July 12, 1927. 1,635,780

F. CARTLIDGE

MINING MACHINE

Filed May 1, 1918 7 Sheets-Sheet 1

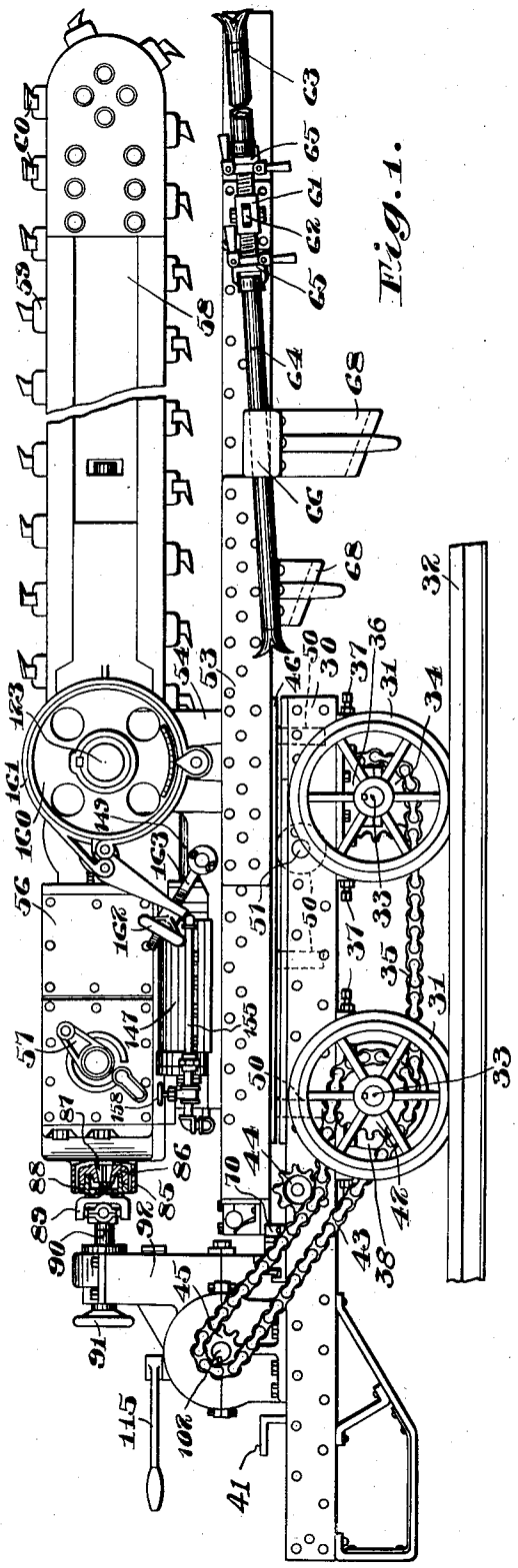


Fig. 1.

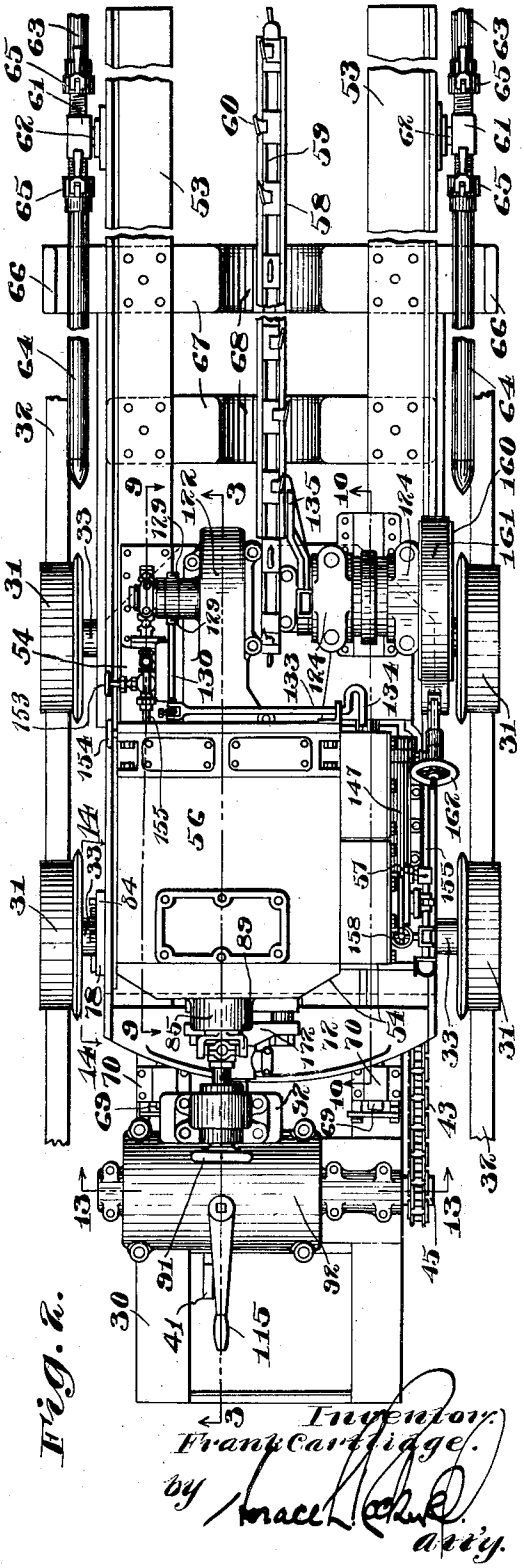


Fig. 2.

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July 12, 1927. 1,635,780

F. CARTLIDGE

MINING MACHINE

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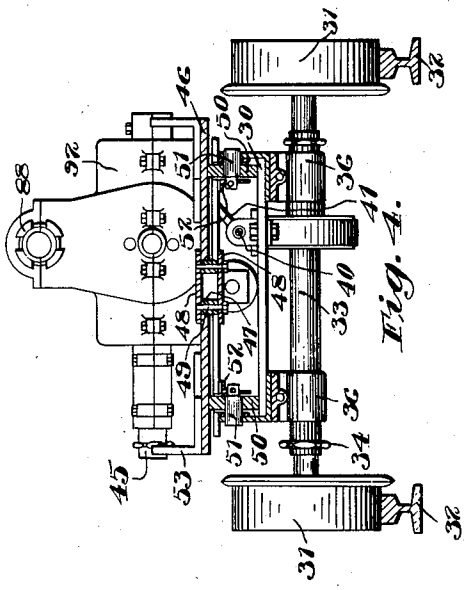


Fig. 4.

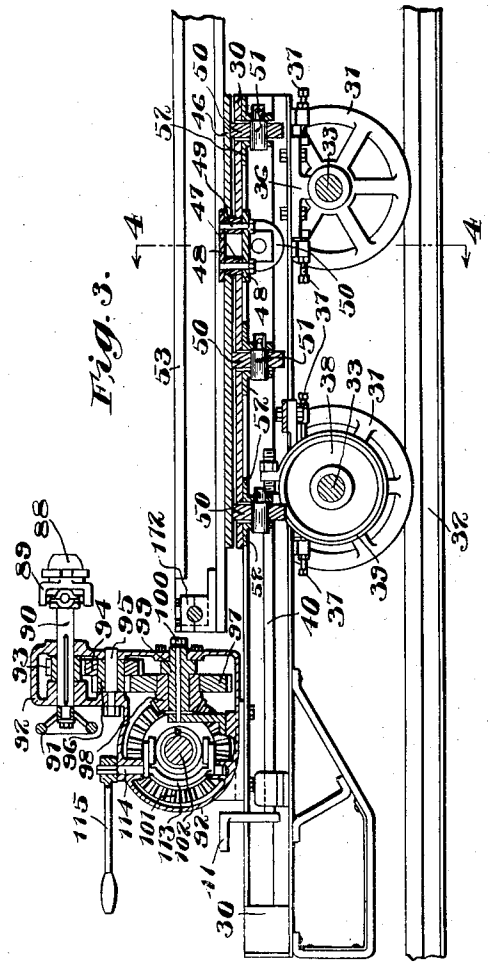


Fig. 3.

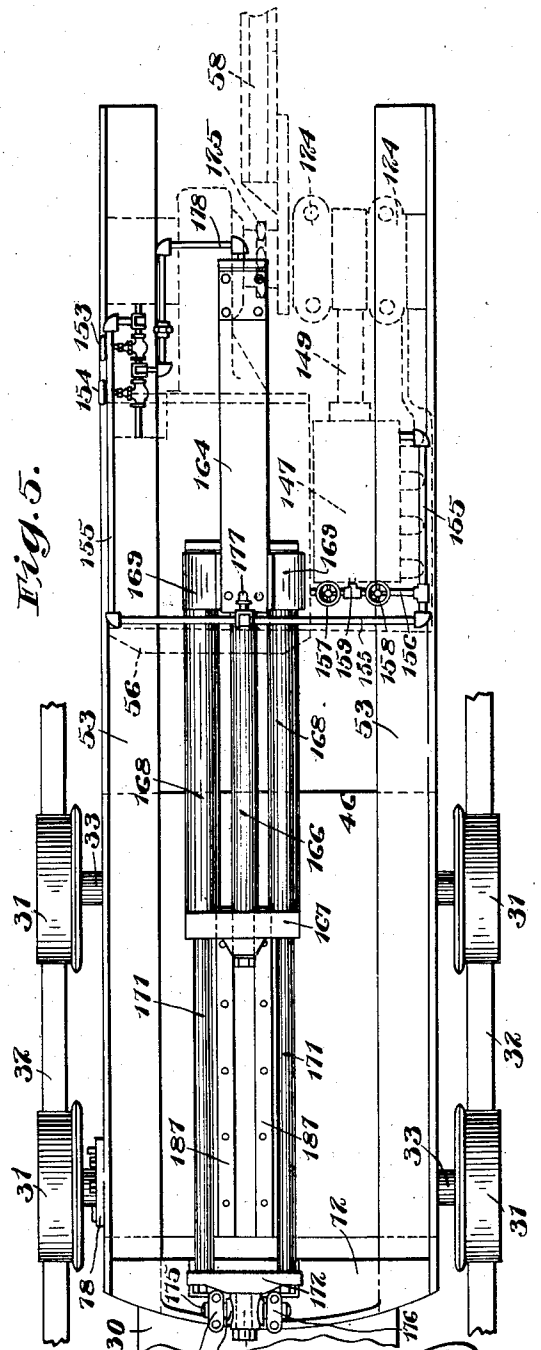


Fig. 5.

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July 12, 1927. 1,635,780

F. CARTLIDGE

MINING MACHINE

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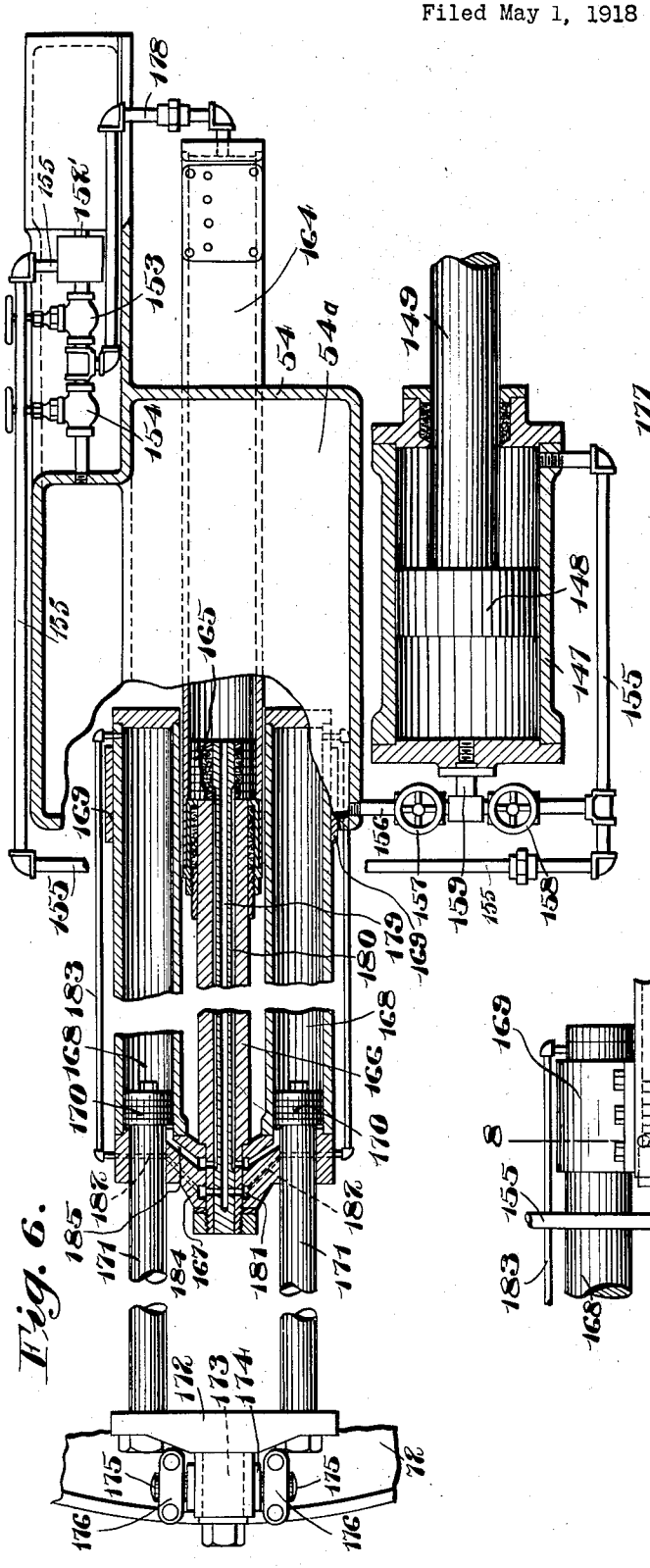


Fig. 6.

