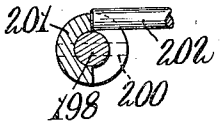
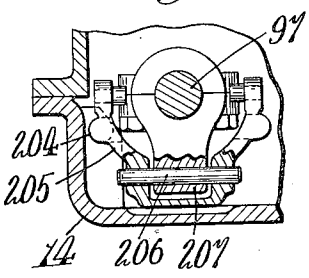


Fig. 19.



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Patented Feb. 11, 1936 2,030,065

UNITED STATES PATENT OFFICE

2,030,065

MINING APPARATUS

Morris P. Holmes, Claremont, N. H., assignor to Sullivan Machinery Company, a corporation of Massachusetts

Application February 27, 1933, Serial No. 658,802

62 Claims. (Cl. 262—28)

This invention relates to mining apparatus, and more particularly pertains to coal mining apparatus of the wheel mounted, track supported and guided, bottom cutting type.

An object of this invention is to provide an improved coal mining apparatus. Another object is to provide an improved coal mining apparatus of the wheel mounted, track supported and guided, bottom cutting type. A further object is to provide in a mining apparatus of the above character, an adjustable kerf cutter mechanism and improved and simplified means for adjusting the kerf cutting mechanism. Still another object is to provide improved means for propelling the apparatus along the mine trackway both during the cutting operation and transport. Still another object of this invention is to provide in a mining apparatus of the above character, improved kerf cutter swinging and adjusting means having associated therewith improved means for propelling the apparatus, the aforesaid means including improved variable speed driving means for effecting drive of the kerf cutter swinging and adjusting means and the propelling means at variable speeds to suit different mining conditions. A further object is to provide in a mining apparatus of the above character improved cutter adjusting and actuating means, the improved means herein being of the plural motor type wherein a plurality of motors are employed for driving the various mechanisms of the apparatus. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

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

In the drawings,—

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

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

Fig. 3 is an enlarged central longitudinally extending vertical sectional view taken substantially on line 3—3 of Fig. 1.

Fig. 4 is a horizontal sectional view taken substantially on line 4—4 of Fig. 3.

Fig. 5 is a longitudinally extending vertical sectional view taken substantially on line 5—5 of Fig. 4.

Fig. 6 is an enlarged horizontal sectional view taken substantially on line 6—6 of Fig. 2.

Fig. 7 is an enlarged plan view of the cuttter frame shown in Fig. 1 with parts shown in horizontal section to illustrate structural details.

Fig. 8 is a longitudinally extending vertical sectional view taken substantially on line 8—8 of Fig. 7.

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

Fig. 10 is a detail sectional view of the control rod shown in Fig. 9.

Fig. 11 is a detail sectional view taken on line 11—11 of Fig. 10.

Fig. 12 is a detail sectional view taken on line 12—12 of Fig. 9.

Fig. 13 is a transverse vertical sectional view taken substantially on line 13—13 of Fig. 1.

Fig. 14 is a detail sectional view taken on line 14—14 of Fig. 1.

Fig. 15 is a detail sectional view taken on line 15—15 of Fig. 14.

Fig. 16 is a fragmentary detail view showing a a portion of the control means for the cutter bar tilt and control clutches.

Fig. 17 is a detail sectional view taken substantially on line 17—17 of Fig. 4.

Fig. 18 is a detail sectional view taken on line 18—18 of Fig. 17.

Fig. 19 is a detail sectional view taken substantially on line 19—19 of Fig. 5.

In this illustrative embodiment of the invention there is shown a coal mining apparatus of the wheel mounted, track supported and guided, bottom cutting type generally comprising a self-propelled base 1 having mounted thereon an adjustable kerf cutting mechanism, generally designated 2. The base 1 is herein in the form of a wheeled truck comprising a low compact truck frame 3 adjustably mounted in the manner as hereinafter described on truck wheels 4 adapted to run along a usual mine trackway 5 laid on the mine bottom. Mounted in superimposed relation on this truck frame 3 for horizontal swinging movement relative thereto about a vertical axis at 6 and overhanging the forward end of the truck frame is a horizontal arm structure 7, said arm structure in turn having pivotally mounted thereon at 8 on the overhanging extremity thereof for horizontal swinging movement relative thereto the elongated plane cutter bar 9 of the kerf cutting mechanism. Carried at the rear end of the truck frame is a motor 10 for driving the cutting mechanism and a pair of motors 11, 11 herein directly connected together to operate in unison for driving the mechanisms for swinging and adjusting the cutter and for

propelling the apparatus along the mine trackway.

Now referring to the kerf cutting mechanism 2, and more particularly to the cutter driving means, it will be noted that the cutter driving motor 10, which is herein preferably of the constant speed, reversible electric type, has its power shaft horizontally disposed and extending longitudinally of the apparatus and fixed to an alined transmission shaft 12 suitably journaled at its rearward end within the front motor head and at its forward end within a bearing 13 supported within a bracket 14 herein formed integral with the truck frame. Keyed at 15 to the forward end of the transmission shaft 12, as shown in Fig. 3, is a bevel pinion 16 meshing with a large bevel gear 17 journaled for rotation about and supported on a vertical shaft 18 herein arranged with its axis coincident with the pivotal axis 6 of the arm structure 7. Formed integral with and driven by the bevel gear 17 is a bevel gear 19 meshing with a bevel gear 20 keyed to a transmission shaft 21 herein arranged with its axis extending radially with respect to the pivotal axis of the arm structure 7 and suitably journaled within the arm structure in the manner shown in Fig. 6. Alined with the shaft 21 and likewise suitably journaled within the arm structure and connected to the shaft 21 by a sleeve coupling 22 is a shaft 23. Keyed to the shaft 23 at its forward end, as shown in Figs. 6 and 8, is a bevel pinion 24 meshing with a large bevel gear 25 rotating about a vertical axis at the outer extremity of the arm structure and keyed at 26 to a tubular drive shaft 27. This tubular drive shaft is suitably journaled within the cutter frame 28 of the kerf cutting mechanism, and is herein arranged with its axis alined with the pivotal axis 8 of the cutter bar 9. Keyed at 29 to the upper reduced end portion 30 of the tubular shaft 27 is a vertical shaft 31 herein formed with longitudinal splineways 32 extending a substantial portion of its length and splined at 33 to the upper end of and having telescopically arranged therein a tubular drive shaft 34. This drive shaft has herein formed integral therewith a chain sprocket 35 which engages and drives a usual endless cutter chain 36 mounted for orbital movement about the margin of the cutter bar 9.

The cutter bar 9 is mounted on the rotatable cutter frame 28 for swinging movement therewith about the bar pivot axis 8 and is adjustable into different elevation positions relative to the cutter frame, as will now be described. The cutter frame 28 is rotatably mounted within upper and lower bearing sleeves 37, 37 encircling the cutter frame and supported by a rigid annular frame 38 rigidly secured to the forward end of the arm frame 39 and constituting the outer overhanging extremity of the arm structure 7. Formed integral with the cutter frame 28 are laterally projecting guides 40, 40 received in vertical guideways 41, 41 formed on an arcuate frame portion 42 integral with a cutter bar hanger 43 by which the cutter bar 9 is carried. These guideways are provided with adjustable bearing plates secured by screws to the guide portions 44 of the hanger frame, as shown in Fig. 7. The bar hanger 43 is provided with a bearing portion 45 carrying bearing sleeves 46, 46 interposed between a flange on the shaft and the chain sprocket 35, and the lower end of the shaft 34 is journaled within these sleeves. It will thus be seen that the cutter bar 9 is swingable with the cutter frame 28 relative to the annular frame 38 of the arm structure and that the cutter may be adjusted into different elevated positions relative to the cutter frame 28 by adjustment thereof along the vertical guides 40, 40.

