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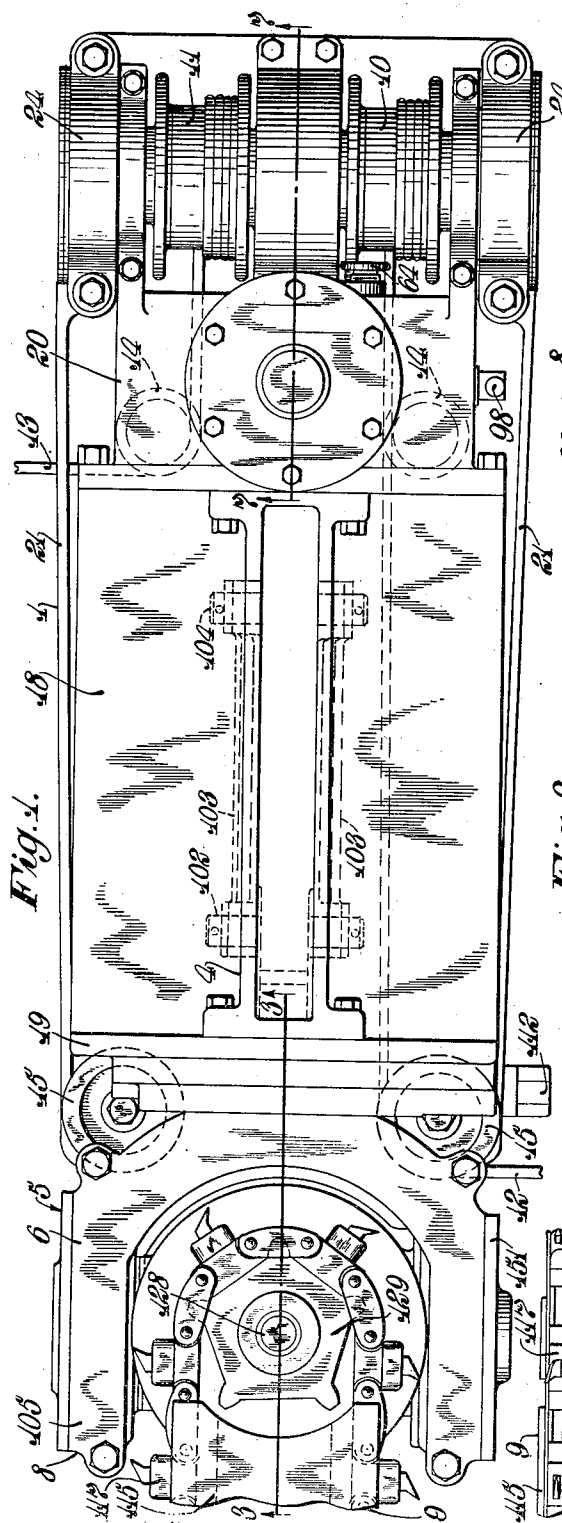
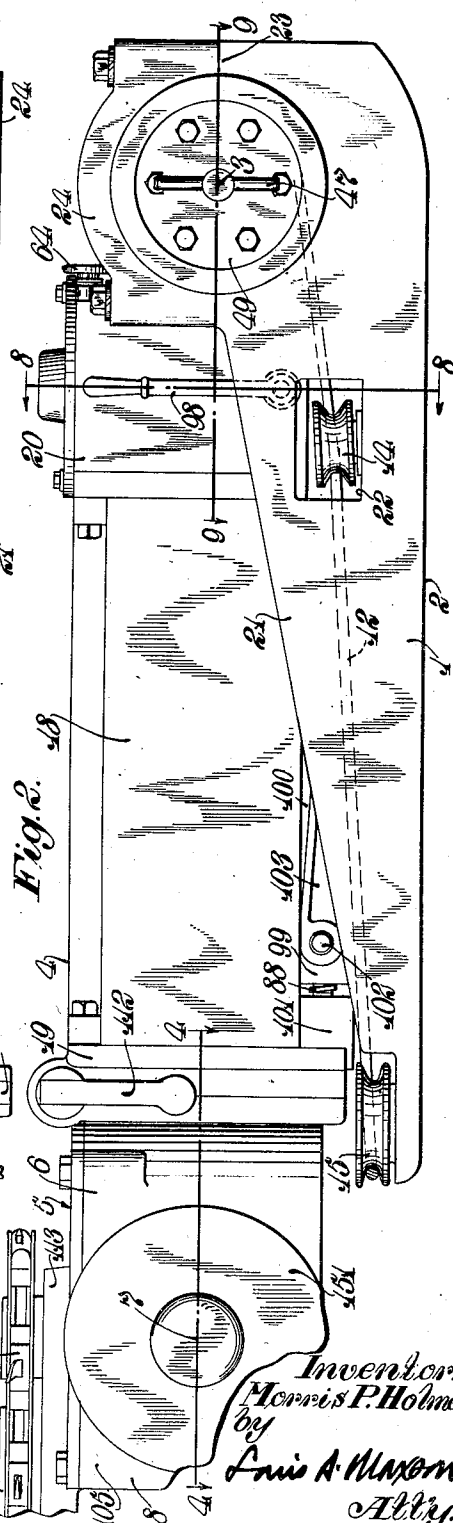
M. P. HOLMES

2,062,660

MINING MACHINE

Filed Jan. 19, 1934

5 Sheets-Sheet 1



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Dec. 1, 1936.