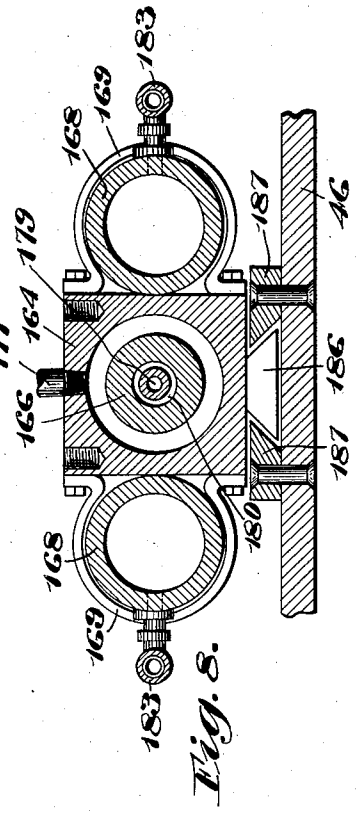


Fig. 8.

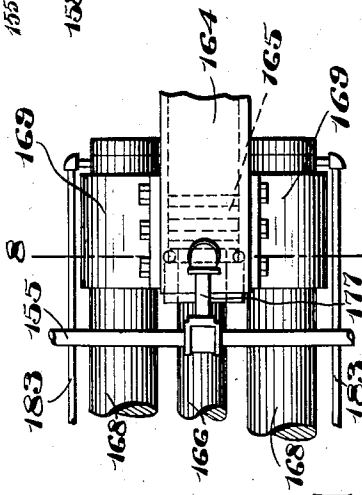


Fig. 7.

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F. CARTLIDGE

MINING MACHINE

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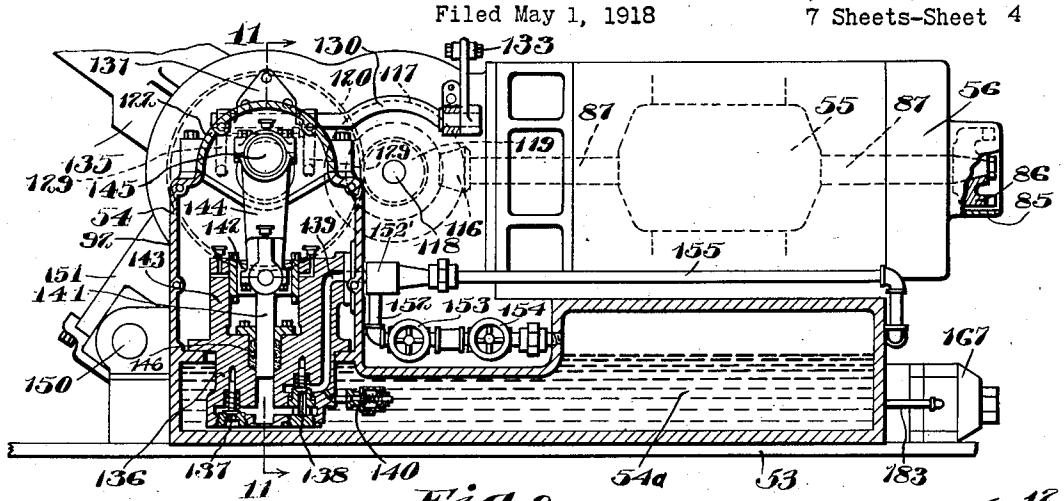


Fig. 9.

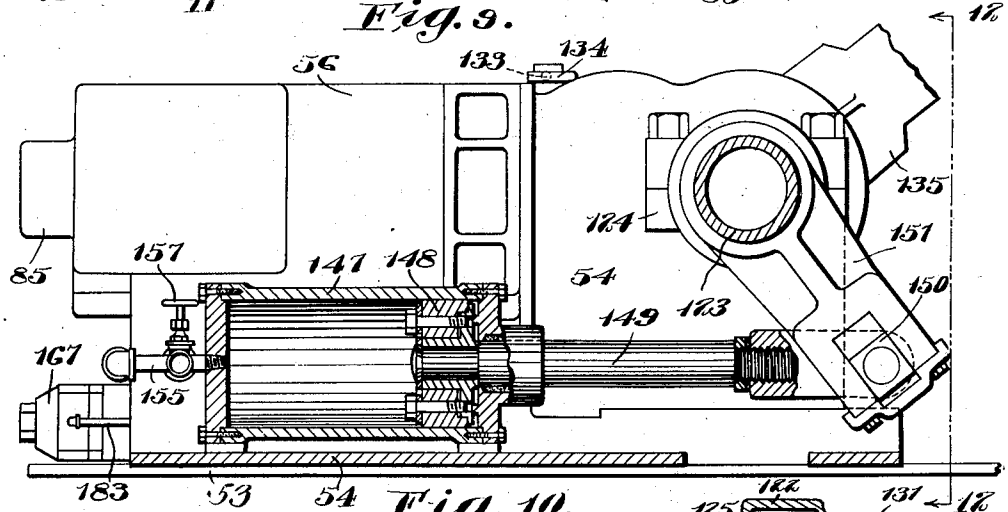


Fig. 10.

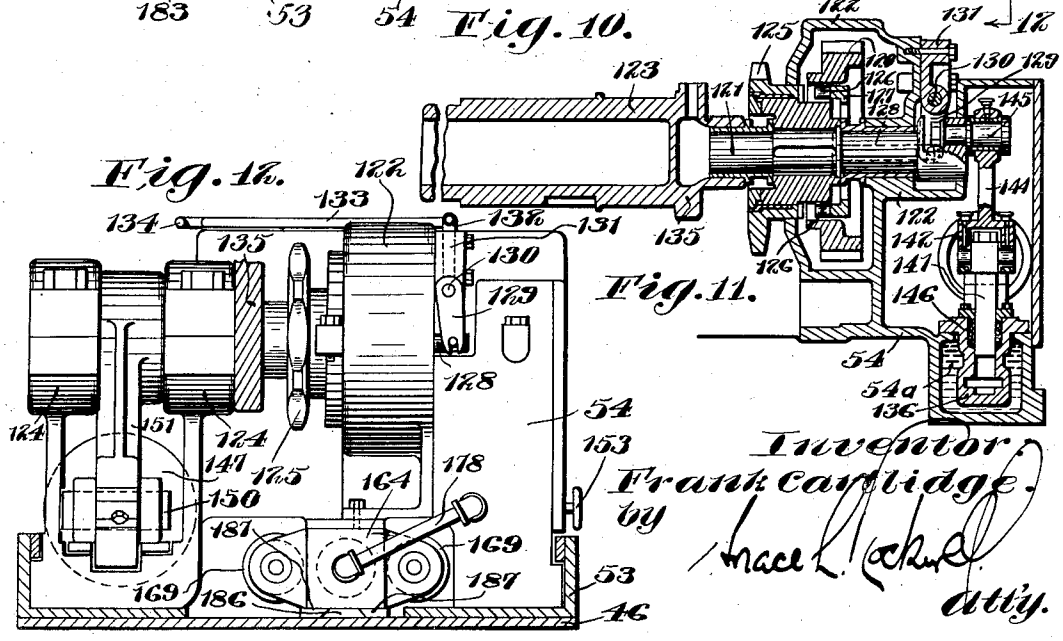


Fig. 11.

Fig. 12.

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July 12, 1927. 1,635,780

F. CARTLIDGE

MINING MACHINE

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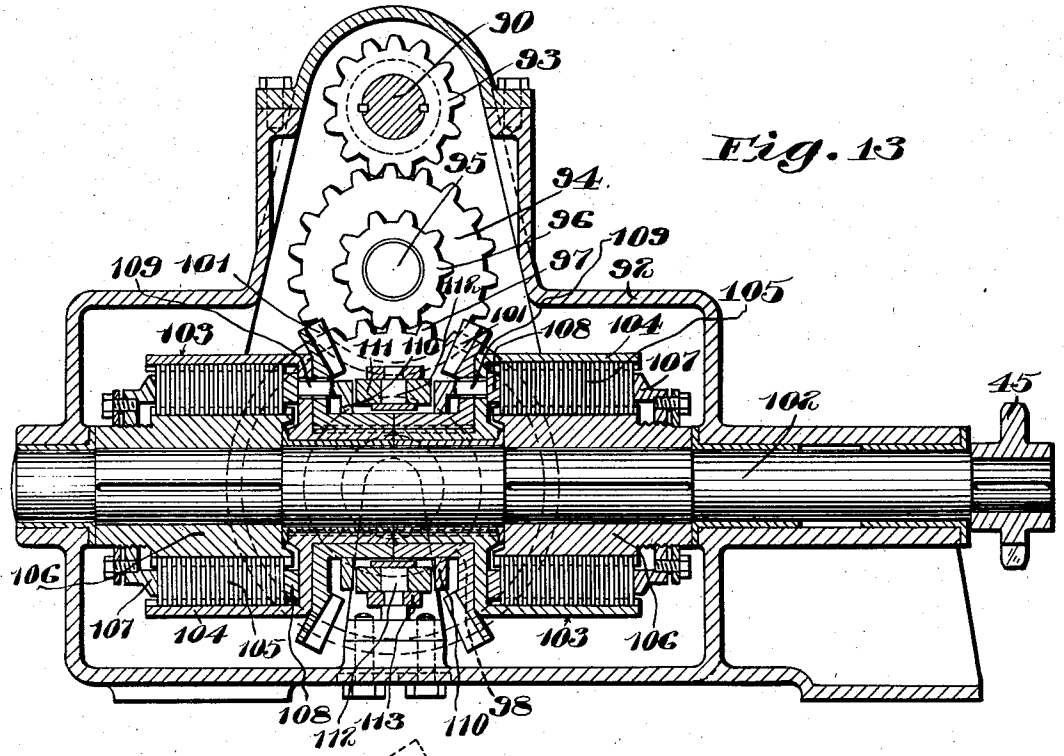


Fig. 13

Fig. 14.

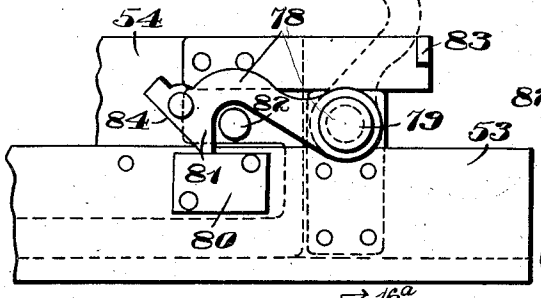
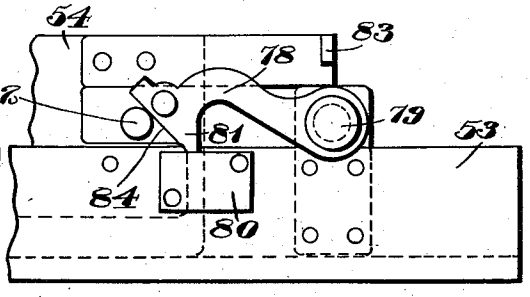


Fig. 15.



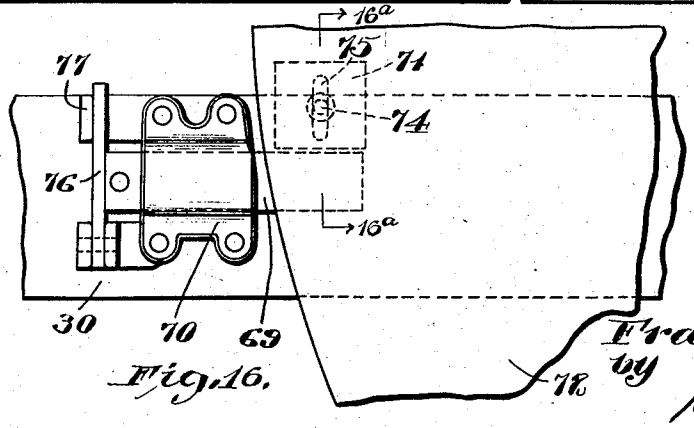


Fig. 16.

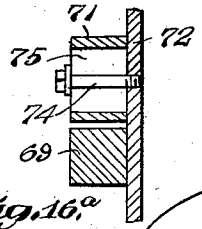


Fig. 16a.

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F. CARTLIDGE

MINING MACHINE

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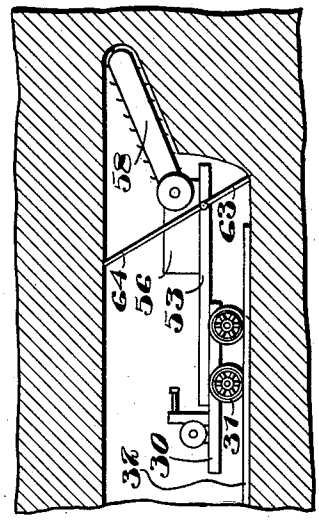


Fig. 19.

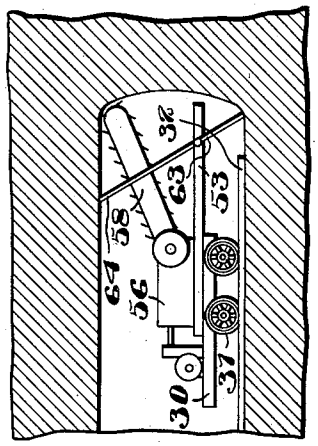


Fig. 18.

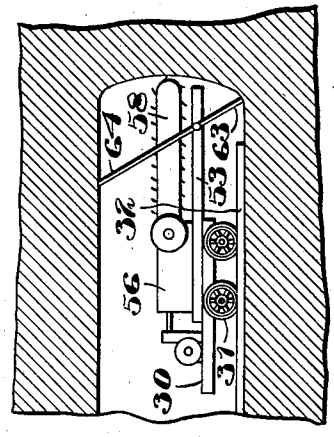


Fig. 17.