The mechanism for adjusting the cutter bar vertically along the guides 40, 40 relative to the cutter frame 28 herein comprises a spur gear 50 rotatably mounted on the tubular shaft 27 and connectible in driving relation with the shaft by a multiple disc clutch 51 of a usual design. Herein arranged parallel with the shaft 27 in advance of the latter and likewise suitably journaled within the cutter frame 28 is a tubular shaft 53 having formed integral therewith at its lower end a nut 54 having internal threads meshing with the external threads of a vertical screw 55. The screw 55 is herein non-rotatable, and is pivotally connected at 56 at its lower end to a transverse pin 57 supported at its ends within spaced depending webs 58 integral with the cutter bar hanger 43. Formed integral with the shaft 53 is a spur gear 59 meshing with a spur gear 60 journaled on a vertical shaft 61 carried by a swingable gear mounting 62. This gear mounting is provided with an arcuate guiding portion 63 rotatably mounted within an arcuate bearing portion 64 herein formed integral with the cutter frame 28, the mounting being swingable horizontally about the axis of the tubular shaft 53. As shown in Fig. 9, the spur gear 60 meshes with a spur gear 65 journaled on a vertical shaft 66 arranged parallel with the shaft 61 and likewise mounted within the swingable gear mounting 62. When the mounting 62 is in the position as shown in Fig. 9, the spur gears 60 and 65 are both out of mesh with the teeth of the spur gear 50, but when the gear mounting is swung in one direction, the teeth of the gear 60 are brought into mesh with the gear 50, while when the gear mounting is swung in the opposite direction, the gear 65 is brought into mesh with the gear 50. It will thus be evident that, depending upon the position of the swingable mounting 62, the gear 59, and consequently the nut 54, may be rotated in one direction or the other, thereby to effect adjustment of the cutter bar upwardly or downwardly along the guideways 40, 40 relative to the cutter frame 28.

The means for applying the clutch 51 and for swinging the mounting 62 for the reversing gears 60, 65 will now be described. As shown in Fig. 7, journaled within the cutter frame 28 is an operating rod 67 having pivotally mounted thereon at 68 an operating lever 69. The inner end of the rod 67 is transversely slotted at 70, 70 to receive arms 71, 71 integral with a rotatable operating member 72 herein surrounding the reduced end 30 of the tubular shaft 27 and supported for rotative movement on the upper operating plate 73 of the clutch 51. Also formed integral with the member 72 is a tooth-like projection 74 fitted within a notch 75 formed on a projection 76 integral with the swingable reverse gear mounting 62. It will thus be seen that when the rod 67 is moved axially in one direction or the other, the operating member 72 is rotated, thereby shifting the reverse gear mounting 62 in one direction or the other to bring either the gear 60 or the gear 65 in mesh with the drive gear 50. Upon rotative movement of the rod 67, the sides of the slotted portions 70 act as cams to effect swinging of the operating member 72 downwardly about its fulcrum 78, thereby to apply the disc clutch 51. In this instance, interlock-

ing means is provided for preventing application of the clutch 51 prior to meshing engagement of one or the other of the gears 60, 65 with the gear 50 and comprises arcuate grooves 79 and 80 formed on the rod 67 and connected by a longitudinal groove 81. Cooperating with these grooves is a pin 82 secured to the cutter frame. When the rod 67 is in the position shown in Fig. 9, rotative movement thereof is prevented by the pin 82 engaging the sides of the longitudinal groove 81. When the rod 67 is slid either inwardly or outwardly to bring either the gear 60 or the gear 65 in meshing engagement with the drive gear 50, the pin 82 is brought into registry with one or the other of the arcuate grooves 79, 80, thereby permitting rotation of the rod 67 to effect application of the disc clutch 51.

Now referring to the mechanism for swinging the arm structure and cutter bar about their respective pivots, it will be observed that the motors 11, 11, which are herein preferably of the reversible variable speed electric type, are arranged with their power shafts 85, 85 in axial alinement on axes extending transversely of the machine and at the rear of the arm structure 7 as shown in Fig. 1. The motor power shafts have respectively fixed thereto bevel pinions 86 and 87, as shown in Fig. 4, both meshing with a large bevel gear 88. It will thus be evident that the two motors 11, 11 are directly connected together and during operation act as but a single motor, the two relatively small motors being provided instead of a single large motor merely to reduce the vertical dimensions of the apparatus. The bevel gear 88 is keyed to a tubular shaft 89 herein journaled within a gear housing 90 and arranged with its axis alined with and surrounding the transmission shaft 12. The shaft 89 is clutched at 91 at its forward end to a tubular worm shaft 92 which is in turn clutched at 93 to a tubular shaft 94, the shafts 92 and 94 likewise arranged with their axes coincident with and surrounding the transmission shaft 12, as shown in Fig. 4. Formed integral with the shaft 94 is a spur gear 95 meshing with a spur gear 96 keyed to a longitudinally extending shaft 97 herein arranged parallel with the shafts 89, 92, 94 and suitably journaled within the truck frame. Fixed to the shaft 97 is a worm 98 meshing with a worm wheel 99 keyed to the lower end of the vertical shaft 18, as shown in Fig. 3. Formed on and driven by the shaft 18 is a worm 100 meshing with and driving in opposite directions worm wheels 101 and 102, as shown in Fig. 6. In the present construction, these worm wheels are rotatably mounted on parallel shafts 103 and 104, respectively, arranged at opposite sides of the shaft 18 on longitudinally extending axes and spaced equidistantly from the axis of the shaft 18. These worm wheels are connectible to the shafts 103, 104, respectively, by multiple disc clutches 105 and 106. The shafts 103, 104 are suitably journaled within the arm frame 39, and are connectible by couplings 107, 107 to alined screw shafts 108 and 109, respectively. Threadedly engaging the screws 108, 109 are trunnion nuts 110 and 111, respectively, mounted within longitudinal guideways 112 formed in the arm frame and pivotally connected at 113 and 114, respectively, to pairs of link members 115 and 116 and the link members 115 are pivotally connected at 117 with a rotatable cutter frame 28, while the link members 116 are pivotally connected at 118 to a lug 119 formed integral with a frame member 120 secured to the frame of the truck. The arm frame 39 is provided with a circular guide flange 121 mounted within an arcuate guideway 122 formed in the frame 120, and is supported for rotative movement by a bearing sleeve 123. The arm structure 7 is guided during its swinging movement relative to the truck frame, by an arcuate guide 124 integral with the front portion of the truck frame and engaging an arcuate guideway 125 formed on the frame 39 of the arm structure. It will thus be seen that when the clutch 105 is applied, the screw shaft 108 may be rotated in one direction or the other, depending upon the direction of rotation of the motors 11, 11, thereby to swing the cutter bar 9 in either direction about its pivot through the trunnion nut and link connection 110, 115. It will also be seen that when the clutch 106 is applied, the screw shaft 109 may be rotated in one direction or the other depending upon the direction of rotation of the motors 11, 11 thereby to effect swinging of the arm structure 7 in either direction through the sliding trunnion nut and link connection 111, 116. By varying the speed of the motors 11, 11 the swinging speed of the cutter bar and arm structure may be varied as desired.