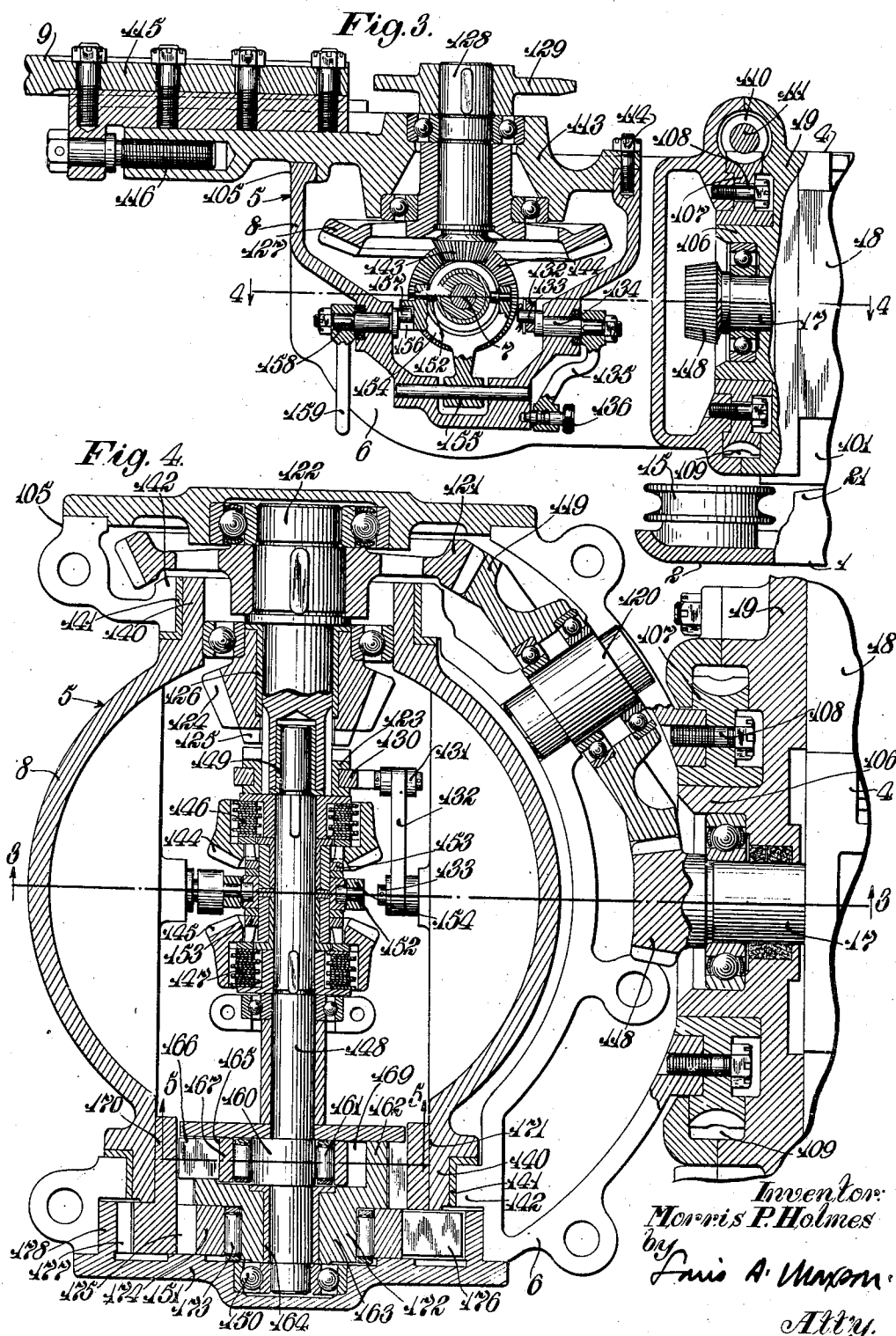
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Fig. 5.

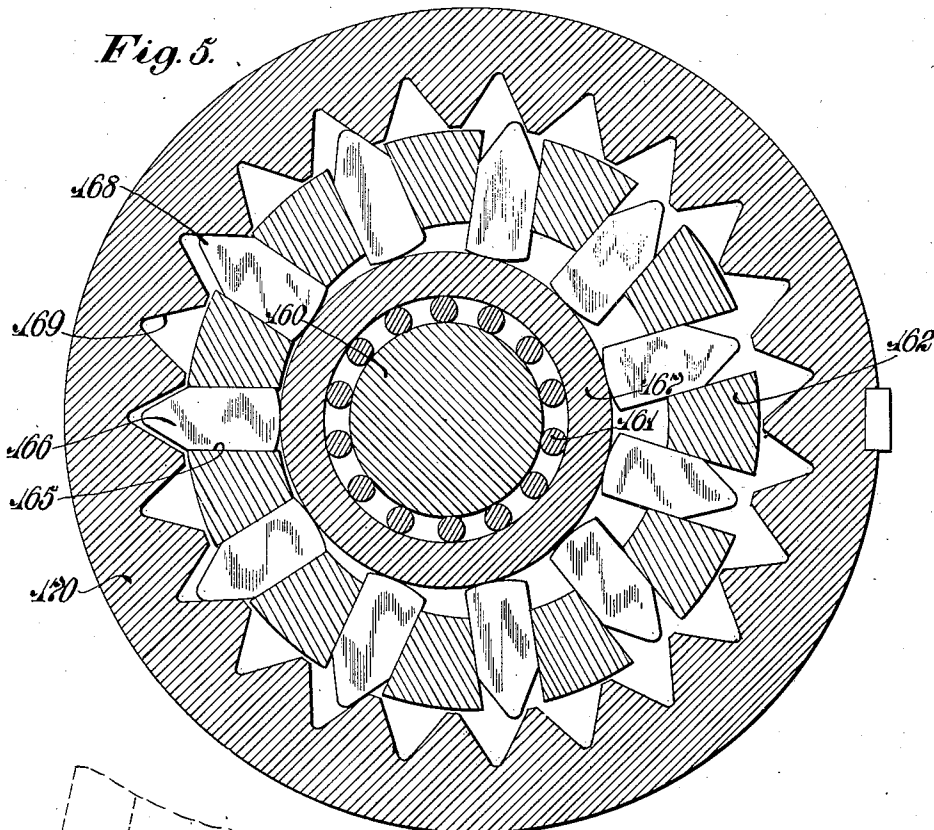
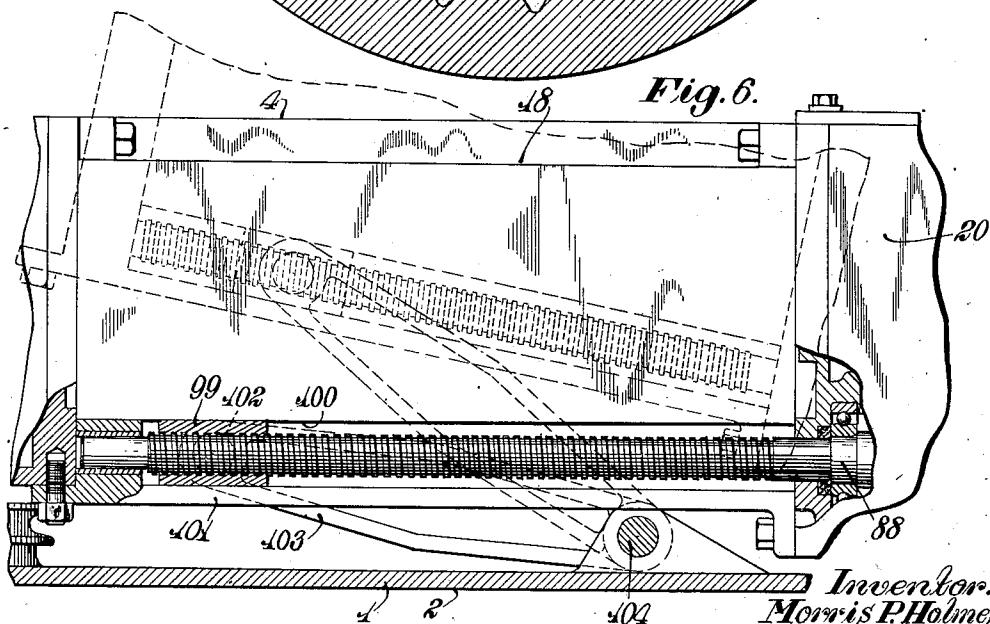