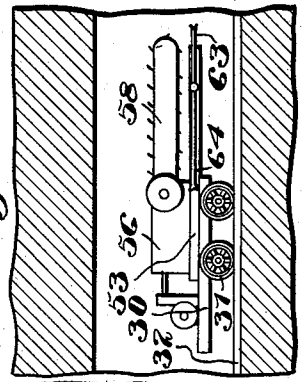


Fig. 22.

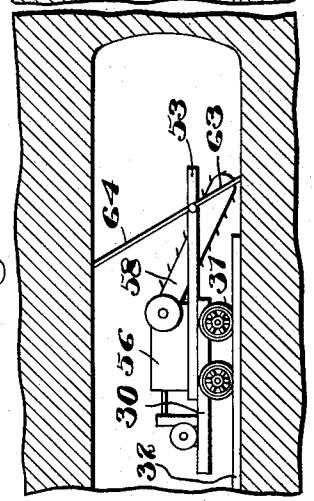


Fig. 21.

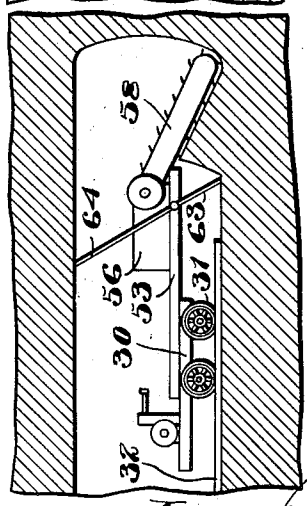


Fig. 20.

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F. CARTLIDGE

MINING MACHINE

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Fig. 23

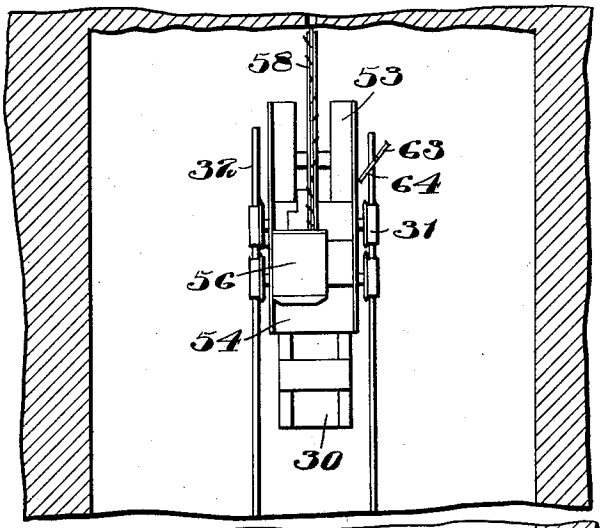


Fig. 24.

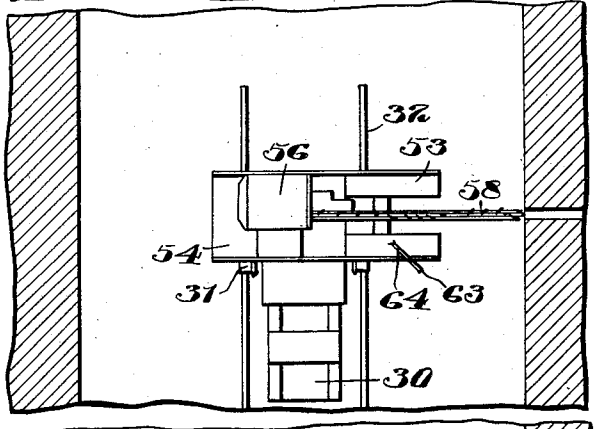
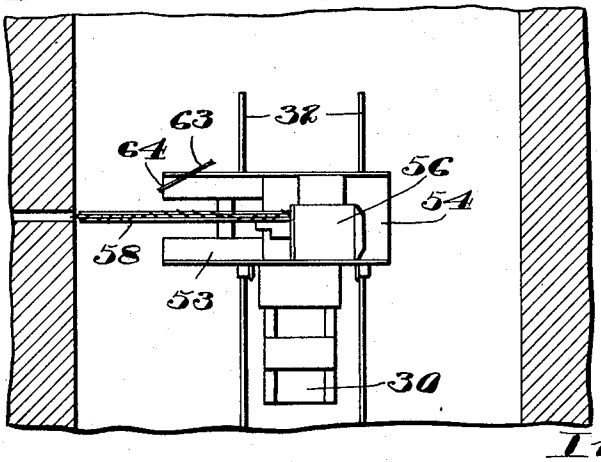


Fig. 25.



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by
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Patented July 12, 1927. 1,635,780

UNITED STATES PATENT OFFICE.

FRANK CARTLIDGE, OF CLAREMONT, NEW HAMPSHIRE, ASSIGNOR TO SULLIVAN MACHINERY COMPANY, A CORPORATION OF MASSACHUSETTS.

MINING MACHINE.

Application filed May 1, 1918. Serial No. 231,915.

This invention relates to mining machines, and more particularly, although not exclusively, to shearing machines, that is to say, to machines adapted to cut vertical kerfs in the face being operated upon.

The invention has for its general object to provide a new and improved machine of this character of practical construction and adapted to perform its intended function in a convenient and efficient manner, and to this end said invention, in its preferred form, subject, however, to considerable variation as to the construction, arrangement, and application of certain of its features, comprises a truck mounted, self-propelled machine adapted to cut a kerf of considerable depth in substantially any desired vertical plane, and consists in certain novel constructions, arrangements, and combinations of parts constituting the cutting appliances, the means for supporting, guiding, and transporting said cutting appliances, the mechanisms for actuating and controlling the same, and certain auxiliary parts associated therewith.

The foregoing and other more particular objects of the invention, together with means whereby the same may be carried into effect, will best be understood from the following description of one form or embodiment thereof illustrated in the accompanying drawings.

In said drawings,—

Fig. 1 is a side elevation of the complete machine.

Fig. 2 is a plan view thereof.

Fig. 3 is a longitudinal section, taken substantially on the line 3—3, Fig. 2, of the truck and turret with the cutting mechanism removed.

Fig. 4 is a transverse section on the line 4—4, Fig. 3.

Fig. 5 is a plan view of the turret, a portion of the truck, and a portion of the motor mechanism for moving the cutting mechanism, the latter being removed and a part of the piping being shown diagrammatically to facilitate illustration.

Fig. 6 is an enlarged plan view, partly in horizontal section, of the hydraulic motor mechanism for moving the cutting mechanism toward and from the work and for swinging the cutter bar, a part of the piping and valve controls being shown diagrammatically.

Fig. 7 is a fragmentary plan view of certain of the parts broken away in Fig. 6.

Fig. 8 is a transverse vertical section substantially on the line 8—8, Fig. 7.

Fig. 9 is a longitudinal section taken in the longitudinal vertical plane of the line 9—9 of Fig. 2, said section not being extended through the mining machine motor proper.

Fig. 10 is a longitudinal section taken in the longitudinal vertical plane of the line 10—10 of Fig. 2, said section not being extended through the mining machine motor proper.

Fig. 11 is a fragmentary transverse vertical section taken substantially on the line 11—11, Fig. 9.

Fig. 12 is an end elevation, partly in section on the line 12—12, Fig. 10.

Fig. 13 is a vertical transverse section, substantially on the line 13—13, Fig. 2.

Fig. 14 is a detail elevation taken on the line 14—14, Fig. 2 of the latch mechanism for securing the cutting mechanism in position on the turret.

Fig. 15 is a view similar to Fig. 14, showing the parts in a slightly different position.

Fig. 16 is a detail plan view of one of the latches for locking the turret against angular movement on the truck.

Fig. 16^a is a transverse sectional view thereof taken substantially on the line 16^a—16^a of Fig. 16.

Figs. 17 to 22, inclusive, are diagrammatic views in elevation, and Fig. 23 a diagrammatic view in plan, illustrating the operation of the machine in entry cutting.

Figs. 24 and 25 are diagrammatic views in plan, illustrating the operation of the machine in cutting kerfs in other vertical planes.

Referring to Figs. 1 and 2, the machine comprises a truck 30 mounted on wheels 31 adapted to run on tracks 32 on the mine bottom, said wheels being mounted on axles 33 carrying sprocket wheels 34 connected by a sprocket chain 35, said axles 33, as shown in Fig. 3, being preferably journaled in brackets 36 adjustable longitudinally of the truck frame by means of abutment screws

37, in order to take up undue slack in the chain 35. The rearmost axle 33, as shown in Fig. 3, is preferably provided with a brake drum 38 with which cooperates a band brake 39 operated through a screw shaft 40 by a suitable crank 41. Said last named axle 33, as shown in Fig. 1, is also provided with a sprocket 42 connected by a chain 43, passing over an idler sprocket 44, with a sprocket 45 forming a part of the truck propelling mechanism hereinafter more fully described.

Mounted on the truck for angular movement about a vertical axis, is a turret comprising a turntable 46 pivoted to the truck platform by means of a suitable bushing 47 (see Figs. 3 and 4) passing through aligned openings in said platform and turntable and secured in place in said openings by plates 48 connected by bolts 49 passing through said bushing. The turntable 46 is supported for rotary movement about the axis of the bushing 47 by means of rollers 50 journaled on studs 51 carried by brackets 52 bolted or otherwise secured to the under face of the truck platform, said rollers projecting through suitable openings in said platform.

Said turret is provided with a pair of parallel ways 53 arranged substantially in a horizontal plane, in which ways the cutting mechanism is slidably mounted for longitudinal movement. Said cutting mechanism comprises a frame or body 54 (a bottom portion of which, as herein shown, is formed hollow to constitute a liquid tank or reservoir 54^a for purposes hereinafter explained), an electric or other motor 55 (see dotted lines, Fig. 9) in a suitable casing 56 (Figs. 1 and 2), said motor having suitable controlling devices 57, and a cutter bar 58 carrying a cutter chain 59 provided with cutter bits 60 and actuated, through connections hereinafter described, by the motor 55, said cutter bar being pivoted to swing about a horizontal axis extending transversely of the machine, and, when so swung, moving in a substantially vertical plane between the ways 53.

Each of the ways 53 carries at its outer side a jack comprising a central or intermediate member 61 pivoted at 62 to the corresponding way, and oppositely extending lower and upper end members 63 and 64 independently adjustable with respect to the intermediate member 61 by means of nuts 65 carried by the inner ends of said members 63 and 64 and engaging threaded end portions of the intermediate member 61, which threaded portions are received within the members 63 and 64 which are made hollow for this purpose. By this construction, it will be seen that each of the jacks is rendered independently extensible in either or both directions from its pivot. When in use, the jacks are turned about their pivots 62 into more or less upright positions to cause the members 63 and 64 to engage, at their ends, the mine bottom and roof, respectively, as hereinafter more fully explained. At other times, as when the machine is being transported from place to place, said jacks are turned into the approximately horizontal position shown in Figs. 1 and 2, the members 64 thereof being supported by brackets 66 carried by one of the cross members 67 which connect, space, and brace the ways 53, said members being depressed at their central portions, as shown most clearly at 68 in Fig. 1, to permit the cutter bar 58 to be swung downwardly to the maximum extent about its pivot.

When the apparatus is being transported from place to place, and in the operation of entry cutting, the turret occupies a position in which the ways 53 extend substantially parallel to the length of the truck body 30, as shown in Figs. 1 to 4. For the purpose of so positioning the turret, and for locking the same in this position, there is provided a pair of bolts 69 (Figs. 2 and 16) slidably mounted in brackets 70 secured to the truck platform and engaging blocks 71 which are secured to the under side of a cross bar 72 connecting the rear ends of the ways 53, as by cap screws 74 passing through slots 75 in said blocks, whereby said blocks are rendered slightly adjustable in order to vary the angular position of the turret, as may be required. For the purpose of retaining the bolts 69 in position to engage the blocks 71, there are provided swinging latches 76 each pivoted at one end to a bracket 70 and engaging at its central portion the end of the corresponding bolt 69, and at its opposite end a fixed lug 77. It will be evident that by projecting the proper one of the bolts and then swinging the turret to transport position, the latter will be stopped when proper position is reached.

When the machine is idle, or when the same is being transported from place to place, the cutting mechanism occupies its rearmost position in the ways 53, as shown in Figs. 1 and 2. To retain said machanism in this position, there is provided a vertically swinging gravity latch 78 (see Figs. 2, 14, and 15) pivoted at 79 to one of the ways 53 and limited in its downward swinging movement by a lug or stop 80 projecting from the side of said way. Said latch is formed with a hook portion 81 adapted to engage a lug or stud 82 projecting from the side of the frame or body 54, thereby locking the cutting mechanism against forward movement, as shown in full lines in Fig. 14. In order to release the cutting mechanism, to permit the same to move forwardly in the ways 53, the latch 78 is raised by hand into the position shown in dotted lines in Fig. 14, said latch, when in this position, resting against a second lug or projection 83 on the body 54. As said

body 54 moves forwardly, the projection 83 causes the latch 78 to be returned to its operative position, as shown in Fig. 15, the lug 82 having, however, at this time passed beyond the hook 81. The forward end of the latch 78 is beveled, as at 84, whereby, as the body 54 is returned to its rearmost position, the lug 82 will, by engagement with said beveled end, raise said latch and, after passing beneath the hook 81, permit said latch to return to normal position, as shown in Fig. 14.

At its rear end, the motor casing 56 is provided with a socket 85 (see Figs. 1, 2, and 9) within which is a clutch member 86 carried by the end of a rearwardly extending portion of the shaft 87 of the motor 55 (Fig. 9). The clutch member 86 is adapted, when the turret is in its normal position above referred to, and the cutting mechanism is in its rearmost position, to be engaged by a cooperating clutch member 88 (see also Figs. 3 and 4) connected by a universal joint 89 with a short shaft 90 slidably and rotatably mounted in bearings in an upright gear casing 92 supported by the truck body 30 adjacent the rear end thereof, said shaft being preferably provided at its outer end with a suitable handle herein shown as a wheel 91. The shaft 90 constitutes a primary driving shaft. By moving the shaft 90 longitudinally by means of the hand wheel 91, the clutch member 88 may be engaged with or disengaged from the clutch member 86, and when disengaged may be withdrawn from the socket 85, thereby permitting the turret to turn, the socket 85 protecting said clutch member 86 against accidental injury when said turret is so turned.