The operating means for each of the clutches 105, 106 is identical to the operating means for the other clutch, and therefore a description of one will suffice for both. As shown in Figs. 14 and 15, pivotally connected at 128 to an operating member 129 is a shipper yoke 130. This operating member is threadedly connected at 131 to a rod 132 having an operating handle 133. The shipper yoke 130 is fulcrumed at 134 against the forward face of the bearing bracket 135 for the rear shaft bearings and engages at 136 a pressure plate 137 for applying the clutch. The member 129 projects within and is guided by a longitudinal slot 138 formed on the frame of the arm structure, as shown. It will thus be seen that when the handle 133 is rotated, the shipper yoke 130 is swung about its fulcrum 134 thereby to move the pressure plate 137 axially to effect application of the clutch. It will thus be seen that the clutches 105, 106 may be independently or simultaneously applied at the will of the operator.

The improved mechanism for effecting truck wheel drive to propel the apparatus along the mine trackway both during cutting and transport, herein comprises a worm 140 formed on the worm shaft 92, as shown in Figs. 3 and 4, and meshing, as shown in Fig. 13, with a worm wheel 141 surrounding the rear axle 142 of the truck. This worm wheel is keyed to a clutch housing 143 connectible by a disc clutch 144 to the axle 142. Keyed to the opposite ends of the axle 142 are chain sprockets 145, 145 connected by endless chains 146, 146 to sprockets 147, 147 secured to the front truck wheels 4. It will thus be seen that when the clutch 144 is applied, the truck wheels may be driven at the desired speed and in either direction by the variable speed motors 11, 11 through the gearing 86, 87, 88, shaft 89 and worm gearing 140, 141. The truck wheels may be braked by a braking clutch 148 comprising discs connected to the rear axle 142 and interleaved with discs fixed to a brake housing 149 keyed to the gear housing 90. Operating means are provided for the clutch and brake so that when one is applied, the other is released, and comprises pivoted levers 150 and 151 for the brake and clutch, respectively. The lever 151 is fulcrumed at 152 and engages the pressure plate 153 for the clutch 144, while the lever 150 is fulcrumed at 154 and engages the pressure plate 155 for the

brake clutch 148. The upper ends of these levers are pivotally connected at 156 to operating members 157 and 158, respectively, these members being threadedly connected to the opposite ends of an operating rod 159. Engaging this operating rod is a pivoted operating lever 160. It will thus be seen that when the handle of the lever 160 is swung downwardly, the rod 159 is moved axially to the right as viewed in Fig. 13, thereby to apply the clutch 144 and release the brake 148. When the lever 160 is moved in the opposite direction the brake 148 is applied and the clutch 144 is released.

As mentioned above, the truck frame is adjustably mounted, and to afford such adjustment thereof the gear housing 90 is provided with bearing portions 165 and 166 mounted within bearing sleeves 167 carried within bearing supports 168 and 169 formed on the truck frame, as shown in Fig. 4. This bearing mounting on the gear housing 90 permits rocking movement of the truck frame about a longitudinal axis, i. e., the axis of the transmission shaft 12. The gearing housing 90 for the truck frame is also provided with journals 170, 170 within which the rear truck wheel axle 142 is rotatably mounted, and these journals form a pivotal mounting for the truck frame to enable tilting of the truck frame about a transverse axis, i. e., the axis of the rear axle 142. The improved mechanism for effecting such tilting movement of the truck frame to vary the angle in altitude of the cutting mechanism, herein comprises the gear 96 meshing with the gear 95, and the longitudinal shaft 97. Also meshing with the gear 95 is a gear 171 keyed to a longitudinally extending shaft 172 herein arranged parallel with the shaft 97 and at the opposite side of and equidistantly spaced from the axis of the vertical shaft 18, as shown in Fig. 4. The shafts 97 and 172 are respectively connectible by disc clutches 173 and 174 to alined shafts 175 and 176, respectively. In this instance, these shafts are connected by sleeve couplings 177 to alined screw shafts 178 and 179, respectively. These shafts are suitably journaled within the truck frame and respectively engaging the screw shafts 178 and 179 are non-rotatable, axially movable nuts 180 and 181, respectively, in turn respectively engaging the bifurcated arms 182 and 183 of bell-crank levers or arms 184. These bell crank levers, respectively, are connected to axles 185, 186 on which the front truck wheels 4 are journaled and each comprises spaced arms 187 and 188 having a common hub 189 keyed to a shaft 190 to which the lever 182 is also keyed. It will thus be seen that when the clutches 173, 174 are applied, the screw shafts 178, 179 may be rotated at the desired speed and in the desired direction by the motors 11, 11, thereby tilting the truck frame either upwardly or downwardly about the axis of the rear truck wheel axle. By releasing one or the other of the clutches 173, 174, one of the wheel levers may be swung while the other is stationary, thereby effecting tilting of the truck frame within its journal 165, 166 about a longitudinal axis. It is accordingly evident that by suitable adjustment of the levers connected to the front truck wheels the truck frame may be tilted relative to the horizontal, and as a result the angle in altitude of the cutter bar relative to the horizontal may be varied, it being possible to tilt the cutter bar about transverse and longitudinal axes thereby to enable the bar to accommodate itself to a rolling bottom or pitching coal seam. The drive chains 146, 146 for the front truck wheels are maintained under tension by spring pressed guide plates or shoes 195, 196 slidably engaging the upper and lower runs of the chains and maintained under tension by coiled springs 197, the spring pressed plates 195, 196 maintaining the chains at all times under tension during adjustment of the front tilting arms for the truck frame.

The operating means for the clutches 173, 174 will now be described. The operating means for both clutches are identical and therefore a description of one will suffice for both. Pivotally connected, as shown in Figs. 4, 16, and 17, to a vertical shaft 198, is a lever 199. The shaft 198 has fixed thereto by a pin 200, a cam member 201 engaging, as shown in Fig. 18, a horizontal operating rod 202. The forward end of this operating rod abuts at 203 a projection 204 integral with a shipper yoke 205 (see also Fig. 19). This shipper yoke is pivotally mounted on a pin 206 carried within the bearing bracket 207 for the forward bearing in which one of the shafts 97 or 172 is journaled. This shipper yoke engages the pressure plate 208 for the clutch. It will thus be seen that when the shaft 198 is rotated by the lever 199, the cam 201 effects axial movement of the rod 202, thereby to swing the shipper yoke 205 about its pivot, and as a result the pressure plate 208 is moved axially to apply the clutch. It will thus be seen that the clutches 173, 174 may be independently or simultaneously applied at the will of the operator.