Fig. 6.



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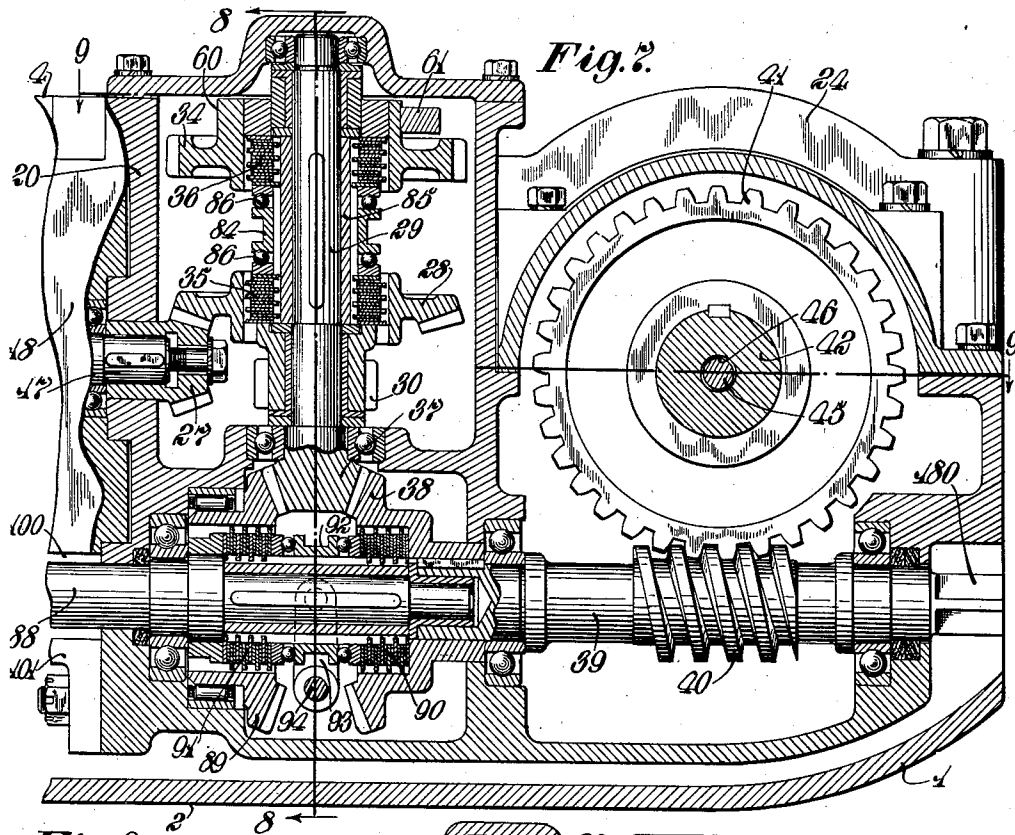
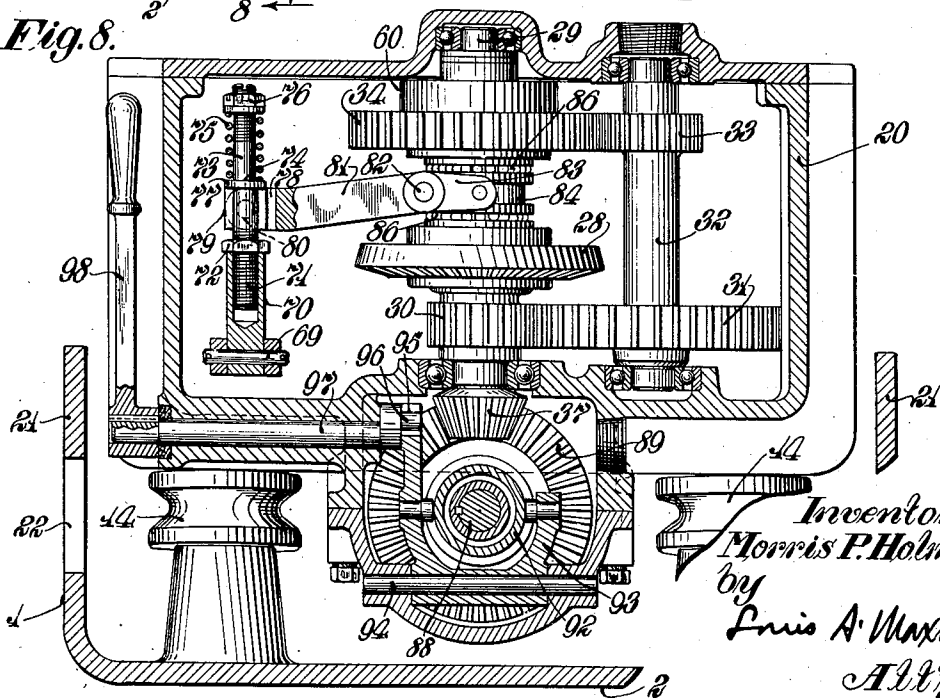


Fig. 8.