The shaft 90 has a splined connection with a pinion 93 (Figs. 3 and 13) which meshes with a gear 94 journaled on a stud 95 supported by the gear casing 92, said gear 94 having a pinion portion 96 which meshes with a spur gear 97 on the hub of a beveled gear 98 rotatably mounted on a stud shaft 99 secured, as by a bolt 100, in the gear casing 92. The gear 98 meshes with two oppositely disposed beveled gears 101 loosely mounted on a shaft 102 suitably journaled in the casing 92 and carrying at its end the truck propelling sprocket 45 (see also Fig. 1). Said gears 101 may be alternatively clutched to the shaft 102, to cause the truck to be propelled in either direction, by means of friction clutches, designated as a whole by the numeral 103 (Fig. 13), each comprising a shell 104 having a hub upon which the corresponding gear 101 is rotatably mounted, a series of friction disks 105, alternate disks being in notched engagement with the shell 104, and the remaining disks being in notched engagement with a sleeve 106 keyed or otherwise secured to the shaft 102, the outermost disk engaging an abutment ring 107 in threaded, and consequently adjustable, engagement with the sleeve 106. The innermost disk 105 of each clutch 103 is engaged by a clutch controlling ring 108 which, when moved toward the abutment ring 107, will cause the disks 105 to be pressed into engagement with one another, thereby rendering the clutch operative, as will be familiar to those skilled in the art. Each of the rings 108 is connected, by means of one or more pins or rods 109 passing through openings in the corresponding shell 104 and gear 101, with a ring 110 loosely mounted on the hub of said gear 101, said pins 109 serving to connect each gear 101 with the corresponding shell 104 for rotation therewith. Located intermediate the rings 110 is an annulus 111 which, by movement in one direction or the other, will engage one or the other of the rings 110, thereby rendering the corresponding clutch 103 operative to connect its gear 101 with the shaft 102. Said annulus is provided with trunnions 112 which are engaged by a clutch fork 113 (see Fig. 3) operable by means of a shaft 114 journaled in the gear casing 92 and having at its outer end an operating handle 115. The collars 107 permit an independent adjustment of the clutches 103, thereby making it possible conveniently to provide for a neutral position of the clutch controlling mechanism in which the lever 115 is substantially in alignment with the length of the truck, as shown in Fig. 2.

The motor shaft 87 is provided at its end opposite the clutch member 86 with a beveled pinion 116 (Fig. 9) which meshes with a beveled gear 117 on a shaft 118 suitably journaled in the body 54. Fast on the shaft 118 is a pinion 119 which meshes with a gear 120 (see also Fig. 11) having a hub keyed or otherwise secured to a shaft 121 journaled at one end in a suitable cover 122 (which, together with a suitably formed portion of the body 54, constitutes a gear casing), and at its opposite end in the end of a hollow shaft 123 journaled in bearings 124 (see Fig. 12) supported by the body 54. Loosely mounted on the hub of the gear 120 is a sprocket 125 which drives the cutter chain 59, said sprocket being adapted to be clutched to the gear 120 for rotation therewith by means of clutch pins 126 carried by a ring or annulus 127 connected by links 128 with arms 129 secured to a shaft 130 journaled in a bracket 131 secured to the gear cover 122, said shaft 130 having an arm 132 to which is connected a slide rod or clutch shifter 133 having a handle 134 (see also Fig. 2), whereby the actuation of the feed chain 59 may be controlled.

The shaft 123 is provided with an arm 135 (Figs. 2, 11, and 12) to which the cutter

bar 58 is secured, said arm and cutter bar being slightly offset to bring the latter substantially into alignment with the sprocket 125.

For moving the cutting mechanism longitudinally in the ways 53, and also for swinging the cutter bar 58 about its axis, fluid pressure (preferably hydraulic) mechanism is employed, said mechanism comprising the reservoir 54ª, above referred to, and which contains a suitable liquid, preferably oil, a hydraulic motor for moving the cutting mechanism in its ways, a hydraulic motor for swinging the cutter bar about its pivot, pressure mechanism, herein shown as a pump, for drawing liquid from the reservoir 54ª and delivering the same under pressure to said motors, and suitable conduit and valve devices for distributing and controlling the supply of pressure to said motors.

The pressure pump, as shown most clearly in Figs. 9 and 11, comprises a pump cylinder 136 having an inlet valve 137 controlling communication between said cylinder and the tank or reservoir 54ª, and an outlet valve 138 controlling an outlet passage 139 having a spring loaded relief valve 140 adapted to discharge liquid from said outlet passage into the tank or reservoir 54ª when the pressure in said passage becomes excessive. Cooperating with the pump cylinder 136 is a solid piston or plunger 141 extending through a stuffing box 146 and carried by a crosshead 142 guided in ways 143 formed on the cylinder 136 and connected by a pitman 144 with a crank pin 145 carried by the end of the shaft 121, whereby said piston is reciprocated in said cylinder to draw liquid from the tank 54ª and force the same into the discharge passage 139.

Referring particularly to Figs. 6 and 10, the motor for swinging the cutter bar upon its axis comprises a cylinder 147 suitably supported by a portion of the body 54, and within which is a piston 148 to which is connected at its forward side a piston rod 149 pivoted at its opposite end to a block 150 slidably mounted in the forked end of an arm 151 fixed to the shaft 123, whereby reciprocation of the piston 148 in the cylinder 147 causes angular movement of said shaft 123, and consequent swinging movement of the cutter bar carried thereby, forward movement of said piston causing said cutter bar to be swung upwardly and rearward movement thereof causing said bar to be swung downwardly. Communicating through a pipe union 152′ with the discharge passage 139 of the pump, is a pipe 152 having two cut-off valves 153 and 154 and communicating at its opposite end with the tank or reservoir 54ª. Communicating with the pipe 152 between the pump and the first valve 153, is a pipe 155 leading to the forward end of the cylinder 147. Leading from the pipe 155 and communicating at its opposite end with the tank or reservoir 54ª, is a pipe 156 having two cut-off valves 157 and 158, said pipe having a branch 159 leading therefrom between said valves and communicating with the rear end of the cylinder 147.

The cross sectional area of the piston rod 149 is preferably less than one-half of the cross sectional area of the piston 148, so that, while the pressure area at the forward side of said piston is less than the pressure area at the rear side of said piston, it is greater than the cross sectional area of the piston rod. It will be observed that when the valve 158 is open and the valve 157 is closed, the pipes 155 and 156 constitute conduit means connecting the opposite ends of the cylinder 147 and communicating also with the source of pressure, or pump. At this time, both sides of the piston 148 will be subjected to equal pressure, but inasmuch as the area of the rear side of the piston is greater than that of the forward side thereof, the total pressures will be unbalanced, causing the piston to move forwardly. During this forward movement, the liquid in the forward end of the cylinder will be forced through the pipes 155 and 156 into the rear end thereof, so that the liquid supplied by the pump will be only sufficient to compensate for the difference between the two piston pressure areas. In other words, the volume of liquid required to cause the piston 148 to travel forwardly a given distance will be equal to that distance multiplied by the cross sectional area of the piston rod 149. If the valve 158 be closed and the valve 157 opened, liquid will be forced by the pump into the forward end only of the cylinder 147, the liquid in the rear end of said cylinder being discharged or exhausted therefrom through the pipes 159 and 156 into the tank or reservoir 54ª. At this time, the amount of liquid supplied by the pump will correspond to the pressure area at the forward side of the piston 148, that is to say, the volume of liquid required to cause the piston to travel rearwardly a given distance, will be equal to that distance multiplied by the pressure area at the forward side of the piston. From the foregoing it will be seen that, the supply of liquid delivered by the pump being constant, the ratio of the speed of forward travel of the piston to the speed of rearward travel thereof will be equal to the ratio of the forward piston pressure area to the cross sectional area of the piston rod 149. As above stated, the forward pressure area of the piston 148 is greater than the cross sectional area of the piston rod 149, so that the forward movement of said piston will be at greater speed than the rearward movement thereof, thus providing for a relatively rapid upward swinging movement of the cutter bar

and a relatively slow downward swinging movement thereof.

By closing both of the valves 157 and 158, the liquid in the rear end of the cylinder 147 will be trapped therein, while the forward end of said cylinder will be subjected to the pump pressure applied through the pipe 155. Inasmuch as at this time the piston 148 cannot, on account of the trapped liquid, move rearwardly under the influence of the pressure applied to the forward side thereof, said piston will be held stationary, thereby holding the cutter bar with considerable rigidity in any angular position into which it may have been swung. At this time, the excess liquid delivered under pressure by the pump to the outlet passage 139 will be discharged therefrom through the loaded relief valve 140 into the tank or reservoir 54ª, the loading of said relief valve determining the pressure or force with which said cutter bar is held in adjusted position.

As an auxiliary means for holding said cutter bar against angular movement, as when the pump is idle during times when the machine is not in operation, or when repairs are being made, the shaft 123 is provided with a brake drum 160 (see Figs. 1 and 2) with which cooperates a brake band 161 adapted to be tightened about said drum by means of a hand nut 162 on a threaded rod 163 pivoted to the body 54. The brake 161 may also be employed to supplement the action of the hydraulic motor in holding the cutter bar against swinging movement, should such additional holding means be at any time necessary or desirable.

Referring to Figs. 5 to 8, the motor for moving the cutting mechanism longitudinally in the ways 53 comprises a hydraulic cylinder 164 which, for convenience, comprises a prism of square cross sectional form and having a cylindrical bore. The cylinder 164 is located in a recess in the under side of the body 54, and is bolted or otherwise secured thereto. Operating in the cylinder 164 is a piston 165 having a piston rod 166 to which is secured a crosshead 167 having a dove-tailed projection 186 guided in undercut ways 187 on the turret. The crosshead 167 carries a pair of cylinders 168 arranged parallel to the cylinder 164 and longitudinally movable in guides 169 carried by said cylinder 164. Working in the cylinders 168 are pistons 170 having piston rods 171 guided in the crosshead 167 and connected at their ends by a crosshead 172 having a stem 173 swiveled in a block 174 having trunnions 175 journaled in brackets 176 carried by the cross bar 72. By the foregoing, it will be seen that rearward movement of the pistons 165 and 170 in the cylinders 164 and 168 will cause forward movement of the body 54 in the ways 53, while movement of said pistons in the opposite direction in their respective cylinders will cause rearward movement of said body.

Leading from the pipe 155 is a branch pipe 177 communicating with the rear end of the cylinder 164, while leading from the pipe 152 between the valves 153 and 154, is a pipe 178 communicating with the forward end of said cylinder. The piston rod 166 is formed with two concentric passages 179 and 180, the former communicating with the cylinder 164 in advance of the piston 165, and the latter communicating with said cylinder in rear of said piston. The passage 179 communicates with a chamber 181 in the crosshead 167, which chamber communicates, through passages 182 in said crosshead, with pipes 183 leading to the forward ends of the cylinders 168. The passage 180 communicates with a chamber 184 in the crosshead 167, said chamber communicating, in turn, through passages 185 in said crosshead, with the rear ends of the cylinders 168.

By these connections, it will be seen, the forward ends of all three cylinders are in communication with one another, as are also the rearward ends thereof, so that fluid pressure in either end of any cylinder will be communicated to the corresponding ends of the other cylinders. It will also be seen that the connections above described between the cylinders 164 and 168 and the pump, on the one hand, and between said cylinders and the tank or reservoir 54ª, on the other, are substantially similar to the corresponding connections, above described, to and from the cylinder 147. It will therefore be understood that, by closing the valve 154 and opening the valve 153, the cylinders 164 and 168 will be caused to move forwardly with respect to their respective pistons, that by closing the valve 153 and opening the valve 154 said cylinders will be caused to move rearwardly with respect to said pistons, and that by closing both valves 153 and 154 said cylinders will be held immovable with respect to their respective pistons. The cross sectional areas of the piston rods 166 and 171, however, are substantially equal to one-half of the cross sectional areas of their respective pistons, so that the smaller pressure area at the rear of each piston is substantially equal to the cross sectional area of the corresponding piston rod. The speed of travel of the cylinders 164 and 168 relative to their pistons will therefore be the same in both directions, rather than more rapid in one direction than in the other, as in the case of the piston 148 and cylinder 147, the difference in speed in the latter case being, as above explained, due to the difference between the cross sectional area of the piston rod and the smaller pressure area of the piston.

In Figs. 17 to 23 is illustrated the operation of the machine in entry cutting, that is

to say, in cutting kerfs in substantially the vertical plane of the center line of the machine. In Fig. 22 the machine is illustrated as in condition for transportation about the mine, the turret being in its normal angular position with the ways 53 extending longitudinally of the machine, the clutch shifter 133 being in a position to disconnect the cutter chain sprocket 125 from the gear 120, the valves 153, 154, 157, and 158 being closed to retain the cutting mechanism in its rearmost position and the cutter bar in a horizontal position, the clutch 86, 88 and one of the clutches 103 being in engagement to connect the truck propelling mechanism with the motor 55, and the jacks being in horizontal position in their brackets 66. Having arrived at the end of an entry which is to be further driven, the clutch controlling lever 115 is moved into neutral position to stop the travel of the truck, the jacks are turned into an inclined position, as shown in Fig. 17, and the lower and upper ends thereof adjusted to engage firmly the bottom and roof of the mine, respectively, thereby rigidly bracing the ways 53 against movement in any direction, and the clutch shifter 133 operated to start the cutter chain. The valve 158 is then opened (the valve 157 remaining closed) to cause the cutter bar 58 to be swung upwardly into the position shown in Fig. 18, this upward movement being an idle one and being, as above explained, relatively rapid. The valve 158 is then closed, thereby rigidly retaining the cutter bar in this position. The valve 153 is then opened (the valve 154 remaining closed) to cause a forward movement of the cutting mechanism, thereby causing the cutter bar to enter the face to produce the sumping cut, as shown in Fig. 19. The valve 153 is then closed, causing the cutting mechanism to be rigidly held in its forward position, and the valve 157 opened, causing the piston 148 to move slowly backwardly and the cutter bar to be swung downwardly from the position shown in Fig. 19 into that shown in Fig. 20, thereby making a vertical cut. The valve 157 being again closed to cause the cutter bar to be rigidly held in its last position, the valve 154 is opened, causing the feeding mechanism to move rearwardly into the position shown in Figs. 21 and 23 and causing the cutter bar to complete the cut.