Power may be supplied to the motors 10 and 11, 11 through a power conductor cable wound, in the usual manner, on a cable reel 210 under the control of a control apparatus 211 mounted on the truck frame. This control apparatus has a control lever 212 for controlling the motor 10 and a control lever 213 for controlling the variable speed motors 11, 11. The cable reel 210 may be driven in any suitable manner, herein preferably by an independent driving motor having suitable control apparatus, not shown.

The operation of the improved mining apparatus is as follows: The apparatus is propelled along the mine trackway at a high transport speed by the motors 11, 11 under the control of the control lever 213. The direction of high speed truck wheel drive may be reversed by reversing the motors 11, 11. When the working face is reached, the truck drive controlling clutch 144 is released, and upon application of the disc clutch 106, the screw 109 is rotated, thereby effecting swinging of the arm structure 7 horizontally relative to the truck frame through the trunnion nut and link connection from the central position shown in Fig. 1 to a position wherein the bar pivot 8 lies outside the trackway. As the arm structure is swung laterally, the clutch 105 may be applied to effect drive of the screw 108, thereby to effect swinging of the cutter bar about its pivot through the trunnion nut and link connection in the opposite direction until the parts assume an angularly related position with the tip end of the cutter bar at the right hand rib of the entry. The bar and arm swinging clutches 105, 106 are then released. The bar elevating nut 54 is then operated by bringing the proper gears 60, 65 in mesh with the spur gear 50, thereby lowering the cutter bar relative to the cutter frame to a position at the level of the mine bottom outside and below the level of the mine trackway, the gears 60, 65 thereafter being swung into an inoperative position. The motors

11, 11 are then suitably operated, and upon application of the truck wheel drive controlling clutch 144 the truck wheels are driven to propel the apparatus forwardly along the mine trackway at a low speed to sump the cutter bar beneath the coal. After the completion of the sumping cut, the clutch 144 is released and the brake 148 applied, thereby holding the truck wheels stationary, and the arm and bar swinging screws 106, 109 are then operated to swing the arm and cutter bar in opposite directions about their respective pivots until they assume a straight line position, the bar swinging screw thereafter being disconnected from its drive and the cutter bar swung about the axis 6 of the arm to effect its swinging cut across the coal face in advance of the trackway. When the tip end of the cutter bar reaches the left hand rib, the cutter bar is swung in the opposite direction until the parts assume an angularly related position, the arm and bar swinging mechanisms thereafter being disconnected from their respective drives. The brake 148 is then released, and upon application of the clutch 144 the apparatus is propelled rearwardly along the mine trackway by the motors 11, 11 to effect withdrawal of the cutter bar from beneath the coal. It will be evident that the arm 7 and cutter bar 9 may be independently or simultaneously swung about their respective pivots at variable cutting speeds under the control of the control apparatus for the variable speed motors 11, 11 and that the apparatus may be propelled by the motors 11, 11 at variable speeds. If it is desired to tilt the cutter bar to vary its angle in altitude during the horizontal cutting operation, this may be accomplished by operating the clutches 173, 174 controlling the tilting screws 178, 179, respectively, it being possible to tilt the cutter bar about longitudinal or transverse axes. The cutter bar may be adjusted to cut at different levels simply by operating the elevating screw and nut mechanism 54, 55 to raise and lower the cutter bar.

As a result of this invention, it will be noted that an improved wheel mounted, track supported and guided, bottom cutting type coal mining apparatus is provided having improved adjustable cutting mechanism whereby a horizontal kerf may be cut at the level of the mine bottom outside and below the level of the mine trackway and in advance of the trackway. It will further be noted that by the provision of the improved bar adjusting and swinging mechanisms and improved propelling means for the apparatus, it is possible to swing and adjust the cutter bar and to propel the apparatus in an improved manner. It will further be noted that by provision of a plurality of motors, the adjusting and swinging mechanisms for the cutter bar and the propelling mechanism for the apparatus are greatly simplified, it further being noted that by the provision of the variable speed motors it is possible to adjust and feed the cutting mechanism at variable speeds without the necessity of separate and relatively complicated speed varying transmission devices. These and other uses and advantages of the improved mining apparatus will be clearly apparent to those skilled in the art.

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

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

1. In a mining apparatus, a portable base, a frame mounted on said base to swing relative thereto, a kerf cutter pivotally mounted on said frame to swing relative thereto, a motor for actuating said kerf cutter, and a separate variable speed motor for swinging said frame and kerf cutter about their respective pivots, purely by motor control, through a wide range of cutting speeds.

2. In a mining apparatus, a portable base, a frame mounted on said base to swing relative thereto, a kerf cutter pivotally mounted on said frame to swing relative thereto, a motor for actuating said kerf cutter, and a separate variable speed motor for swinging said frame and kerf cutter about their respective pivots and for propelling said base all, purely by motor control, through a wide range of cutting speeds.

3. In a mining apparatus, a portable base, an arm structure pivotally mounted on said base to swing relative thereto, a kerf cutter pivotally mounted on said arm structure, a motor for actuating said kerf cutter, and a separate variable speed motor for swinging said arm structure relative to said base and said kerf cutter relative to said arm structure.

4. In a mining apparatus, a portable base, an arm structure pivotally mounted on said base to swing relative thereto, a kerf cutter pivotally mounted on said arm structure, a motor for actuating said kerf cutter, and a separate variable speed motor for swinging said arm structure and said kerf cutter about their respective pivots and for propelling said base.

5. In a mining apparatus, a portable base, an arm pivotally mounted on said base to swing horizontally relative thereto, a kerf cutter pivotally mounted on said arm to swing relative thereto, mechanism for adjusting the elevation of said kerf cutter relative to said arm, a motor on said base for actuating said kerf cutter and said kerf cutter adjusting mechanism, and a separate variable speed motor for swinging said arm and kerf cutter about their respective pivots, purely by motor control, through a wide range of cutting speeds.

6. In a mining apparatus, a portable base, an arm pivotally mounted on said base to swing horizontally relative thereto, a kerf cutter pivotally mounted on said arm to swing relative thereto, mechanism for adjusting the elevation of said kerf cutter relative to said arm, a motor on said base for actuating said kerf cutter and said kerf cutter adjusting mechanism, and a separate variable speed motor for swinging said arm and kerf cutter about their respective pivots and for propelling said base all, purely by motor control, through a wide range of cutting speeds.

7. In a mining apparatus, a portable base, an arm structure mounted on and overlying said base and at its forward extremity overhanging said base, a cutter frame mounted on the outer overhanging extremity of said arm structure for rotation relative thereto about a vertical axis and having vertical guides, a cutter support mounted on said cutter frame for vertical adjustment along said guides, a kerf cutter carried by said support, a motor for actuating said kerf cutter, and a separate motor for swinging said arm structure.

8. In a mining apparatus, a portable base, an arm structure mounted on and overlying said base

and at its forward extremity overhanging said base, a cutter frame mounted on the outer overhanging extremity of said arm structure for rotation relative thereto about a vertical axis and having vertical guides, a kerf cutter carried by said support, a motor for actuating said kerf cutter and for adjusting said kerf cutter along said guides, and a separate motor for swinging said arm structure relative to said base.