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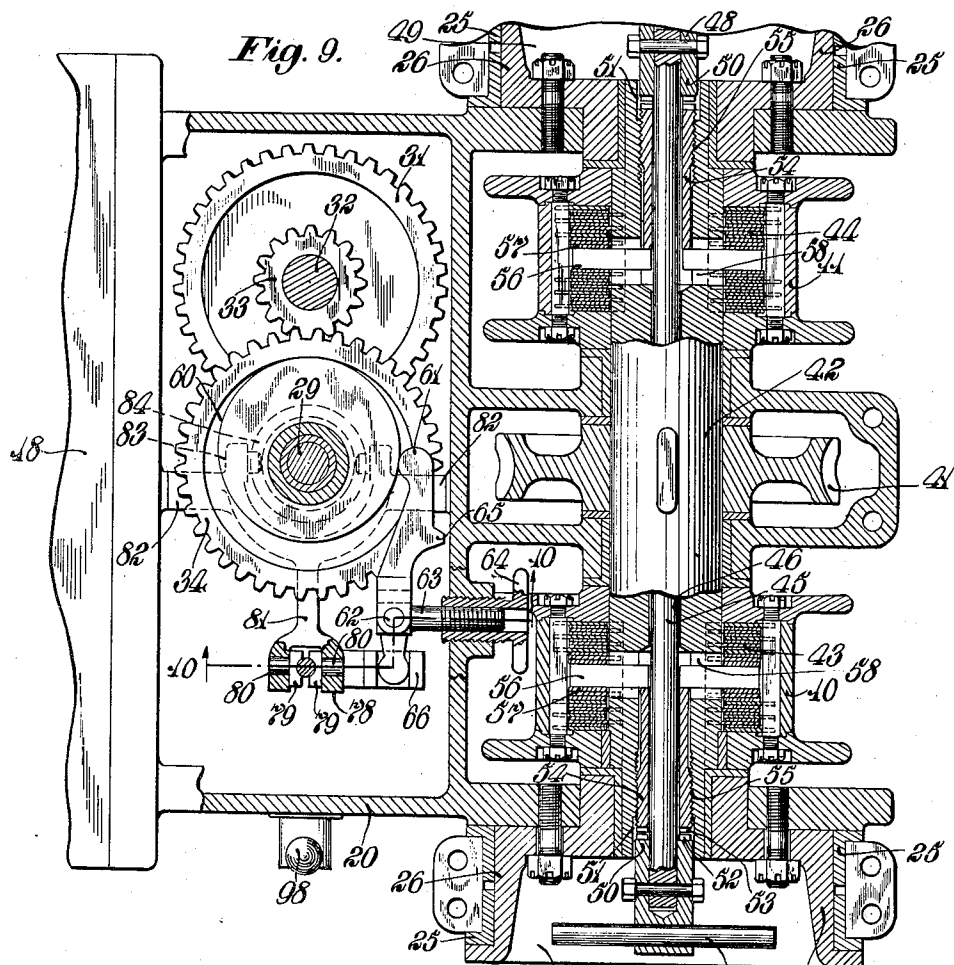
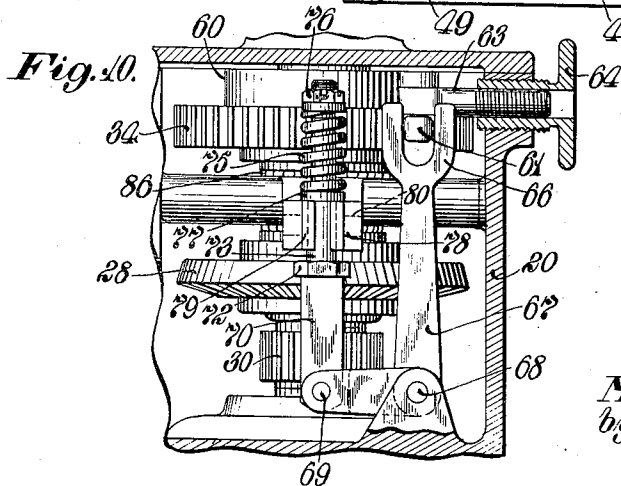
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MINING MACHINE

Filed Jan. 19, 1934

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,062,660

MINING MACHINE

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Application January 19, 1934, Serial No. 707,321

19 Claims. (Cl. 262—30)

This invention relates to mining machines, and more particularly, but not exclusively, to improvements in coal mining machines of the flexibly fed, floor cutter type.

5 An object of this invention is to provide an improved coal mining machine. Another object is to provide an improved mining machine having improved adjustable kerf cutting mechanism. Another object is to provide an improved adjustable kerf cutting mechanism for a coal mining machine of the flexibly fed, floor cutter type. A still further object is to provide an improved mechanism for adjusting the kerf cutter of such a machine. These and other objects will, however, hereinafter more fully appear.

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

In these drawings,—

20 Fig. 1 is a plan view of the illustrative form of the improved coal mining machine.

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

25 Fig. 3 is a longitudinally extending vertical sectional view taken substantially on line 3—3 of Figs. 1 and 4.

Fig. 4 is a horizontal sectional view taken substantially on line 4—4 of Figs. 2 and 3.

30 Fig. 5 is a cross sectional view taken substantially on line 5—5 of Fig. 4.

Fig. 6 is a detail view showing structural details of the improved cutter adjusting mechanism.