It will be seen that, by virtue of the arrangement above described, whereby the cutter bar is permitted to move in a vertical plane between the ways 53, said ways may be extended as close as desirable to the face to be cut, thereby supporting and guiding the cutting mechanism in close proximity to said face, while permitting a movement of the parts into the position shown in Fig. 21, as is necessary to complete a relatively deep cut with a long cutter bar.

In Figs. 24 and 25 is illustrated the operation of the machine in cutting vertical kerfs in a face substantially parallel to the track upon which the machine travels, as in opening a room neck or a cross entry. For this purpose the turret is turned about its pivot in one direction or the other, depending upon the face to be cut, into an angular position substantially 90° from its normal position, the operation of the machine being otherwise substantially identical with that above described in connection with entry cutting.

It will, of course, be understood that the turret may be turned into any desired angular position in accordance with the requirements of the work.

While I have in this application specifically described one form which my 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 other forms without departing from its spirit or the scope of the appended claims.

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

1. In a mining machine, a pair of parallel ways, cutting mechanism movable longitudinally in said ways during cutting operation, said cutting mechanism including a motor, a cutter bar having cutting elements and bodily movable during cutting in a position wherein it extends between said ways and also adjustable to cut a kerf above said ways, said cutting elements being arranged to cut a kerf to admit the bar, and means deriving power from said motor for transmitting power from one end thereof to swing said bar and actuate said cutting elements.

2. In a mining machine, a pair of parallel ways and cutting mechanism including a motor movable longitudinally in said ways during operation thereof, said cutting mechanism including a cutting element carrying cutter bar movable between said ways and operative to cut a kerf partially above and partially below the plane of said ways, said cutting elements being arranged to cut a kerf to admit the bar and said motor having at one end thereof a power transmitting element transmitting power to effect longitudinal movement of said cutting mechainsm and actuation of said cutting elements.

3. In a mining machine, a pair of parallel ways and cutting mechanism movable longitudinally in said ways said cutting mechanism including a motor and a pivoted cutter bar the latter having cutting elements and mounted to swing to cut that portion of the plane which passes through said pair of ways that lies between said ways, said cutting elements being arranged to cut a kerf to admit the bar, and means operable by said motor for transmitting power from one

end thereof to swing said bar and to actuate said cutting elements.

4. In a mining machine, a pair of parallel ways, and cutting mechanism movable longitudinally in said ways, said cutting mechanism including a motor and a cutter bar provided with orbitally moving cutting elements and pivoted to permit the swinging of a portion thereof through between said ways and operative to cut a kerf either above or below the plane of said ways, said cutting elements being arranged to cut a kerf to admit the bar and said motor having at one end thereof a power transmitting element transmitting power to effect longitudinal movement of said cutting mechanism, swinging of said bar and orbital movement of said cutting elements.

5. In a mining machine, a pair of parallel ways, and cutting mechanism movable in said ways, said cutting mechanism comprising a motor, a cutter bar and a cutter chain carried by said bar and actuated by said motor, said cutter bar being mounted to permit a portion thereof to be swung between said ways whereby the orbit of said chain may lie in a plane between said ways and partially on one side and partially on the other of a plane passing through said pair of ways, said chain being arranged to cut a kerf to admit the chain and bar and means operable by said motor for transmitting power from one end thereof to swing said bar and actuate said cutting elements.

6. In a mining apparatus, a pair of ways, cutting mechanism movable longitudinally along said ways, said cutting mechanism including a motor and a pivoted cutter bar, the latter having cutting elements and carrying cutting means and having adjacent the free end thereof a pivot about which said cutting means moves, said cutter bar being adapted to swing between said ways between positions in which said pivot is above and below the plane of said ways and said cutting elements being arranged to cut a kerf to admit said bar, and means operable by said motor for transmitting power from one end thereof to swing said bar and to actuate said cutting elements.

7. In a mining machine, a pair of parallel ways disposed in a substantially horizontal plane, and cutting mechanism movable longitudinally in said ways, said cutting mechanism including a motor and a cutter bar having orbitally moving cutting elements and movable between said ways in a vertical plane and operative to cut above said ways, said cutting elements being arranged to cut a kerf to admit said bar and said motor having at one end thereof a power transmitting element transmitting power to effect longitudinal movement of said cutting mechanism and actuation of said cutting elements.

8. In a mining machine a pair of parallel ways disposed in a substantially horizontal plane, and cutting mechanism movable longitudinally in said ways, said cutting mechanism including a motor and a pivoted cutting element carrying cutter bar mounted to swing in a vertical plane to cut the portion of the plane lying between said ways, said motor having at one end thereof a power transmitting element transmitting power to effect longitudinal movement of said cutting mechanism and swinging of said bar and said cutting element carrying bar being arranged to cut a kerf into which it is admissible.

9. In a mining apparatus, a portable base, a pair of parallel ways carried thereby and a mining machine movable upon said ways and having a plane kerf-cutting mechanism movable between said ways with the plane thereof making an angle with the plane passing through said ways and adapted to cut a kerf above said ways in which said kerf-cutting mechanism is admissible, said mining machine comprising a motor having at one end thereof a power transmitting element effecting cutting operation of said kerf cutting mechanism and to effect longitudinal movement of said machine in said ways.

10. In a mining apparatus, a portable base, a pair of parallel ways carried thereby and projecting beyond the base, and a mining machine movable along said ways and having a cutting mechanism operative to cut a kerf in which said mechanism is admissible, in a vertical plane lying between said ways and either above or below the plane passing through said ways, said machine comprising a motor having at one end thereof a power transmitting element providing power to effect bar adjustment and longitudinal feed of said machine along said ways.

11. In a mining apparatus, a portable base, a pair of parallel ways carried thereby, and a mining machine having a cutting mechanism a portion of which is swingable through between said ways and adapted to cut a kerf above and below said ways into which kerf the said cutting mechanism is admissible, said machine comprising a motor having at one end thereof a power transmitting element providing power to effect bar swing and longitudinal feed of said machine along said ways.

12. In a mining apparatus a portable base, a pair of parallel ways carried thereby, and a mining machine having a swinging cutter bar and movable along on top of said ways, said machine being operative to move said bar in a position intermediate said ways and to cut a kerf into which said bar is admissible, in a plane at an angle to the plane of said ways and extending on opposite sides thereof, said machine comprising a motor having a power transmitting ele-

ment at one end thereof operative to transmit power to effect the functioning recited.

13. In a mining machine, a pair of projecting parallel ways, supporting means for the projecting portions of said ways for maintaining them in fixed angular relation to the face to be cut, a cutting mechanism supported on said ways and including a plane cutter bar having circulating cutting elements and a motor for causing said elements to traverse an orbit about said bar, said elements being arranged to cut a kerf to admit said bar, and means for effecting movement of said cutting mechanism bodily longitudinally of said ways with said cutter bar in position to cut a kerf in a plane which makes an angle with the plane which passes through said pair of ways and whose intersection with the latter plane is parallel to said ways and lies between the latter, said motor having a power shaft from one end of which power is transmitted to cause the traversing of said cutting elements of their orbit and the bodily longitudinal movement of said cutting mechanism.

14. In a mining machine, a pair of projecting parallel ways, supporting means for the projecting portions of said ways for maintaining them in fixed angular relation to the face to be cut, a cutting mechanism supported on said ways and including a plane cutter bar having circulating cutting elements and a motor for causing said elements to traverse an orbit about said bar, said elements being arranged to cut a kerf to admit said bar, and means for effecting movement of said cutting mechanism bodily longitudinally of said ways and for moving said cutter bar to cut a kerf in a plane which makes an angle with the plane which passes through said pair of ways and whose intersection with the latter plane is parallel to said ways and lies between the latter, said motor having a power shaft from one end of which power is transmitted to cause the traversing of said cutting elements of their orbit and the bodily longitudinal movement of said cutting mechanism.

15. In a mining machine, a pair of projecting parallel ways, supporting means for the projecting portions of said ways for maintaining them in fixed angular relation to the face to be cut and spaced above the mine bottom, cutting mechanism supported in said ways and movable longitudinally therein and swingable therebetween, said cutting mechanism including a cutter bar provided with circulating cutting elements arranged to cut a kerf to admit the bar and a motor for driving said cutting elements and moving said bar to positions in which its median longitudinal line makes different angles with its projection perpendicularly on the portion of the plane of the ways lying between said ways, means for holding said bar in said adjusted positions, and means for moving said cutting mechanism bodily longitudinally of said ways in opposite directions while the bar is held in such adjusted positions.

16. In a mining machine, a truck, a pair of parallel horizontal ways carried thereby and normally projecting therefrom in parallelism with the longitudinal axis of the truck, a plane pivoted cutter bar having a mounting slidable in the ways and adjustable about its pivot to positions in which its free end lies respectively above and below a given horizontal plane, said bar being so pivoted that its plane intersects the plane of said ways along a line parallel to and intermediate said ways, and self-contained power means including a single motor for adjusting said bar to a position with its free end at one side of a given horizontal plane, maintaining it therein and moving the same bodily along said ways into the face to be cut, swinging said bar to move its free end to the opposite side of said given horizontal plane while its pivot remains stationary and moving said bar bodily rearwardly along said ways in the position last mentioned.

17. In a mining machine, a truck, a pair of parallel horizontal ways carried thereby and normally projecting therefrom in parallelism with the longitudinal axis of the truck, a pivoted plane cutter bar having a mounting movable along the ways and adjustable about its pivot to positions in which its free end lies respectively above and below a horizontal plane including the pivot of the cutter bar, said cutter bar being so pivoted that its plane intersects the plane of said ways along a line parallel to and intermediate said ways, and self-contained power means including a single motor for adjusting said bar to a position with its free end at one side of said horizontal plane, maintaining it therein and moving the same bodily along said ways into the face to be cut, swinging said bar to move its free end to the opposite side of said given horizontal plane while its pivot remains stationary and moving said bar bodily rearwardly along said ways in the position last mentioned.

18. In a mining apparatus, a track supported truck, a pair of parallel guideways having portions projecting therefrom, supporting means movable in said guideways, cutter mechanism thereon comprising a pivotally mounted cutter bar having an orbitally moving chain adapted to cut a kerf for said bar in a face when said bar is presented edgewise thereto, into which kerf the bar is admissible, the plane of the orbit of said chain intersecting the plane of said guideways in a line parallel to and intermediate said guideways, and self-contained power operated means for moving said bar bodily rectilinearly of the guideways, about its

pivot in the same plane, and reversely rectilinearly of the guideways to insert a parallel edged kerf in a face in front of the ends of the guideways.

19. In a mining apparatus, supporting means adapted for propulsion about a mine, parallel guideways having portions projecting therefrom, cutter mechanism movable along said guideways comprising a pivotally mounted cutter bar operating between said ways having a chain adapted to cut a kerf for said bar in a face when said bar is presented edgewise thereto, into which kerf the bar is admissible, and self-contained power operated means for moving said bar bodily rectilinearly relative to the guideways, about its pivot in the same plane, and reversely rectilinearly to insert a parallel-edged kerf in a face in front of the guideways, of which kerf the edges are respectively on opposite sides of the plane of said guideways and to the plane of which kerf the guideways are parallel and at opposite sides thereof.

20. In a mining apparatus, a support adapted for transportation about a mine, parallel guideways mounted on said support and having portions projecting therefrom adapted to have one end thereof moved into close proximity to the face to be cut, and cutting mechanism including supporting means movable in said guideways and a pivoted cutter bar, and self-contained power means for swinging said cutter bar through a sector between the lines of the guideways, portions of said sector lying on opposite sides of a plane passing through said guideways.

21. In a mining machine, in combination, a support, a turret mounted to turn on said support and having a pair of parallel guideways projecting therefrom, and cutting mechanism movable longitudinally in said ways, said cutting mechanism including a cutting element carrying cutter bar arranged to cut a kerf into which it is admissible and movable through a path which cuts the portion of a plane passing through said ways which lies between the ways and a motor having at one end thereof a power transmitting element transmitting power to actuate said cutting elements and to effect longitudinal movement of said cutting mechanism in said ways.

22. In a mining apparatus, a portable base, a turntable on said base, a pair of parallel ways carried thereby and having portions projecting therefrom, and a mining machine movable along said ways and having a cutting mechanism movable between said projecting portions and adapted to cut a kerf above said ways into which said cutting mechanism is admissible, said cutting mechanism comprising a motor having at one end thereof a power transmission connection transmitting power to effect operation of said cutting mechanism and movement thereof along said ways.

23. In a mining machine, in combination, a support, a turret mounted to turn on said support and having a pair of parallel ways, and cutting mechanism movable longitudinally in said ways, said cutting mechanism including a pivoted cutter bar mounted to swing in a path cutting the plane between the ways in that portion thereof included between the ways, and a motor having at one end thereof a power transmitting element supplying power to swing said bar and move said cutting mechanism longitudinally in said ways.