9. In a mining apparatus, a portable base, an arm structure mounted on and overlying said base and at its forward extremity overhanging said base, a cutter frame mounted on the outer overhanging extremity of said arm structure for rotation relative thereto about a vertical axis and having vertical guides, a cutter support mounted on said cutter frame for vertical adjustment along said guides, a kerf cutter carried by said support and swingable horizontally with said support and cutter frame relative to said arm structure, a motor for actuating said kerf cutter, and a separate motor for swinging said arm structure relative to said base and for swinging said kerf cutter with said support and cutter frame relative to said arm structure.

10. In a mining apparatus, a frame, an arm pivotally mounted on said frame to swing horizontally relative thereto, a cutter frame mounted on said arm for rotation relative thereto about a vertical axis parallel with the axis of arm swing and having vertical guides, a cutter support mounted on said cutter frame for rotation therewith and adjustable vertically along said guides, a kerf cutter carried by said support, a motor supported on said frame and relative to which said cutter frame is rotatable for actuating said kerf cutter, and a separate motor for rotating said cutter frame.

11. In a mining apparatus, a frame, an arm pivotally mounted on said frame to swing horizontally relative thereto, a cutter frame mounted on said arm for rotation relative thereto about a vertical axis parallel with the axis of arm swing and having vertical guides, a cutter support mounted on said cutter frame for rotation therewith and adjustable vertically along said guides, a kerf cutter carried by said support, a motor supported on said frame and relative to which said cutter frame is rotatable for actuating said kerf cutter and for adjusting said cutter support along said guides, and a separate motor for rotating said cutter frame.

12. In a mining apparatus, a frame, an arm pivotally mounted on said frame to swing horizontally relative thereto, a cutter frame mounted on said arm for rotation relative thereto about a vertical axis parallel with the axis of arm swing and having vertical guides, a cutter support mounted on said cutter frame for rotation therewith and adjustable vertically along said guides, a kerf cutter carried by said support and swingable horizontally with said support and cutter frame relative to said first mentioned frame, a motor supported on said first frame and relative to which said cutter frame is rotatable for actuating said kerf cutter, and a separate motor for rotating said cutter frame.

13. In a mining apparatus, a frame, an arm pivotally mounted on said frame to swing horizontally relative thereto, a cutter frame mounted on said arm for rotation relative thereto about a vertical axis parallel with the axis of arm swing and having vertical guides, a cutter support mounted on said cutter frame for rotation therewith and adjustable vertically along said guides, a kerf cutter carried by said support and swingable horizontally with said support and cutter frame relative to said first mentioned frame, a motor supported on said first frame and relative to which said cutter frame is rotatable for actuating said kerf cutter and for adjusting said support along said guides, and a separate motor for rotating said cutter frame.

14. In a mining apparatus, a portable base, an arm pivotally mounted on said base to swing horizontally relative thereto, a kerf cutter pivotally mounted on the outer extremity of said arm, and motor operated devices for swinging said arm and kerf cutter about their respective pivots at a wide range of speeds while the cutter speed remains substantially constant and including a variable speed driving motor by which said devices are driven and solely by the control of which said wide range of speeds is effected.

15. In a mining apparatus, a portable base, an arm pivotally mounted on said base to swing horizontally relative thereto, a kerf cutter pivotally mounted on the outer extremity of said arm, motor operated devices for swinging said arm and kerf cutter about their respective pivots at a wide range of speeds and including a variable speed driving motor, and a motor separate from said variable speed motor for actuating said kerf cutter.

16. In a mining apparatus, a portable base, a kerf cutter swingably mounted on said base for swinging at different times about different axes, motor operated devices for swinging said kerf cutter relative to said base about either axis at variable cutting speeds while the speed of the kerf cutter remains substantially constant, and motor operated devices for propelling said base at variable cutting speeds, said cutter swinging and base propelling devices including a common variable speed motor solely by the control of which said variable speeds are effected.

17. In a mining apparatus, a portable base, a kerf cutter swingably mounted on said base for swinging at different times about different axes, motor operated devices for swinging said kerf cutter relative to said base about either axis at variable cutting speeds, motor operated devices for propelling said base at variable cutting speeds, said cutter swinging and base propelling devices including a common variable speed motor solely by the control of which said variable speeds are effected, and a motor separate from said variable speed motor for actuating said kerf cutter.

18. In a mining apparatus, a portable base, an arm mounted on and overlying said base and at its outer extremity overhanging said base, a kerf cutter pivotally mounted on the overhanging extremity of said arm, motor operated swinging devices carried by said arm for independently swinging said arm and kerf cutter about their respective pivots, a motor carried by said base and relative to which said arm is swingable for actuating said kerf cutter, and a separate variable speed motor for operating said arm and kerf cutter swinging devices.

19. In a mining apparatus, a portable base, kerf cutting mechanism on said base including an arm swingable horizontally relative to said base and a kerf cutter pivotally mounted at its rear end on said arm about an axis located in advance of said base, a motor on said base for actuating said kerf cutter, and a separate variable speed motor for swinging said arm and kerf cutter purely by motor control about their pivots through a wide range of cutting speeds.

20. In a mining apparatus, a portable base, kerf cutting mechanism on said base including a horizontally swingable frame, a forwardly projecting kerf cutter having orbitally movable cutting means and pivoted on said frame about an axis located within the rear portion of the cutting means orbit, a motor for actuating said kerf cutter, and a separate variable speed motor for swinging said frame and kerf cutter about their respective pivots purely by motor control through a wide range of cutting speeds.

21. In a mining apparatus, a portable base, an elongated frame arranged in horizontal planes lying closely adjacent said base and at its forward extremity overhanging said base, said frame swingable horizontally over the top of said base, a cutter frame mounted on the outer overhanging extremity of said frame for rotation relative thereto about a vertical axis and having vertical guides depending therefrom and extending downwardly in advance of said first frame and base, a cutter support mounted on said cutter frame for rotation therewith and adjustable vertically along said guides, a kerf cutter carried by said support, a motor for actuating said kerf cutter, and a separate motor for rotating said cutter frame.

22. In a mining apparatus, a portable base, an elongated frame arranged in horizontal planes lying closely adjacent said base and at its forward extremity overhanging said base, said frame swingable horizontally over the top of said base, a cutter frame mounted on the outer overhanging extremity of said frame for rotation relative thereto about a vertical axis and having vertical guides depending therefrom and extending downwardly in advance of said first frame and base, a cutter support mounted on said cutter frame for rotation therewith and adjustable vertically along said guides, a kerf cutter carried by said support, a motor for actuating said kerf cutter and for adjusting said cutter support along said guides, and a separate motor for rotating said cutter frame.

23. In a mining apparatus, a portable base, an elongated frame arranged in horizontal planes lying closely adjacent said base and at its forward extremity overhanging said base, said frame swingable horizontally over the top of said base, a cutter frame mounted on the outer overhanging extremity of said frame for rotation relative thereto about a vertical axis and having depending vertical guides extending downwardly in advance of said first frame and base, a cutter support mounted on said cutter frame for rotation therewith and adjustable vertically along said depending guides, a kerf cutter carried by said support and swingable horizontally with said support and cutter frame relative to said first mentioned frame, a motor for actuating said kerf cutter, and a separate motor for rotating said cutter frame.