35 Fig. 7 is a longitudinally extending vertical sectional view taken substantially on line 7—7 of Fig. 1.

Fig. 8 is a cross sectional view taken on line 8—8 of Figs. 2 and 7.

Fig. 9 is a horizontal sectional view taken substantially on line 9—9 of Figs. 2 and 7.

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

45 In this illustrative embodiment of the invention there is shown a coal mining machine of the flexibly fed, floor cutter type generally comprising a portable base, herein preferably in the form of a bottom skid 1 having a plane bottom surface 2 whereby the machine may rest upon and slide in any direction over the mine floor. Piv-
50 otally mounted at 3 on a transverse axis at the rear end of the skid for swinging movement in a vertical direction relative thereto is an elongated arm structure 4 overlying the skid and having adjustably mounted thereon the improved adjustable kerf cutting mechanism generally designated
55 5. The kerf cutting mechanism includes a ro-

tatable cutter head 6 mounted for rotative movement relative to the arm structure about an axis extending longitudinally of the arm structure, and having pivotally mounted thereon for swinging movement relative thereto about a transverse axis at 7, a cutter support 8 which carries an endless chain kerf cutter 9. The machine is fed over the mine floor by improved flexible feeding means including relatively rotatable feed operating and controlling cable winding drums 10 and 11 cooperating respectively with flexible feeding and controlling cables 12 and 13. Arranged on the skid beneath the arm structure 4 and in advance of the drums are inclined guide sheaves 14, 14, while arranged at the opposite front corners of the skid are horizontal guide sheaves 15, 15. These guide sheaves guide the feeding and controlling cables in various directions during operation of the machine, in the manner well understood by those skilled in the art. The machine may be fed longitudinally and laterally over the mine floor to effect sumping and withdrawal cuts and connecting transverse or rectilinear cuts, and the arm structure 4 may be swung vertically relative to the skid to move the cutter head into different elevated positions whereby the kerf cutter may cut kerfs in any desired horizontal planes between the mine roof and mine floor, and the cutter head may be rotated relative to the arm structure to enable cutting of kerfs in vertical planes in the coal face, as will presently be described.

In this illustrative construction, the arm structure 4 carries a motor, herein preferably of the reversible electric type having its power shaft 17 extending longitudinally of the arm structure, and in this instance the casing 18 of this motor constitutes a part of the arm structure and forms a connecting element between a front head frame 19 rigidly fixed to the front end of the motor casing and a rear frame member 20 rigidly fixed to the rear end of the motor casing, the frame section 20 forming the housing for certain of the transmission gearings, as presently described. The elements 18, 19 and 20 thus constitute a rigid arm swingable in a vertical direction about the horizontal transversely extending axis 3 relative to the bottom skid 1. The skid 1 is provided with upstanding side frames 21, 21, these side frames extending vertically from the lateral edges of the skid bottom and having lateral openings 22 through which the cables 12, 13 may be extended laterally from the rear guide sheaves 14. These side frames also have rearwardly located integral bearing supporting portions 23, as shown in Fig. 2 having detachable caps 24 and

receiving bearing sleeves 25 within which are journaled trunnions 26, 26 detachably secured, as by screws, to the vertical sides of the rear frame section 20 of the arm structure 4. It will thus be seen that the arm structure 4 is mounted to swing in a vertical direction relative to the skid about the axes of the trunnions 26, 26 journaled within the bearing supports 23 of the skid frame. The improved means for swinging the arm structure is arranged beneath the arm structure between the latter and the skid bottom and is operated by the motor power shaft 17, as hereinafter described.

The feeding and controlling drums 10 and 11 are, in this instance, arranged with their axes coincident with the axis of swinging movement of the arm 4, and the mechanism for driving these drums comprises a bevel pinion 27 keyed to the rear end of the motor power shaft 17 and meshing with a bevel gear 28 journaled for rotation about the axis of a vertical shaft 29, in turn suitably journaled within the rear frame section 20 of the arm. Formed on the depending hub portion of the bevel gear 28 is a spur pinion 30 meshing, as shown in Fig. 8, with a spur gear 31 fixed to a vertical shaft 32 likewise suitably journaled within the rear frame 20. Fixed to the upper end of the shaft 32 is a spur pinion 33 meshing with a spur gear 34 herein arranged coaxially with the bevel gear 28 and likewise journaled for rotation on the vertical shaft 29. The bevel gear 28 and spur gear 34, respectively, constitute high and low speed driving elements and are connectible in driving relation with the vertical shaft 29 by means of multiple disc clutches 35 and 36, respectively. These disc clutches are provided with improved operating means to be later described whereby the shaft 29 may be driven from the bevel gear 28 at a relatively high speed or from the spur gear 34 at relatively low variable speeds from zero to a predetermined maximum low speed. Formed on the lower end of the vertical shaft 29 is a bevel pinion 37 meshing with a bevel gear 38 having its hub fixed to a horizontal shaft 39, herein extending longitudinally of the arm structure and suitably journaled within the rear frame 20. Fixed to this shaft 39 is a worm 40 meshing with a worm wheel 41 keyed, as shown in Fig. 9, to a horizontal transversely extending drum driving shaft 42, herein arranged with its axis aligned with the axes of the drums 10 and 11 and the arm pivot axis. This shaft 42 is suitably journaled within the rear frame 20 and in turn has journaled thereon and supports the drums 10 and 11. The drums 10 and 11 are connectible in driving relation with the shaft 42 by multiple disc clutches 43 and 44 respectively, housed within the drums and having operating means including a control rod 45 extending axially through a central bore 46 in the shaft 42 and having fixed thereto at its opposite ends operating handles 47 and 48, these handles being arranged at the opposite side of the machine within chambers or recesses 49 formed within the trunnions 26, 26 of the arm structure. Each of these handles is provided with a hub 50 projecting within a bore 51 formed in the shaft 42 and this hub is provided with clutch teeth 52 connectible with clutch teeth 53 formed on a clutch operating member 54 threaded at 55 within the shaft bore. The inner end of the member 54 engages lever elements 56 interposed between sets of clutch discs and acting on a pressure plate 57 for each set, these levers projecting inwardly through slotted apertures 58 formed in the

shaft 42 in the manner shown in Fig. 9. It will thus be seen that when the handle 47 is slid inwardly from the position shown in Fig. 9, it is clutched to the operating element 54, and upon rotation of the handle the element 54 is rotated, and due to its threaded connection with the shaft, is moved axially inwardly, thereby swinging the levers 56 to effect spreading of the pressure plates 57 to apply the clutch, and as a result the drum 10 is connected in driving relation with the shaft 42. When the control rod 45 is slid in the opposite direction with respect to the shaft 42, the handle 47 is disconnected from its operating element 54, and upon rotation of the handle 48 the clutch within the drum 11 is applied, connecting the drum 11 in driving relation with the shaft. It will thus be seen that the drums 10 and 11 may be separately or simultaneously connected in driving relation with the drum drive shaft 42.