24. In a mining machine, in combination, a support, a turret mounted to turn about a vertical axis on said support and having a pair of parallel ways disposed in a substantially horizontal plane, and cutting mechanism movable longitudinally in said ways, said cutting mechanism including a cutting element carrying cutter bar movable between said ways in a vertical plane and operative to cut above said ways and to enter the kerf cut and a motor having at one end thereof a power transmitting element transmitting power to actuate said cutting elements and to effect longitudinal movement of said cutting mechanism in said ways.

25. In a mining machine, in combination, a portable base, a turret mounted to turn on said support and provided with ways, the width of said base being substantially the same as that of said ways, and cutting mechanism longitudinally movable in said ways and including a plane cutter bar operative to cut along the entire edge thereof and to enter the kerf cut and swinging in a plane making an angle with the plane of said ways, the edge of said angle lying between the ways, and a motor having at one end thereof a power transmitting element supplying power to swing said bar and move said cutting mechanism longitudinally in said ways.

26. In a mining machine, in combination, a support, a turret mounted to turn on said support and provided with open ended ways mounted in the same plane, and a cutting mechanism longitudinally movable in said ways and including a pivoted cutter bar adapted to be swung across the plane of said ways and provided with cutting elements arranged to cut a kerf to admit the bar, said cutting mechanism also including a motor having a power shaft provided at one end with a power transmitting connection supplying power to swing said bar and to effect longitudinal feed of said cutting elements, said bar in certain positions of said cutting mechanism lying between the open ends of said ways.

27. In a mining machine, in combination, a support, a turret mounted to turn on said support and provided with projecting open

ended ways mounted in substantially the same plane as said turret, and a cutting mechanism including a pivoted cutter bar movable across the plane of said ways during the cutting operation, and provided with cutting elements arranged to cut a kerf to admit the bar, said cutting mechanism also including a motor having a power shaft provided at one end with a power transmitting connection supplying power to swing said bar and to effect longitudinal feed of said cutting elements.

28. In a mining machine, a truck, a pivotally connected frame thereon normally disposed longitudinally thereof and movable into a transverse position thereon, said frame including a plurality of longitudinally extending guides, and cutting mechanism disposed longitudinally of said frame and including a pivoted cutter bar movable between said guides and provided with cutting elements arranged to cut a kerf to admit the bar, said cutting mechanism also including a motor having a power shaft provided at one end with a power transmitting connection supplying power to swing said bar and to effect longitudinal feed of said cutting elements.

29. In a mining machine, a truck, a pivotally connected frame thereon normally disposed longitudinally thereof and movable into a transverse position thereon, said frame including a plurality of longitudinally extending guides, and cutting mechanism disposed longitudinally of said frame and adapted to swing between said guides and to enter the kerf formed thereby during cutting, said cutting mechanism comprising an actuating motor having a power shaft effecting cutting operation of said cutting mechanism and also longitudinal movement and swinging of the latter.

30. In a mining machine, a truck, a pivotally connected frame thereon normally disposed longitudinally thereof and movable into a transverse position thereon, said frame including a plurality of longitudinally extending horizontal guides, cutting mechanism disposed longitudinally of said frame and including a pivoted cutter bar movable thereon relative to said truck and adapted to swing between said guides and to enter the kerf formed during cutting, and a motor movable longitudinally along said frame with said cutter bar and having at one end thereof a power transmitting element transmitting power to effect feed of said motor and bar and swing of said bar.

31. In a mining machine, a truck, a pivotally connected guide frame thereon normally disposed longitudinally thereof and movable into a transverse position thereon, said frame comprising horizontally spaced longitudinally extending guide members, and cutting mechanism disposed longitudinally of said frame and comprising a plane kerf cutter movable longitudinally of said guide frame and pivotally mounted for swinging movement between said guide members and operative to cut a kerf into which said cutter is admissible, and a motor movable longitudinally along said frame with said cutter bar and having at one end thereof a power transmitting element transmitting power to effect feed of said motor and bar and swing of said bar.

32. In a mining machine, in combination, a support, a turret mounted to turn on said support, cutting mechanism reciprocable bodily upon said turret and including a motor and an elongated cutting element carrying cutter bar pivoted to swing in a vertical plane and operative to cut a kerf into which the bar is admissible when it is moved edgewise into the face, said motor having at one end thereof a power connection transmitting power to effect such reciprocation of said cutting mechanism and to swing said bar, and means for angularly positioning said turret and locking the same, said bar lying substantially midway between the sides of said turret.

33. In a mining machine, in combination, a support, a turret mounted to turn on said support, cutting mechanism including a vertically swinging cutter bar carried by said turret and provided with cutting elements arranged to cut a kerf to admit the bar, locking bolts on said support, and stops on said turret cooperating with said bolts, said bolts being adapted to serve as abutments to stop movements of said turret as the latter is turned to transport position.

34. In a mining machine, in combination, a support, a turret mounted to turn on said support, cutting mechanism carried by said turret including a cutter bar, said mechanism being operable to make a shearing cut into which the major portion of the bar is admissible, bolts on said support, and stops on said turret adapted to cooperate with said bolts, said bolts when extended being respectively engageable by said stops as the turret is turned in opposite directions and stopping the latter when the desired position is reached.

35. In a mining machine, the combination with a truck and means for propelling the same, including a primary driving shaft on said truck and flexible driving connections driven thereby, of a turret mounted to turn on said truck, cutting mechanism carried by said turret, said cutting mechanism including a motor and a vertically swinging cutter bar provided with cutting devices arranged to cut a kerf to admit said bar, and means for operatively connecting said motor and the primary driving shaft of said truck propelling means when said turret is in one angular position only.

36. In a mining machine, the combination with a truck and means for propelling the same, including a primary driving shaft on said truck and flexible driving connections driven thereby, of a turret mounted to turn on said truck, cutting mechanism carried by said turret, said cutting mechanism including a motor and a verfically swinging cutter bar provided with cutting devices arranged to cut a kerf to admit said bar, means for operatively connecting said motor and the primary driving shaft of said truck propelling means when said turret is in one angular position, said means being disconnected at all other times, and means for angularly positioning said turret and locking the same.

37. In a mining machine, the combination with a truck and means for propelling the same, of a turret mounted to turn on said truck and provided with ways, cutting mechanism including a motor carried by said turret and movable in opposite directions in said ways during cutting, a clutch member operatively connected with said motor, and a clutch member operatively connected with said truck propelling means whereby said motor and truck propelling means may be operatively connected when said turret is in one angular position.

38. In a mining machine, the combination with a truck and means for propelling the same, of a turret mounted to turn on said truck, cutting mechanism including a motor carried by said turret, a clutch for operatively connecting said motor and truck propelling means when said turret is in one angular position, said clutch including a member carried by said cutting mechanism and a cooperating member, and a universal joint connecting said last named clutch member with said propelling means.

39. In a mining machine, the combination with a truck and means for propelling the same, of a turret mounted to turn on said truck and provided with ways, cutting mechanism carried by said turret and movable in said ways, means for reciprocating said cutting mechanism in said ways during the operation of said cutting mechanism, said cutting mechanism including a swinging cutter bar and a motor, a socket carried by said cutting mechanism, and means including a clutch member within said socket for operatively connecting said motor and truck propelling means when said turret is in one angular position.

40. In a mining machine, the combination with a truck and means for propelling the same, of a turret mounted to turn on said truck, cutting mechanism carried by said turret, said cutting mechanism including a vertically swinging cutter bar and a motor, a socket carried by said cutting mechanism, a clutch member within said socket operatively connected with said motor, and a clutch member operatively connected with said truck propelling means and movable into and out of said socket, whereby said motor and truck propelling means may be operatively connected when said turret is in one angular position.

41. In a mining machine, the combination with a pivoted cutter bar having orbitally moving cutting elements, said bar being swingable to cut with its full length a horizontal plane passing through its pivot, of fluid pressure actuating means for exerting a constant swinging force on said cutter bar including means movable in opposite directions by the direct action of fluid pressure thereon to swing the same in opposite directions in the plane of said orbit and giving a different speed in each direction automatically during cutting operation.

42. In a mining machine, the combination with a movable cutter bar provided with cutting elements operative when the bar is presented in one direction upon engagement with the coal to cut a kerf and clear the cuttings from said kerf, of mechanism cooperating with said cutter bar and adapted to impart to the same a predetermined relatively slow movement in such direction and on mere reversal a predetermined relatively quick movement in the opposite direction, said mechanism comprising a rectilinearly reciprocable bar moving force transmitting element and means for differentially applying power to said element in its opposite directions of reciprocatory movement respectively.

43. In a mining machine, the combination with a pivotally movable cutter bar provided with cutting elements operative when the bar is swung in one direction upon engagement with the coal to cut a kerf and clear the cuttings from said kerf, of mechanism adapted to swing said bar at a predetermined relatively slow rate in such direction and on mere reversal to swing it in the opposite direction at a predetermined relatively quick rate, said mechanism comprising a rectilinearly reciprocable bar swinging force transmitting element and means for differentially applying power to said element in its opposite directions of reciprocatory movement respectively.

44. In a mining machine, the combination with a movable cutter bar provided with cutting elements operative when the bar is presented in one direction upon engagement with the coal to cut a kerf and clear the cuttings from said kerf, of mechanism cooperating with said cutter bar and adapted to impart to the same a predetermined relatively slow movement in such direction and a predetermined relatively quick movement in the opposite direction, said means including a fluid pressure motor for moving said bar,

and means for supplying motive fluid to said motor, said motor and fluid supplying means cooperating through different pressure areas in the motor to give said cutter bar such predetermined relatively slow and quick movements.

45. In a mining machine, the combination with a pivotally movable cutter bar provided with cutting elements operative when the bar is swung in one direction upon engagement with the coal to cut a kerf and clear the cuttings from said kerf, of mechanism adapted to swing said bar at a predetermined relatively slow rate in such direction and to swing it in the opposite direction at a predetermined relatively quick rate, said means including a fluid pressure motor for swinging said bar, and means for supplying motive fluid to said motor, said motor and fluid supplying means cooperating through different pressure areas in the motor to give said cutter bar such predetermined relatively slow and quick swinging movements.

46. In a mining machine, the combination with a turret mounted pivotally movable cutter bar, of a fluid pressure motor for actuating said cutter bar, and self-contained means carried by said turret for supplying motive fluid to said motor, said motor and fluid supplying means being constructed to give said cutter bar a relatively quick movement in one direction and a relatively slow movement in the opposite direction under the action of fluid pressure.

47. The combination with a mining machine having a movable cutter bar, of a cutter bar actuating means comprising a cylinder, a piston therein having opposite relatively small and large pressure areas, conduit means connecting the opposite ends of said cylinder, and controlling means for supplying liquid under pressure at a uniform rate of flow through said conduit means to act on both of said pressure areas, or for admitting liquid under pressure to said small pressure area only, while exhausting liquid from said large pressure area.

48. In a mining machine, the combination with a movable cutter bar, of a fluid pressure motor for swinging said cutter bar at one speed in one direction and at a different speed in another direction, said motor comprising a cylinder and a piston therein having opposite relatively small and large pressure areas, conduit means connecting the opposite ends of said cylinder, and controlling means for supplying fluid pressure through said conduit means at a uniform rate to act on both of said pressure areas, or for admitting fluid pressure to said small pressure area only, while exhausting fluid pressure from said large pressure area.

49. In a mining machine, the combination with a movable cutter bar, of a hydraulic motor for actuating said cutter bar, said motor comprising a cylinder and a piston therein having opposite relatively small and large pressure areas, conduit means connecting the opposite ends of said cylinder, a liquid reservoir, a pump for drawing liquid from said reservoir and supplying the same to said motor at a uniform rate, and controlling means for placing said conduit means in communication with said pump, or for placing said small pressure area only in communication with said pump, while placing said large pressure area in communication with said reservoir.

50. The combination with a mining machine having a turret mounted cutter bar, of a cutter bar actuating means comprising a hydraulic motor having a cylinder and a piston therein, said piston having opposite relatively small and large pressure areas, conduit means connecting the opposite ends of said cylinder, a liquid reservoir carried by the turret, a pump for drawing liquid from said reservoir and supplying the same to said motor, and controlling means for placing said conduit means in communication with said pump.

51. In a mining machine, the combination with a movable cutter bar, of a fluid pressure motor for actuating said cutter bar, said motor comprising a cylinder and a piston therein having opposite relatively small and large pressure areas, the former being more than one half of the latter, conduit means connecting the opposite ends of said cylinder, and controlling means for supplying fluid pressure through said conduit means at a constant rate to act on both of said pressure areas, or for admitting fluid pressure to said small pressure area only, while exhausting fluid pressure from said large pressure area.

52. In a mining machine, the combination with a movable cutter bar, of a fluid pressure motor for positively actuating said cutter bar in either of two opposite movements, said motor comprising a cylinder and a piston therein having a piston rod secured thereto at one side, thereby providing said piston with opposite relatively small and large pressure areas, conduit means connecting the opposite ends of said cylinder, and controlling means for supplying fluid pressure through said conduit means at a constant rate to act on both of said pressure areas, or for admitting fluid pressure to said small pressure area only, while exhausting fluid pressure from said large pressure area.

53. In a mining machine, the combination with a movable cutter bar, of a fluid pressure motor for actuating said cutter bar, said motor comprising a cylinder and a piston therein having a piston rod secured thereto at one side, thereby providing said piston with opposite relatively small and

large pressure areas, the cross sectional area of said piston rod being less than one half that of the piston, conduit means connecting the opposite ends of said cylinder, and controlling means for supplying fluid pressure at a constant rate through said conduit means to act on both of said pressure areas or for admitting fluid pressure to said small pressure area only while exhausting fluid pressure from said large pressure area.