24. In a mining apparatus, a portable base, an elongated frame arranged in horizontal planes lying closely adjacent said base and at its forward extremity overhanging said base, said frame swingable horizontally over the top of said base, a cutter frame mounted on the outer overhanging extremity of said frame for rotation relative thereto about a vertical axis and having depending vertical guides extending downwardly in advance of said first frame and base, a cutter support mounted on said cutter frame for rotation therewith and adjustable vertically along said depending guides, a kerf cutter carried by said support and swingable horizontally with said support and cutter frame relative to said first mentioned frame, a motor for actuating said kerf cutter and for adjusting said support along said depending guides, and a separate motor for rotating said cutter frame.

25. In a mining apparatus, a portable base, an elongated frame arranged in horizontal planes lying closely adjacent said base and at its forward extremity overhanging said base, said frame swingable horizontally over the top of said base, a cutter frame mounted on the outer overhanging extremity of said frame for rotation relative thereto about a vertical axis and having vertical guides, a cutter support mounted on the outer overhanging extremity of said cutter frame beneath the latter for rotation therewith and adjustable vertically along said guides toward and from the bottom of said cutter frame, a kerf cutter mounted on said support beneath the latter, a motor for actuating said kerf cutter, and a separate motor for rotating said cutter frame.

26. In a mining apparatus, a portable base, an elongated frame arranged in horizontal planes lying closely adjacent said base and at its forward extremity overhanging said base, said frame swingable horizontally over the top of said base, a cutter frame mounted on the outer overhanging extremity of said frame for rotation relative thereto about a vertical axis and having vertical guides, a cutter support mounted on said cutter frame beneath the latter for rotation therewith and adjustable vertically along said guides toward and from the bottom of said cutter frame, a kerf cutter mounted on said support beneath the latter, a motor for actuating said kerf cutter and for adjusting said cutter support along said guides, and a separate motor for rotating said cutter frame.

27. In a mining apparatus, a portable base, an elongated frame arranged in horizontal planes lying closely adjacent said base and at its forward extremity overhanging said base, said frame swingable horizontally over the top of said base, a cutter frame mounted on the outer overhanging extremity of said frame for rotation relative thereto about a vertical axis and having vertical guides, a cutter support mounted on said cutter frame beneath the latter for rotation therewith and adjustable vertically along said guides toward and from the bottom of said cutter frame, a kerf cutter carried by said support beneath the latter and swingable horizontally with said support and cutter frame relative to said first mentioned frame, a motor for actuating said kerf cutter, and a separate motor for rotating said cutter frame.

28. In a mining apparatus, a portable base, an elongated frame arranged in horizontal planes lying closely adjacent said base and at its forward extremity overhanging said base, said frame swingable horizontally over the top of said base, a cutter frame mounted on the outer overhanging extremity of said frame for rotation relative thereto about a vertical axis and having vertical guides, a cutter support mounted on said cutter frame beneath the latter for rotation therewith and adjustable vertically along said guides toward and from the bottom of said cutter frame, a kerf cutter carried by said support beneath the latter and swingable horizontally with said support and cutter frame relative to said first mentioned frame, a motor for actuating said kerf cutter and for adjusting said support along said

guides, and a separate motor for rotating said cutter frame.

29. In a mining apparatus, a frame mounted for tilting movement relative to the horizontal, kerf cutting mechanism mounted on said frame including a pivoted kerf cutter, a motor on said tiltable frame for driving the kerf cutter, and a separate motor on said tiltable frame for effecting tilting of said frame.

30. In a mining apparatus, a frame mounted for tilting movement relative to the horizontal, kerf cutting mechanism mounted on said frame including a pivoted kerf cutter, a motor on said tiltable frame for driving the kerf cutter, and a separate motor on said tiltable frame for effecting tilting of said frame and for swinging said kerf cutter about its pivot.

31. In a mining apparatus, a frame mounted for tilting movement relative to the horizontal, kerf cutting mechanism mounted on said frame and including an arm swingable horizontally relative to said frame, and a kerf cutter pivotally mounted on said arm, a motor on said frame and relative to which said arm is swingable for driving said kerf cutter, and a separate motor on said frame and relative to which said arm is swingable for tilting said frame.

32. In a mining apparatus, a frame mounted for tilting movement relative to the horizontal, kerf cutting mechanism mounted on said frame and including an arm swingable horizontally relative to said frame, and a kerf cutter pivotally mounted on said arm, a motor on said frame and relative to which said arm is swingable for driving said kerf cutter, and a separate motor on said frame and relative to which said arm is swingable for tilting said frame and for swinging said arm relative to said frame.

33. In a mining apparatus, a frame mounted for tilting movement relative to the horizontal, kerf cutting mechanism mounted on said frame and including an arm swingable horizontally relative to said frame, and a kerf cutter pivotally mounted on said arm, a motor on said frame and relative to which said arm is swingable for driving said kerf cutter, and a separate motor on said frame and relative to which said arm is swingable for tilting said frame, for swinging said arm relative to said frame and for swinging said kerf cutter about its pivot.

34. In a mining apparatus, a portable base, a horizontally swingable arm structure pivotally mounted on and overlying said base and at its forward extremity overhanging said base, a cutter frame mounted on the outer overhanging extremity of said arm structure for rotation relative thereto about a vertical axis and having vertical guides, a cutter support mounted on said cutter frame for vertical adjustment along said guides, a kerf cutter carried by said support, a motor for driving said kerf cutter, and a separate motor for swinging said arm structure.

35. In a mining apparatus, a portable base, a horizontally swingable arm structure pivotally mounted on and overlying said base and at its forward extremity overhanging said base, a cutter frame mounted on the outer overhanging extremity of said arm structure for rotation relative thereto about a vertical axis and having vertical guides, a cutter support mounted on said cutter frame for vertical adjustment along said guides, a kerf cutter carried by said support and swingable horizontally with said support and cutter frame relative to said arm structure, a motor on said base for driving said kerf cutter, and a separate motor on said base for swinging said arm structure and kerf cutter about their respective pivots.

36. In a mining apparatus, a frame, a cutter frame mounted on said frame for rotation relative thereto about a vertical axis and having depending vertical guides extending downwardly from the upper portion thereof, a cutter support mounted on said cutter frame for rotation therewith and adjustable vertically along said depending guides, a kerf cutter carried by said support, a motor mounted on said first frame and relative to which said cutter frame is rotatable for driving said kerf cutter and for adjusting said cutter support, and a motor mounted on said first frame and relative to which said cutter frame is rotatable for rotating said cutter frame.

37. In a mining apparatus, a wheeled truck frame, an arm pivotally mounted on said truck frame for horizontal swinging movement relative thereto about a vertical axis located between the front and rear truck wheel axes, a kerf cutter pivotally mounted on the outer extremity of said arm, a motor on said truck frame for driving said kerf cutter, devices between the truck frame and the front truck wheels and separately or simultaneously adjustable to effect tilting of said truck frame about transverse and longitudinal axes, and a motor on said truck frame for driving said tilting devices.