Now referring to the improved operating mechanism for the high and low speed disc clutches 35, 36, and more particularly to the improved operating means for the low speed clutch 36 whereby a variable low speed drive is attained, it will be noted that, as shown in Figs. 7 and 9, a cam or eccentric 60 is formed on the hub of the low speed gear 34, and engaging the surface of this eccentric is a lever 61 pivoted at 62 on an adjustable control member, herein an eye-bolt member 63. This eye-bolt member is threadedly connected within the hub of a control handle 64, the hub of this handle in turn being threadedly secured within the vertical end wall of the rear frame 20 of the arm, as shown in Fig. 9. This lever 61 is provided with a projection 65 engageable with the inner surface of the vertical end wall of the frame 20 for limiting swinging movement of the lever 61 in a direction outwardly from the eccentric. The opposite end of the lever 61 projects between the bifurcations of the bifurcated end 66 of a bell crank lever 67 pivotally mounted at 68 within the rear frame 20. The other arm of this bell crank is pivotally connected at 69 to a member 70 which, as shown in Fig. 8, has threadedly connected thereto at 71 and held in adjusted position therein by a lock nut 72, a rod 73. This rod has a reduced portion forming a shoulder 74, and a spring 75 is compressed between a nut 76 threaded on the reduced end of the rod 73 and a collar 77 slidably mounted on the rod and normally engaging the shoulder 74 of the rod enlargement. The enlarged portion of the rod 73 passes through a trunnion device 78 comprising, as shown in Fig. 9, trunnion elements 79, 79 having concave recesses slidably engaging the cylindrical body of the rod enlargement, and these elements 79 are pivotally connected at 80 to a clutch shipper lever 81. As shown in Fig. 8, this clutch shipper lever is pivoted at 82 within suitable bearing supports within the frame 20 and is provided with a yoke portion 83 engaging the shipper member 84 for the clutches 35, 36. This shipper member 84 is slidably mounted on a sleeve 85 keyed to the shaft 29 and is provided with clutch applying elements 86 for the clutches 35 and 36. This clutch shipper member 84 is operative to transmit the pressure of the clutch shipper lever 81 to effect loading of the disc clutches 35 and 36. It will thus be seen that when the parts are in the position shown in Figs. 8 and 9 and the eccentric 60 is rotated, the lever 61 is swung about its pivot 62, thereby swinging the bell crank 67 and moving the rod 73 axially in a downward direction. Movement of this rod in a downward direction will result in the transmission of no

pressure to the clutch shipper lever 81 until the sliding collar 77 engages the upper end of the trunnion device 78, but that further movement downwardly of the rod will thereafter impart a load to the clutch shipper lever 81 which will be determined by the extent of the movement of the rod and the degree of compression of the spring 75. It is therefore evident that as the eccentric 60 revolves, the shipper lever 81 is swung back and forth intermittently to apply the disc clutch 36, and as a result, the shaft 29 is intermittently rotated at a relatively low speed. The eye-bolt 63 provides a movable fulcrum for the lever 61, and upon movement of this eye-bolt by the handle 64 in an axial direction, the interval of engagement of the lever 61 with the eccentric surface will be varied, and as a result, the time of application of the disc clutch 35 will be correspondingly varied. Upon movement of the lever fulcrum 62 to the right to a position sufficient to bring the lever 61 out of engagement with the cam surface, the disc clutch 36 will be maintained in released position during rotation of the cam. Upon further movement of the eye-bolt to the right the nut 72 engages the bottom of the trunnion device 78 and swings the shipper lever 81 to move the shipper member 84 downwardly, thereby to apply the high speed disc clutch 35, the low speed disc clutch being of course at that time released. When the eye-bolt is moved to the left so far that the lever 61 continuously presses, under the pressure of the spring 75, against the trunnion device 78, continuous rotation of the shaft 29 will take place, and the spring will compress during each revolution of the cam an amount substantially equal to the full throw of the cam; but since the load of the spring is above the minimum necessary to effect power transmission through the clutch discs, there will be no release even when the lowest point in the cam is opposite the point of engagement of the lever 61 with the cam. By moving the eye-bolt graduated amounts toward the right in Fig. 9, the period of drive during each revolution of the cam may be progressively reduced until it is entirely discontinued. Therefore, the drive through the low speed clutch 36 may be so adjusted as to obtain a continuous maximum low speed drive and an intermittent variable low speed drive from said maximum low speed down to zero, and a predetermined high speed drive may be obtained through the clutch 35. As a result, the feeding and controlling drums 10 and 11 may be driven in the cable winding direction at a relatively high predetermined speed, at a continuous maximum low speed and at intermittent low speeds between said maximum low speed and zero.