54. In a mining machine, the combination with a movable cutter bar having cutting devices thereon and means for operating said cutter bar, of a hydraulic motor for actuating said cutter bar, said motor comprising a cylinder and a piston therein, a liquid reservoir, a pump driven by said first mentioned means having a loaded relief valve communicating with said reservoir, and controlling means for said motor adapted to trap liquid in said cylinder at one side of said piston while placing the portion of said cylinder at the opposite side of said piston in communication with said pump.

55. In a mining machine, the combination with cutting mechanism including a movable cutter bar, of fluid pressure actuated means for moving said cutting mechanism toward and from the work and comprising overlapping staggered cylinders and pistons.

56. In a mining machine, the combination with cutting mechanism including a movable cutter bar, of a hydraulic motor for moving said cutting mechanism toward and from the work, a hydraulic motor for actuating said cutter bar, a liquid tank into which both of said hydraulic motors exhaust, a pump for drawing liquid from said tank and supplying the same to both of said motors, and valve devices for independently controlling said motors, all of said mechanism being mounted on a single bed and movable as a whole by said first mentioned motor.

57. The combination with a mining apparatus comprising a truck, a turret mounted on said truck, and provided with ways, a mining machine on said ways, and a cutter bar carried by said machine and movable relatively thereto, of a mining machine actuating means comprising a hydraulic motor having relatively movable members, one of which is connected to the turret and another to said mining machine, and a cutter bar actuating means comprising a hydraulic motor carried by said turret.

58. The combination with a mining apparatus comprising a truck, a turret movably mounted on said truck, and provided with ways, a mining machine on said ways, and a cutter bar carried by said mining machine and movable relatively thereto, of a mining machine actuating means comprising a hydraulic motor having relatively movable members, one of which is connected to the turret and another to said mining machine, a cutter bar actuating means comprising a hydraulic motor carried by said turret, a liquid tank carried by said turret, and a pump also carried by said turret for drawing liquid from said tank and supplying the same to both of said motors.

59. The combination with a mining apparatus comprising a truck, a turret movably mounted on said track, and provided with ways, a mining machine on said ways, and a cutter bar carried by said mining machine and movable relatively thereto, of a mining machine actuating means comprising a hydraulic motor having relatively movable members, one of which is connected to the turret and another to said truck, a cutter bar actuating means comprising a hydraulic motor carried by said turret, a liquid tank carried by said turret, a pump also carried by said turret for drawing liquid from said tank and supplying the same to both of said motors and valve devices for independently controlling said motors.

60. In a mining machine, the combination with cutting mechanism, of a fluid pressure motor for moving said cutting mechanism toward and from the work, said motor including a cylinder and a piston therein having opposite relatively small and large pressure areas, the former being approximately one half of the latter, conduit means connecting the opposite ends of said cylinder, and controlling means for supplying fluid pressure through said conduit means at a constant rate to act on both of said pressure areas, or for admitting fluid pressure to said small pressure area only, while exhausting fluid pressure from said large pressure area.

61. In a mining machine, the combination with cutting mechanism, of a hydraulic pressure motor for moving said cutting mechanism toward and from the work, said motor including a cylinder and a piston therein having a piston rod secured thereto at one side, thereby providing said piston with opposite relatively small and large pressure areas, conduit means connecting the opposite ends of said cylinder, and controlling means for supplying liquid through said conduit means at a uniform rate to act on both of said pressure areas, or for admitting liquid to said small pressure area only, while connecting said large pressure area to exhaust.

62. In a mining machine, the combination with cutting mechanism, of a hydraulic pressure motor for moving said cutting mechanism toward and from the work, said motor including a cylinder and a piston therein having a piston rod secured thereto at one side, thereby providing said piston with opposite relatively small and large pressure areas, the cross sectional area of said piston rod being approximately one half that of said piston, conduit means connecting the

opposite ends of said cylinder, and controlling means for supplying liquid under pressure through said conduit means at a constant rate to act on both of said pressure areas, or for admitting liquid under pressure to said small pressure area only while connecting said large pressure area to exhaust.

63. In a mining machine, the combination with cutting mechanism, of a series hydraulic motor for moving said cutting mechanism rectilinearly longitudinally toward and from the work and including relatively movable elements, and controlling means for said motor including means operable at will for holding the elements thereof in rigid relation to each other.

64. In a mining machine, the combination with cutting mechanism, of feeding means therefor operative to effect positive forward and reverse feed thereof and comprising a plurality of motors arranged so that their feeding effect, in terms of distance, is cumulative, and one receiving its motive fluid from the cylinder of another.

65. In a mining machine, the combination with cutting mechanism, of feeding means therefor operative to effect positive forward and reverse feed thereof and comprising a plurality of motors arranged so that their feeding effect, in terms of distance, is cumulative, and controlling means for said motors operative to control the fluid supply to both of them simultaneously to cause operation thereof or to lock them against movement.

66. In a mining machine, the combination with cutting mechanism, of feeding means therefor operative to effect positive forward and reverse feed thereof and comprising a plurality of motors arranged so that their feeding effect, in terms of distance, is cumulative and one receiving its operating fluid supply through the other, and a single controlling means for said plurality of motors.

67. In a mining machine, the combination with cutting mechanism, of feeding means therefor comprising a plurality of motors having cylinders and pistons arranged so that their feeding effect, in terms of distance, is cumulative, and fluid supply means for said motors, the cylinder of one of said motors communicating with a cylinder of another thereof by passages formed through the piston of one of said motors.

68. In a mining machine, the combination with cutting mechanism and driving means therefor, of a hydraulic motor for moving said cutting mechanism toward and from the work, said motor comprising a cylinder and a piston therein, means for supplying actuating fluid thereto comprising a liquid reservoir, a pump driven by said driving means and having a loaded relief valve communicating with said reservoir, and controlling means for said motor adapted to trap liquid in said cylinder at one side of said piston while placing the portion of said cylinder at the opposite side of said piston in communication with said pump.

69. In a mining machine, the combination with cutting mechanism including a pivoted cutter bar, of means for swinging said cutter bar on its pivot, a hyraulic motor for moving said cutting mechanism toward and from the work, said motor comprising a cylinder and a piston therein, and controlling means for said motor necessitating trapping liquid in said cylinder at one side of said piston while admitting liquid pressure to said cylinder at the opposite side of said piston.

70. In a mining machine, the combination with a support and cutting mechanism movably mounted on said support, of means for moving said cutting mechanism comprising a fluid pressure cylinder, a piston therein, a piston rod connected to said piston, a second fluid pressure cylinder carried by said piston rod, and a piston in said second cylinder.

71. In a mining machine, the combination with a support and cutting mechanism movably mounted on said support, of means for moving said cutting mechanism positively in opposite directions comprising a series of motors having one end of one of said motors attached to said support, an end of one of said motors attached to said cutting mechanism and connections therebetween comprising a parallel non-coaxial piston and cylinder.

72. In a mining machine, the combination with a support and cutting mechanism movably mounted on said support, of means for moving said cutting mechanism in opposite directions comprising a fluid pressure cylinder, a piston therein, a piston rod connected to said piston, a pair of fluid pressure cylinders carried by said piston rod and longitudinally movable on said first named cylinder, pistons in said last named cylinders, and piston rods connected to said last named pistons.

73. In a mining machine, the combination with a support and cutting mechanism movably mounted on said support, of motor mechanism interposed between said cutting mechanism and support for moving the former in opposite directions on the latter, said motor mechanism comprising a fluid pressure cylinder, a piston therein, a piston rod connected to said piston, a crosshead carried by said piston rod, a pair of fluid pressure cylinders carried by said crosshead and longitudinally movable on said first named cylinder, pistons in said last named cylinders, piston rods connected to said last named pistons, and a crosshead connecting said last named piston rods.

74. In a mining machine, the combination

with a support provided with ways, and cutting mechanism movable in said ways toward and from the work, of motor mechanism interposed between said cutting mechanism and support for moving said mechanism in said ways, said motor mechanism comprising a fluid pressure cylinder, a piston therein, a piston rod connected to said piston, a crosshead carried by said piston rod and guided on said support, a pair of fluid pressure cylinders carried by said crosshead and guided for longitudinal movement on said first named cylinder, pistons in said last named cylinders, piston rods connected to said last named pistons, and a crosshead connecting said last named piston rods.

75. In a mining machine, the combination with a support and cutting mechanism movably mounted on said support, of means for moving said cutting mechanism comprising a cylinder, a piston therein, a piston rod connected to said piston, a second cylinder carried by said piston rod, a piston in said second cylinder, a liquid reservoir, a pump, a pipe leading from said pump to said reservoir, two valves in said pipe, a second pipe leading from said first named pipe between said valves to one end of said first named cylinder, a third pipe leading from said first named pipe between said pump and valves to the opposite end of said first named cylinder, and conduit means connecting each end of said first named cylinder with the corresponding end of said second cylinder.

76. In a mining machine, the combination with a support and cutting mechanism movably mounted on said support, of means for moving said cutting mechanism comprising a fluid pressure cylinder, a piston therein, a piston rod connected to said piston, a second fluid pressure cylinder, and a piston in said second cylinder, said piston rod having passages each communicating with one end of said first named cylinder and with the corresponding end of said second cylinder.

77. In a mining machine, the combination with a truck having guideways supported at one end thereof and fixed thereto against rotation on a horizontal axis, and cutting mechanism movably mounted on said guideways, of a jack pivoted intermediate its ends to said guideways at a point spaced from said truck, said jack being extensible in either or both directions from its pivot.

78. In a mining machine, the combination with a truck having guideways supported at one end thereof and fixed thereto against rotation on a horizontal axis, and cutting mechanism movably mounted on said guideways, of a jack pivoted intermediate its ends to said guideways at a point spaced from said truck, the portions of said jack at opposite sides of its pivot being independently adjustable.

79. In a mining machine, the combination with a support having a pair of parallel ways disposed in a substantially horizontal plane, and cutting mechanism movable longitudinally in said ways, said cutting mechanism including a cutter bar movable in a vertical plane between said ways, of a jack pivoted intermediate its ends to said ways, said jack being extensible in either or both directions from its pivot.

80. In a mining machine, the combination with a truck having guideways supported at one end thereof and fixed thereto against rotation on a horizontal axis, and cutting mechanism movably mounted on said guideways, of a pair of jacks pivoted intermediate their ends to said guideways at points spaced from said truck, each of said jacks being extensible in either or both directions from its pivot.

81. In a mining machine, the combination with a truck and means for propelling the same, of cutting mechanism including a vertically swinging cutter bar and a motor, said cutting mechanism being mounted for longitudinal movement on said truck, means for operatively connecting said motor and truck propelling means when said mechanism is in one longitudinal position, and means for automatically locking said mechanism in said position.

82. In a mining machine, the combination with a swinging cutter bar, of a motor and means operated thereby for effecting swinging movements of said cutter bar, and separate means frictionally engageable with a portion of said first mentioned means for holding said cutter bar against movement.

83. In a mining machine, the combination with a swinging cutter bar movable bodily rectilinearly during cutting in a path with which it makes an angle, of a band brake for holding said cutter bar against movement during such movement.

84. In a mining machine, the combination with a swinging cutter bar, of a hydraulic motor for moving said cutter bar, controlling means for said motor adapted to retain the same in stationary position, and a band brake for holding said cutter bar against movement.

85. In a mining machine, the combination with a plane pivoted cutter bar having orbitally moving cutting elements and swingable to cut a horizontal plane passing through its pivot, a plurality of fluid pressure actuated cylinder and piston devices for moving said cutter bar in the plane of said orbit during the operation of said cutter bar, the movement effected by one of said means being bodily and that effected by that of another angular.

86. In a mining machine, a cutter bar provided with a series of cutting elements circulating in a plane orbit about its periphery, said bar being swingable in a vertical

plane through a horizontal position, a support on which said bar is pivoted for swinging movement in the plane of said orbit, and means for swinging said bar in said plane and moving said bar bodily in said plane including a pair of fluid pressure motors and means for placing fluid under pressure and supplying it to said motors.

87. In a mining machine, a cutter bar provided with a series of cutting elements circulating in a vertical plane in a plane orbit about its periphery, a support on which said bar is pivoted for swinging movement in the plane of said orbit, and means for swinging said bar in said plane through a horizontal position and moving said bar bodily in said plane including a pair of fluid pressure motors carried on said support and movable therewith during bodily movement of said bar and means for placing fluid under pressure and supplying it to said motors also carried on said support.

88. In a mining machine, an elongated plane cutter bar provided with a series of cutting elements circulating in a plane orbit about its periphery, a support carrying said bar and on which said bar is pivoted, a second support providing guideways along which said first mentioned support is slidable during cutting, and fluid pressure generating and operated power means carried wholly on said first mentioned support for swinging the bar in the plane of said orbit and for moving said support and bar on said guides.

89. In a mining machine, the combination with a support and cutting mechanism movably mounted on said support, of means for moving said cutting mechanism in opposite directions comprising a fluid pressure cylinder, a piston therein, a piston rod connected to said piston, a pair of fluid pressure cylinders carried by said piston rod and longitudinally movable on said first named cylinder, pistons in said last named cylinders, and piston rods connected to said last named pistons.

90. In a mining machine, the combination with a support and cutting mechanism movably mounted on said support, of motor mechanism interposed between said cutting mechanism and support for moving the former in opposite directions on the latter, said motor mechanism comprising a fluid pressure cylinder, a piston therein, a piston rod connected to said piston, a crosshead carried by said piston rod, a pair of fluid pressure cylinders carried by said crosshead and longitudinally movable on said first named cylinder, pistons in said last named cylinders, piston rods connected to said last named pistons, and a crosshead connecting said last named piston rods.