38. In a mining apparatus, a wheeled truck frame, kerf cutting mechanism thereon, a motor on said truck frame for driving said kerf cutting mechanism, devices between the front truck wheels and said truck frame and independently or simultaneously adjustable to effect tilting of said truck frame about transverse and longitudinal axes, and a motor on said truck frame for driving said tilting devices.

39. In a mining apparatus, a portable base, an arm pivotally mounted on said base and overlying said base and at its outer extremity overhanging said base, a kerf cutter pivotally mounted on the overhanging extremity of said arm, a motor on said base for driving said kerf cutter, swinging devices carried by said arm for independently swinging said arm and kerf cutter about their respective pivots, and a motor on said base and relative to which said arm is swingable for actuating said swinging devices.

40. In a mining apparatus, a portable base, an arm mounted on and overlying said base and at its forward extremity overhanging said base, a kerf cutter pivotally mounted on the overhanging extremity of said arm, a motor on said base for driving said kerf cutter, screw and nut devices for independently swinging said arm and kerf cutter about their respective pivots, and a motor on said base and relative to which said arm is swingable for actuating said screw and nut devices.

41. In a mining apparatus, a portable base, an arm mounted on and overlying said base and at its forward extremity overhanging said base, a kerf cutter pivotally mounted on the overhanging extremity of said arm, a motor on said base for driving said kerf cutter, screw and nut devices carried by said arm for independently swinging said arm and kerf cutter about their respective pivots, and a motor on said base and relative to which said arm is swingable for actuating said screw and nut devices.

42. In a mining apparatus, a support, a frame swingably mounted thereon, a kerf cutter pivotally

mounted on said frame, a motor on said support for driving said kerf cutter, screw and nut devices for independently swinging said frame and kerf cutter about their respective pivots, and a motor on said support and relative to which said frame is swingable for actuating said screw and nut devices.

43. In a mining apparatus, a support, a frame swingably mounted thereon, a kerf cutter pivotally mounted on said frame, a motor on said support for driving said kerf cutter, screw and nut devices carried by said frame for independently swinging said frame and kerf cutter about their respective pivots, and a motor on said support and relative to which said frame is swingable for actuating said screw and nut devices.

44. In a mining apparatus, a portable base, a single rigid horizontal arm mounted on and overlying said base and at its outer extremity overhanging said base, said arm swingable horizontally relative to said base, a horizontal kerf cutter pivotally mounted on the overhanging extremity of said arm, and a motor on said base for driving said kerf cutter, and a separate motor on said base and relative to which said arm is swingable for independently swinging said arm and kerf cutter about their respective pivots.

45. In a mining apparatus, a portable base, a single rigid horizontal arm mounted on and overlying said base and at its outer extremity overhanging said base, said arm swingable horizontally relative to said base, a kerf cutter pivotally mounted on the overhanging extremity of said arm and adjustable relative to said arm into different elevated positions, a motor on said base for driving said kerf cutter and for adjusting said kerf cutter into aforesaid elevated positions relative to said arm, and a separate motor on said base and relative to which said arm is swingable for independently swinging said arm and kerf cutter about their respective pivots.

46. In a mining apparatus, a portable base, a single rigid horizontal arm mounted on and overlying said base and at its outer extremity overhanging said base, said arm swingable horizontally relative to said base, a horizontal kerf cutter pivotally mounted on the overhanging extremity of said arm, a motor on said base for driving said kerf cutter, a separate motor on said base and relative to which said arm is swingable for independently swinging said arm and kerf cutter about their respective pivots, and devices driven by said last mentioned motor for propelling said base.

47. In a mining apparatus, a portable base, a single rigid horizontal arm mounted on and overlying said base and at its outer extremity overhanging said base, said arm swingable horizontally relative to said base, a kerf cutter pivotally mounted on the overhanging extremity of said arm and adjustable relative to said arm into different elevated positions, a motor on said base for driving said kerf cutter and for adjusting said kerf cutter into aforesaid elevated positions relative to said arm, a separate motor on said base and relative to which said arm is swingable for independently swinging said arm and kerf cutter about their respective pivots, and devices driven by said last mentioned motor for propelling said base.

48. In a mining apparatus, a portable base, an arm structure pivotally mounted on said base to swing horizontally relative thereto, the forward extremity of said arm structure overhanging the forward end of said base, a cutter frame pivotally mounted on the outer overhanging extremity of said arm structure for rotation about an axis parallel with the arm structure axis and having depending vertical guideways extending downwardly in advance of said base, a cutter support mounted on said guideways for vertical adjustment therealong and swingable with said cutter frame relative to said arm structure, a kerf cutter carried by said cutter support, said cutter frame and cutter support being swingable relative to said arm to swing said kerf cutter about the axis of said cutter frame, a motor on said base and relative to which said arm structure is swingable for driving said kerf cutter, and a separate motor on said base and relative to which said arm structure is swingable for rotating said cutter frame relative to said arm structure.

49. In a mining apparatus, a portable base, an arm structure pivotally mounted on said base to swing horizontally relative thereto, the forward extremity of said arm structure overhanging the forward end of said base, a cutter frame pivotally mounted on the outer overhanging extremity of said arm structure for rotation about an axis parallel with the arm structure axis and having depending vertical guideways extending downwardly in advance of said base, a cutter support mounted on said guideways for vertical adjustment therealong and swingable with said cutter frame relative to said arm structure, a kerf cutter carried by said cutter support, said cutter frame and cutter support being swingable relative to said arm to swing said kerf cutter about the axis of said cutter frame, a motor on said base and relative to which said arm structure is swingable for driving said kerf cutter and for adjusting said cutter support vertically along said guideways, and a separate motor on said base and relative to which said arm structure is swingable for rotating said cutter frame relative to said arm structure.

50. In a mining apparatus, a wheel supported truck frame adapted to run along a mine trackway, horizontal kerf cutting mechanism carried by said truck frame, a motor carried by said truck frame for driving said kerf cutting mechanism, means for tilting said truck frame about transverse and longitudinal axes relative to a horizontal plane including the truck wheel axes including separate axle mountings for the front truck wheels, arms pivotally connected to said axle mountings and swingably mounted on the truck frame about axes offset from the truck wheel axes, and separate adjusting means for independently swinging said arms, and a motor mounted on said truck frame for driving said adjusting means.

51. In a mining apparatus, a support tiltable with respect to the horizontal, an arm pivotally mounted on said support to swing horizontally relative thereto, a kerf cutter pivotally mounted on said arm, a motor on said support and relative to which said arm is swingable for driving said kerf cutter, and a separate motor on said support for tilting the latter and for swinging said arm and kerf cutter about their respective pivots.

52. In a mining apparatus, a support tiltable with respect to the horizontal, an arm mounted on said support to swing horizontally relative thereto, a frame mounted on said arm for adjustment into different elevated positions with respect thereto, a kerf cutter pivotally mounted on said frame, a motor mounted on said support and relative to which said arm is swingable for driv-

ing said kerf cutter and for adjusting said frame relative to said arm, and a separate motor on said support and relative to which said arm is swingable for tilting said support, for swinging said arm and for swinging said kerf cutter.