The improved means operated by the motor for swinging the arm 4 about its pivot relative to the skid comprises a screw shaft 88 suitably journaled on the bottom of the arm and disposed beneath the arm between the latter and the skid, and in the present instance this screw shaft is arranged with its axis extending longitudinally of the arm and aligned with the feed drive shaft 39, as shown in Fig. 7. The bevel gear 38 surrounds the screw shaft 88, and arranged coaxially with this bevel gear and also driven by the bevel pinion 37 is a bevel gear 89, the bevel gears 38 and 89 rotating in opposite directions and constituting reversing gears for the screw shaft. These bevel gears are selectively connectible in driving relation with the screw shaft 88 by multiple disc clutches 90 and 91, respectively, operated by a ball bearing

clutch shipper member 92 surrounding and slidably mounted on the rearward portion of the screw shaft 88 and having a shipper yoke 93. As shown in Fig. 8, this shipper yoke is pivotally mounted on a shaft 94 carried within the frame 20, and has an upstanding lever bifurcated at 95 for engagement with an eccentric pin 96 carried at the inner end of a control rod 97 rotatably mounted within the frame 20 and having an operating lever 98. It will thus be seen that one or the other of the bevel gears 38, 39 may be connected to the screw shaft 88 to effect rotation of the latter in either of opposite directions. Threadedly engaging this screw shaft 88 is a nut 99 guided for rectilinear movement within a longitudinal guideway 100 formed within a guide bracket 101 attached to the bottom of the arm structure. This nut has oppositely projecting trunnions 102 to which there are pivotally connected the upper ends of links 103, these links in turn being pivotally connected at their lower ends at 104 to the bottom of the skid. It is accordingly evident that as the screw shaft 88 is rotated in one direction the nut 99 is moved axially within its guideway 100, swinging the links 103 about their pivot 104, and as a result moving the arm structure 4 upwardly from the full line position shown in Fig. 6 to the dotted line position in that figure. When the screw shaft is rotated in the opposite direction, the parts are of course swung in the opposite direction.

Now referring to the improved kerf cutting mechanism, it will be noted that rotatably mounted on the head frame 19 of the arm structure 4 is a bifurcated or yoke shaped frame 105 of the rotatable cutter head 6. This head frame 19 is formed with a circular bearing support 106 on which the hub of a worm wheel 107 is journaled, and the hub yoke 105 is fixed to the worm wheel as by screws 108. The yoke frame and head frame cooperate to form a chamber 109 within which the worm wheel 107 is housed, and also arranged within this chamber on a transverse axis is a worm 110 meshing with the worm wheel 107 and fixed to a transverse shaft 111. Fixed to one end of this shaft is an operating handle 112. It will thus be evident that when the worm 110 is rotated by the operating handle 112, the worm wheel 107 is rotated, rotating therewith the cutter head 6. This worm gearing is self-locking and holds automatically the cutter head against rotation in its adjusted position. A kerf cutter supporting hanger 113 is rigidly secured, as by screws 114, to the swingable cutter support 8, as shown in Fig. 3. The kerf cutter 9 is herein in the form of a coal saw and comprises a relatively thin cutter bar 115 connected through usual adjusting mechanism 116 to the hanger support 113, and having mounted for circulation about its margin a cutter bit carrying cutter chain 117 of a relatively narrow design. The means for driving this cutter chain for circulating the latter about the margin of the cutter bar comprises a bevel pinion 118 fixed to the forward end of the motor power shaft 17 and meshing, as shown in Fig. 4, with a bevel gear 119 housed within the yoke-shaped frame 105 of the cutter head 6 which is herein made hollow and journaled on the shaft 120 suitably supported within this yoke shaped frame. The bevel gear 119 meshes with and drives a bevel gear 121 fixed to a transverse shaft 122 suitably journaled within the yoke frame and the swingable cutter support 8 in the manner shown. This shaft 122 is arranged with its axis

aligned with the pivotal axis 7 of the cutter support 8 and has connectible thereto, as by a jaw clutch 123 splined to the shaft, a bevel pinion 124. This bevel pinion has clutch teeth 125 engageable with the teeth of the jaw clutch 123 and is journaled on a bearing sleeve 126 supported by the shaft 122. This bevel pinion 124 meshes with a large bevel gear 127 fixed to a shaft 128 herein arranged with its axis perpendicular to the pivotal axis 7 of the cutter support 8 and suitably journaled within the hanger support 113, as shown in Fig. 3. Keyed to the outer end of this shaft 128 is a chain sprocket 129 which engages and drives the cutter chain 117. The operating means for the jaw clutch 123 comprises a shipper yoke 130 pivotally mounted within the cutter support 8 and having a lever 131 connected by a pivoted link 132 to an eccentric pin 133 herein formed on a shaft 134 journaled within the support 8 and having an operating lever 135. A suitable pin lock 136 is provided for holding the lever 135 in its different positions. It will thus be seen that the cutter chain 117 may be connected in driving relation with the motor or remain idle at will during running of the motor.

The cutter support 8 is pivotally mounted at 7 on and between the arms of the yoke shaped frame 105 for swinging movement relative thereto about an axis coinciding with the axis of the shaft 122 and at right angles to the axis of the cutter chain drive shaft 128 and the cutter head axis. This cutter support 8 is provided with lateral trunnions 140 pivotally mounted within bearing sleeves 141 supported within bearing supports 142 formed integral with the yoke shaped frame 105. The improved mechanism for swinging the cutter support 8 relative to the yoke frame of the cutter head to move the kerf cutter into different angularly related cutting planes with respect to the cutter head axis, herein comprises a bevel pinion 143 fixed to the inner end of the cutter chain drive shaft 128 and meshing with oppositely rotatable reverse bevels 144 and 145. These reverse bevels are selectively connectible by multiple disc clutches 146 and 147, respectively, to a shaft 148 aligned with the shaft 122 and suitably journaled at its inner end within a bearing sleeve 149 supported within the shaft 122 and at its outer end within a ball bearing 150 supported within a cover or cap plate 151 detachably secured to the bearing support 142 of the yoke frame 105. The operating means for the disc clutches 146, 147 herein comprises a clutch shipper member 152 surrounding and slidably mounted on the shaft 148 between the reverse bevels 144, 145 and engaging at its opposite side clutch applying elements 153. For sliding the shipper member 152 axially relative to the shaft, there is provided a yoke 154 pivotally mounted at 155 on a shaft supported within the cutter support 8. One side of this yoke is provided with a slotted portion 156 engageable with an eccentric pin 157 formed on the inner end of a shaft 158 suitably journaled within the cutter support and having an operating lever 159.