91. In a kerf cutting mechanism, a motor having a horizontally disposed armature shaft extending longitudinally of said kerf cutting mechanism, a driving pinion on the forward end of said armature shaft, cutting mechanism pivotable on an axis in a vertical transverse plane in advance of the driving pinion, an actuating element for said cutting mechanism rotatable on an axis lying in the same straight line with the axis of pivotal movement of said cutting mechanism, a gear coaxial with said element, driving connections between said gear and pinion, a shaft supporting said gear, and means for swinging said cutting mechanism actuated by power from said last mentioned shaft including a lever arm in fixed angular relation to said cutting mechanism and means for applying a swinging force thereto including a member having a pivotal connection with said arm and means for applying a moving force to said member.

92. In a kerf cutting mechanism, a motor having a horizontally disposed armature shaft extending longitudinally of said kerf cutting mechanism, a driving pinion on the forward end of said armature shaft, cutting mechanism pivotable on an axis in a vertical transverse plane in advance of the driving pinion, an actating element for said cutting mechanism rotatable on an axis lying in the same straight line with the axis of pivotal movement of said cuttitng mechanism, a gear coaxial with said element, driving connections between said gear and pinion, a shaft supporting said gear, and means for swinging said cutting mechanism actuated by power from said last mentioned shaft including an element reciprocable in a path parallel to the axis of the armature shaft and moving continuously in one direction in its path during swing in one direction and continuously in the opposite direction in its path during swing in the opposite direction.

93. In a vertical kerf cutting mechanism, a motor having a horizontally disposed armature shaft extending longitudinally of said kerf cutting mechanism, a driving pinion on the forward end of said armature shaft, cutting mechanism pivotable on an axis in a vertical transverse plane in advance of the driving pinion, an actuating element for said cutting mechanism rotatable on an axis lying in the same straight line with the axis of pivotal movement of said cutting mechanism, a gear coaxial with said element, driving connections between said gear and pinion, a shaft supporting said gear, and means for swinging said cutting mechanism actuated by power from said last mentioned shaft including an element movable continuously in one direction in a rectilinear path to effect swing of said cutting mechanism in one direction.

94. In a vertical kerf cutting mecha-

nism, a motor having a horizontally disposed armature shaft extending longitudinally of the kerf cutting mechanism, a driving pinion on the forward end of the armature shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket and constituting driving means therefor, intermediate driving connections between said gear and pinion, a shaft supporting said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft and including a power connection with said shaft at one end of the latter.

95. In a vertical kerf cutting mechanism, a motor having a horizontally disposed armature shaft extending longitudinally of the kerf cutting mechanism, a driving pinion on the forward end of the armature shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft including a lever arm in fixed angular relation to said cutting mechanism and means for applying a swinging force thereto including an element movable continuously in one direction in a rectilinear path to effect swing of said bar in one direction.

96. In a vertical kerf cutting mechanism, a motor having a horizontally disposed armature shaft extending longitudinally of the kerf cutting mechanism, a driving pinion on the forward end of the armature shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft including an element reciprocable in a path parallel to the axis of the armature shaft and moving continuously in one direction in its path during complete swing in one direction.

97. In a vertical kerf cutting mechanism, a motor having a horizontally disposed armature shaft extending longitudinally of the kerf cutting mechanism, a driving pinion on the forward end of the armature shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket and constituting driving means therefor, intermediate driving connections between said gear and pinion, a shaft supporting said gear, means including a clutch controlling the driving of said sprocket by said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft having a power connection with the latter at one end thereof.

98. In a vertical kerf cutting mechanism, a motor having a horizontally disposed armature shaft extending longitudinally of the kerf cutting mechanism, a driving pinion on the forward end of the armature shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, means including a clutch controlling the driving of said sprocket by said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft including a lever arm in fixed angular relation to said cutter bar and means for applying a swinging force thereto including a member reciprocable substantially in the plane of swing of said lever arm.

99. In a vertical kerf cutting mechanism, a motor having a horizontally disposed armature shaft extending longitudinally of the kerf cutting mechanism, a driving pinion on the forward end of the armature shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, means including a clutch controlling the driving of said sprocket by said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft including an element reciprocable in a path parallel to the axis of the armature shaft.

100. In a mining apparatus, a motor having a horizontally disposed power shaft, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear for transmitting rotation directly thereto, a driving pinion at the other end of said power shaft, pivotally mounted cutting mechanism, and actuating means for said cutting mechanism and swinging means for said cutting mechanism both driven from said driving pinion.

101. In a mining apparatus, a motor having a horizontally disposed power shaft, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear for transmitting power to the latter to cause the same to effect truck propulsion, a driving pinion at the other end of said power shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft.

102. In a mining apparatus, a motor having a horizontally disposed power shaft, a truck having running gear supporting said motor, driving connections for said running gear between one end of said power shaft and said running gear, a driving pinion at the other end of said power shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft including a lever arm in fixed angular relation to said cutter bar and means for applying a swinging force thereto including an element reciprocable substantially in the plane of swing of said arm.

103. In a mining apparatus, a motor having a horizontally disposed power shaft, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear, a driving pinion at the other end of said power shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft including an element reciprocable in a path parallel to the axis of the power shaft and substantially in the plane of swing of said arm.

104. In a mining apparatus, a motor having a horizontally disposed power shaft, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear, a driving pinion at the other end of said power shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, means including a clutch controlling the driving of said sprocket by said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft and having a power connection with one end of the latter.

105. In a mining apparatus, a motor having a horizontally disposed power shaft, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear, a driving pinion at the other end of said power shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, means including a clutch controlling the driving of said sprocket by said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft including a lever arm in fixed angular relation to said cutting mechanism and means for applying a swinging force thereto including an element for transmitting force directly to said lever arm and movable bodily on movement of said arm.

106. In a mining apparatus, a motor having a horizontally disposed power shaft, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear, a driving pinion at the other end of said power shaft, a cutter bar having a circulat-

ing cutter chain thereon pivotable on a transversely extending axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, means including a clutch controlling the driving of said sprocket by said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft including an element reciprocable in a path parallel to the axis of the power shaft.

107. In a mining apparatus, a motor having a horizontally disposed power shaft extending longitudinally of the kerf cutting mechanism, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear, a driving pinion at the other end of said power shaft, pivotally mounted cutting mechanism, and actuating means for said cutting mechanism and swinging means for said cutting mechanism both driven from said driving pinion.

108. In a mining apparatus, a motor having a horizontally disposed power shaft extending longitudinally of the kerf cutting mechanism, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear, a driving pinion at the other end of said power shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft.

109. In a mining apparatus, a motor having a horizontally disposed power shaft extending longitudinally of the kerf cutting mechanism, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear, a driving pinion at the other end of said power shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft including a lever arm in fixed angular relation to said cutter bar and means for applying a swinging force thereto including a member bodily movable, as said arm swings, and pivotally connected with the latter.

110. In a mining apparatus, a motor having a horizontally disposed power shaft extending longitudinally of the kerf cutting mechanism, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear, a driving pinion at the other end of said power shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft including an element reciprocable in a path parallel to the axis of the power shaft and movable throughout swing of said bar in one direction in one direction only to make a complete cut.

111. In a mining apparatus, a motor having a horizontally disposed power shaft extending longitudinally of the kerf cutting mechanism, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear, a driving pinion at the other end of said power shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, means including a clutch controlling the driving of said sprocket by said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft.

112. In a mining apparatus, a motor having a horizontally disposed power shaft extending longitudinally of the kerf cutting mechanism, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear, a driving pinion at the other end of said power shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending horizontal axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis

lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, means including a clutch controlling the driving of said sprocket by said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft including a lever arm in fixed angular relation to said cutting mechanism and means for applying a swinging force thereto.

113. In a mining apparatus, a motor having a horizontally disposed power shaft extending longitudinally of the kerf cutting mechanism, a truck having running gear supporting said motor, driving connections between one end of said power shaft and said running gear, a driving pinion at the other end of said power shaft, a cutter bar having a circulating cutter chain thereon pivotable on a transversely extending axis in advance of the driving pinion, a cutter chain driving sprocket rotatable on an axis lying in the same straight line with the axis of pivotal movement of said bar, a gear coaxial with said sprocket, driving connections between said gear and pinion, a shaft supporting said gear, means including a clutch controlling the driving of said sprocket by said gear, and means for swinging said bar upon its pivotal axis actuated by power from said last mentioned shaft including an element reciprocable in a path parallel to the axis of the power shaft.

114. In a mining machine, a machine frame including a motor, cutting mechanism at one end of said motor including a swinging cutter bar disposed in a vertical plane parallel to the axis of motor rotation and substantially midway between the sides of said frame, and means for operating said cutting mechanism and reversely swinging said bar actuated by said end of said motor.

115. In a mining machine, a machine frame including a motor, cutting and feed operating mechanisms supported on said frame, operative connections between one end of said motor and said cutting mechanism, operative connections between the other end of said motor and said feed operating mechanism, said cutting mechanism being adjustable and disposed in a vertical plane substantially midway between the sides of the frame, and means for adjusting said cutting mechanism driven by said operative connections between said cutting mechanism and said motor.

116. In a mining apparatus, a machine frame including a motor, cutting mechanism including a cutter bar adjustable on a transverse axis on the front end of the frame, means for driving the cutting mechanism from the front end of said motor, and means for adjusting said bar pivotally about its axis to which power is supplied from the same end of said motor, said last mentioned means including an arm bearing a fixed angular relation to said cutter bar, a member reciprocable parallel to the axis of rotation of said motor on application of power from said motor thereto, and operative connections between said reciprocable member and said arm, said reciprocable member moving in its path only in one direction throughout complete bar swing in one direction.

117. In a mining machine, a pair of parallel ways, cutting mechanism movable longitudinally in said ways during cutting operation, said cutting mechanism including a motor, and a cutter bar having cutting elements arranged to cut a kerf to admit the bar, said bar being bodily movable during cutting in a position wherein it extends between said ways and also adjustable to cut a kerf above said ways, said motor transmitting power from one end thereof to effect said bar adjustment and longitudinal movement of said cutting mechanism in said ways.

118. In a mining machine, a pair of parallel ways and cutting mechanism movable longitudinally in said ways, said cutting mechanism including a motor and a pivoted cutter bar, the latter having cutting elements arranged to cut a kerf to admit the bar, said bar being mounted to swing to cut that portion of the plane which passes through said pair of ways that lies between said ways, said motor transmitting power from one end thereof to swing said bar and to effect longitudinal movement of said cutting mechanism in said ways.

119. In a mining machine, a pair of parallel ways and cutting mechanism movable longitudinally in said ways, said cutting mechanism including a motor and a cutter bar provided with orbitally moving cutting elements arranged to cut a kerf to admit the bar, said bar being pivoted to permit the swinging of a portion thereof through between said ways and operative to cut a kerf either above or below said ways, said motor having at one end thereof a power transmitting element transmitting power to effect longitudinal movement of said cutting mechanism and swinging of said bar.

120. In a mining machine, a pair of parallel ways, and cutting mechanism movable in said ways, said cutting mechanism comprising a motor, a cutter bar and a cutter chain carried by said bar and actuated by said motor, said chain being arranged to cut a kerf to admit said bar and said cutter bar being mounted to permit a portion thereof to be swung between said ways whereby the orbit of said chain may lie in a plane between said ways and partially on one side and partially on the other of a plane passing through said pair of ways, said motor transmitting power from one end thereof to

swing said bar and to move said cutting mechanism in said ways.

121. In a mining apparatus, a pair of ways, cutting mechanism movable longitudinally along said ways, said cutting mechanism including a motor and a pivoted cutter bar, the latter having elements carrying cutting means arranged to cut a kerf to admit said bar and having adjacent the free end thereof a pivot about which said cutting means moves, said cutter bar being adapted to swing between said ways between positions in which said pivot is above and below the plane of said ways, and said motor transmitting power from one end thereof to swing said bar and to effect longitudinal movement of said cutting mechanism along said ways.

122. In a kerf cutting mechanism, a motor having a horizontally disposed armature shaft, cutting mechanism pivotable on a horizontal transverse axis in advance of said motor, an actuating element for said cutting mechanism rotatable on an axis lying in the same straight line with the axis of pivotal movement of said cutting mechanism, operative connections between said armature shaft and said element including a pinion coaxial with the former and a gear coaxial with the latter, a shaft supporting said gear, and means for swinging said cutting mechanism actuated by power from said last mentioned shaft including a lever arm in fixed angular relation to said cutting mechanism and means for applying a swinging force thereto including an element movable bodily in one direction throughout swing in one direction and bodily in the opposite direction throughout swing in the opposite direction and a member connecting said lever arm and element.

123. In a kerf cutting mechanism, a motor having a horizontally disposed armature shaft, cutting mechanism pivotable on a horizontal transverse axis in advance of said motor, an actuating element for said cutting mechanism rotatable on an axis lying in the same straight line with the axis of pivotal movement of said cutting mechanism, operative connections between said armature shaft and said element including a pinion coaxial with the former and a gear coaxial with the latter, a shaft supporting said gear, and means for swinging said cutting mechanism actuated by power from said last mentioned shaft including a lever arm in fixed angular relation to said cutting mechanism and means including an element rectilinearly reciprocable in a plane parallel to a plane parallel to the plane of movement of said lever for applying a swinging force to said lever including mechanism having a power connection with said second shaft at one end of the latter.

124. In a kerf cutting mechanism, a motor having a horizontally disposed armature shaft, cutting mechanism pivotable on a horizontal transverse axis in advance of said motor, an actuating element for said cutting mechanism rotatable on an axis lying in the same straight line with the axis of pivotal movement of said cutting mechanism, operative connections between said armature shaft and said element including a pinion coaxial with the former and a gear coaxial with the latter, a shaft supporting said gear, and means for swinging said cutting mechanism actuated by power from said last mentioned shaft including a lever arm in fixed angular relation to said cutting mechanism and means for applying a swinging force thereto including an element reciprocable substantially in the plane of swing of said lever arm.

In testimony whereof I affix my signature.

FRANK CARTLIDGE.