53. In a mining apparatus, a support tiltable with respect to the horizontal, an arm pivotally mounted on said support to swing horizontally relative thereto, a kerf cutter pivotally mounted on said arm, a motor on said support and relative to which said arm is swingable for driving said kerf cutter, a separate motor on said support for tilting the latter and for swinging said arm and kerf cutter about their respective pivots, and means driven by said last mentioned motor for propelling said support.

54. In a mining apparatus, a support tiltable with respect to the horizontal, an arm mounted on said support to swing horizontally relative thereto, a frame mounted on said arm for adjustment into different elevated positions with respect thereto, a kerf cutter pivotally mounted on said frame, a motor mounted on said support and relative to which said arm is swingable for driving said kerf cutter and for adjusting said frame relative to said arm, a separate motor on said support and relative to which said arm is swingable for tilting said support, for swinging said arm and for swinging said kerf cutter, and means driven by said last mentioned motor for propelling said support.

55. In a mining apparatus, a frame, a cutter frame mounted on said frame for rotation relative thereto about a vertical axis and having depending vertical guides extending downwardly below the bottom of said first frame, a cutter support mounted on said cutter frame beneath the latter for rotation therewith and adjustable vertically along said guides, a kerf cutter carried by said support, a motor supported on said first frame and relative to which said cutter frame is rotatable and disposed in planes below the top of said cutter frame for actuating said kerf cutter, and a separate motor for rotating said cutter frame.

56. In a mining apparatus, a frame, a cutter frame mounted on said frame for rotation relative thereto about a vertical axis and having depending vertical guides extending downwardly below the bottom of said first frame, a cutter support mounted on said cutter frame beneath the latter for rotation therewith and adjustable vertically along said guides, a kerf cutter carried by said support, a motor supported on said frame and relative to which said cutter frame is rotatable and disposed in planes below the top of said cutter frame for actuating said kerf cutter and for adjusting said cutter support along said guides, and a separate motor for rotating said cutter frame.

57. In a mining apparatus, a portable base of relatively low overall height, a horizontal kerf cutter, means for swingably supporting said kerf cutter on said base comprising but a single rigid horizontal arm mounted on and disposed in horizontal planes closely adjacent the top of said base in overlying relation with respect to the latter, said rigid arm at its forward extremity overhanging the forward end of said base and swingable horizontally relative to said base about a vertical axis, said horizontal kerf cutter pivotally mounted on the forward overhanging extremity of said rigid arm, a motor on said base at the rear of said arm and relative to which said arm is swingable for actuating said kerf cutter, and a separate motor on said base at the rear of said arm and relative to which said arm is swingable for independently swinging said arm and kerf cutter about their respective pivots, said motors disposed within the vertical limits of the apparatus below the top surface of said arm.

58. In a mining apparatus, a portable base of relatively low overall height, a horizontal kerf cutter, means for swingably supporting said kerf cutter on said base comprising but a single rigid horizontal arm mounted on and disposed in horizontal planes closely adjacent the top of said base in overlying relation with respect to the latter, said rigid arm at its forward extremity overhanging the front end of said base and swingable horizontally relative to said base about a vertical axis, said kerf cutter being pivotally mounted on the forward overhanging extremity of said arm and adjustable relative to said arm into different elevated positions between the lower surface of said arm and the mine floor, a motor on said base at the rear of said arm and relative to which said arm is swingable for actuating said kerf cutter and for adjusting said kerf cutter into aforesaid differently elevated positions relative to said arm, and a separate motor on said base at the rear of said arm and relative to which said arm is swingable for independently swinging said arm and kerf cutter about their respective pivots, said motors disposed within the vertical limits of the apparatus below the top surface of said arm.

59. In a mining apparatus, a portable base of relatively low overall height, a horizontal kerf cutter, means for swingably supporting said kerf cutter on said base comprising but a single rigid horizontal arm mounted on and disposed in horizontal planes closely adjacent to the top surface of said base, said rigid arm at its forward extremity overhanging the front end of said base and swingable horizontally relative to said base about a vertical axis, said kerf cutter pivotally mounted on the forward overhanging extremity of said arm, a motor on said base at the rear of said arm and relative to which said arm is swingable for actuating said kerf cutter, and a separate motor on said base at the rear of said arm and relative to which said arm is swingable for independently swinging said arm and kerf cutter about their respective pivots and for propelling the apparatus, said motors disposed within the vertical limits of the apparatus below the top surface of said arm.

60. In a mining apparatus, a portable base of relatively low overall height, a horizontal kerf cutter, means for swingably supporting said kerf cutter on said base comprising but a single rigid horizontal arm mounted on and disposed in horizontal planes closely adjacent to the top surface of said base, said rigid arm at its forward extremity overhanging the front end of said base and swingable horizontally relative to said base about a vertical axis, said kerf cutter pivotally mounted on the forward overhanging extremity of said arm and adjustable relative to said arm into different elevated positions between the bottom of said arm and the mine floor, a motor on said base at the rear of said arm and relative to which said arm is swingable for actuating said kerf cutter and for adjusting said kerf cutter into aforesaid differently elevated positions relative to said arm, and a separate motor on said base at the rear of said arm and relative to which said arm is swingable for independently swinging said arm

and kerf cutter about their respective pivots and for propelling the apparatus, said motors disposed within the vertical limits of the apparatus below the top surface of said arm.

61. In a mining apparatus, a portable base of relatively low overall height, a horizontal kerf cutter, means for swingably supporting said kerf cutter on said base comprising but a single rigid horizontal arm mounted on and disposed in horizontal planes closely adjacent the top surface of said base in overlying relation with respect to the latter, said rigid arm at its forward extremity overhanging the forward end of said base and swingable horizontally relative to said base about a vertical axis, the forward overhanging extremity of said arm having depending vertical guideways extending downwardly in advance of said base and disposed below the top surface of said arm, a cutter support adjustable vertically along said guideways between the bottom surface of said arm and the mine floor, said kerf cutter carried by said cutter support and swingable with said support horizontally relative to said arm about an axis parallel with the arm pivot axis, a motor on said base at the rear of said arm and relative to which said arm is swingable for actuating said kerf cutter, and a separate motor on said base at the rear of said arm and relative to which said arm is swingable for independently swinging said arm and kerf cutter about their respective pivots, said motors arranged within the vertical limits of the apparatus below the top surface of said arm.

62. In a mining apparatus, a portable base of relatively low overall height, a horizontal arm pivotally mounted on said base to swing horizontally relative thereto about a vertical axis and arranged in horizontal planes closely adjacent to the top surface of said base, the forward extremity of said arm overhanging the forward end of said base, depending vertical guideways carried by the forward overhanging extremity of said arm and extending downwardly in advance of said base below the top surface of said arm, a cutter support mounted on said guideways below the bottom surface of said arm for vertical adjustment therealong between the bottom surface of said arm and the mine floor, a kerf cutter carried by said cutter support, said kerf cutter swingable horizontally relative to said arm in any adjusted position of said cutter support along said guideways about an axis parallel to the arm pivot axis, a motor carried by said base at the rear of said arm and relative to which said arm is horizontally swingable for actuating said kerf cutter and for adjusting said cutter support vertically along said guideways, and a separate motor carried by said base at the rear of said arm and relative to which said arm is horizontally swingable for swinging said arm and kerf cutter about their respective pivots and for propelling the apparatus.

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