Again referring to the cutter support swinging mechanism, and more particularly to the speed reducing means between the shaft 142 and the support 8, it will be noted that the shaft 148 is formed with an eccentric 160 having rotatably mounted thereon through a roller bearing 161 an annular member 162. This annular member is provided with a hub portion 163 journaled on a bearing sleeve 164 supported by the shaft 148 and has formed therein, as shown

in Fig. 5, a plurality of radially located chambers 165 in each of which there is slidably guided a plunger 166. These plungers at their inner ends engage in sliding abutting relation the exterior periphery of the outer race 167 of the roller bearing and are formed at their outer extremities with tooth-like projections 168 adapted to engage with a wedging action the inclined surfaces of tooth-like portions 169 formed on an annular frame 170 herein arranged in a bore 171 formed in the adjacent trunnion 140 of the cutter support 8 and secured to the latter as by a key. The annular member 162 has formed on its hub portion 163 an eccentric 172 having rotatably mounted thereon, through anti-friction rollers 173, an annular member 174. Formed in the annular frame 170 is a plurality of radially located chambers 175 similar to the chambers 165 above described and having similarly slidably guided therein plungers 176 similar to the plungers 166. These plungers engage at their inner ends in sliding abutting relation the exterior periphery of the annular member 174 and are formed at their outer extremities with tooth-like projections similar to the projections 168 on the plungers 166 and similarly adapted to engage with a wedging action the inclined surfaces of tooth-like portions 177 formed on an annular flange 178 herein formed integral with the cap plate 151 secured to the cutter head frame. This mechanism forms a compound speed reducing mechanism between the shaft 148 and the tiltable cutter support 8, and as the eccentrics 160, 172 are revolved by the shaft 148, the plungers 166, 176 are driven radially outwards through the chambers in the frames 162, 170 so that the ends of the plungers engage the inclined sides of the tooth-like projections 169, 177 and thereby transmit rotary motion to the annular frame 170 secured to the cutter support 8 to tilt the latter about the axis of the shaft 148 relative to the cutter head frame. The operation of the tooth-like plungers is continuous and the elements of this speed reducing mechanism form what might be termed a compound continuous wedge or heliocentric speed reducing mechanism. It will thus be seen that when one or the other of the disc clutches 146, 147 is applied, the cutter support 8, together with the kerf cutter supported thereby, may be tilted in one direction or the other about the axis 7 relative to the yoke-shaped frame 105 of the cutter head.

The improved mining machine is adapted to be supported on a usual transport truck during movement of the machine about the mine, and the truck driving means on the machine for effecting drive of the wheels of the transport truck herein comprises a polygonal driving element 180 formed on the shaft 39, as shown in Fig. 7, and engageable with a polygonal socket member formed on the truck. It will thus be seen that the wheels of the transport truck on which the machine is supported may be driven at a predetermined high speed and through a wide range of relatively low speeds through the feed drive mechanism, it being possible to drive the truck wheels at relatively low variable speeds or at a relatively high predetermined speed, as conditions may require.

The operation of the improved mining machine will be clearly apparent from the description given. When the parts are in the position shown in Figs. 1 and 2, the arm 4 is in its lowermost position with respect to the skid and the cutter head 6 is positioned to locate the kerf cutter 9

in a top cutting position above the head axis. When the parts are thus disposed, the feed cable 12 is extended from the feed drum 10 around the guide sheaves 14, 15 at the advancing side of the machine and the free end of this cable is extended laterally from the forward end of the skid frame to a suitable anchor jack located at the left hand rib. The controlling cable 13 is extended from the control drum 11 around the adjacent guide sheave 14 and laterally through the opening 22 in the side frame of the skid at the receding side of the latter to a suitable anchor jack located at the right hand rib. When the parts are thus disposed the kerf cutter is sumped in and fed transversely across the face to cut a relatively narrow horizontal kerf a substantial distance above the level of the mine floor. When the kerf cutter is in the position shown, the feeding and controlling cables may be extended forwardly from the skid to suitable anchor jacks located adjacent the coal face so that, as the cables are wound in, the machine may be moved bodily rectilinearly towards the coal face to sump the kerf cutter within the coal. When it is desired to adjust the kerf cutter to cut a horizontal kerf at the floor level the operator grasps the handle 112 and rotates, through the worm gearing 110, 107, the cutter head 6 to a position to locate the kerf cutter at its lowermost horizontal cutting position beneath the head axis. The screw and nut elevating mechanism may be operated to swing the arm structure into any desired angular position with respect to the skid, thereby to support the kerf cutter at different elevations. The cutter head may also be rotated to move the kerf cutter at either side of the head axis into a vertical shearing position. When the kerf cutter is in such shearing position, the arm 4 may be swung upwardly to position the tip end of the kerf cutter at the roof. The cutter bar is then sumped in, swung downwardly in its plane by swinging the arm 4 about its pivot, and thereafter withdrawn from the face. These and various other operations will be clearly apparent to those skilled in the art.

As a result of this invention, it will be noted that an improved mining machine is provided of the flexibly fed, floor cutter type having improved adjustable kerf cutting mechanism and improved mechanism for adjusting the kerf cutting mechanism. It will further be noted that by the provision of the improved adjustable supporting structure for the kerf cutter, the kerf cutter may be positioned to cut horizontal kerfs in the coal face at any desired elevation between the mine roof and mine floor and to cut a vertical kerf. It will also be evident that by the provision of the improved flexible feeding means the machine may be maneuvered into cutting positions and fed during sumping, transverse cutting and withdrawal in an improved and more expeditious manner.

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

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

1. In a mining machine, a portable base, an arm structure pivotally mounted on and overlying said base, said arm structure being swing-

able in a vertical direction relative to said base, a kerf cutter carried by said arm structure, and motor operated means for swinging said arm structure relative to said base including a screw and nut mechanism operatively connected between said arm structure and said base, the screw and nut elements of said mechanism mounted on said arm structure and swingable therewith relative to said base.

2. In a mining machine, a portable base, an arm structure pivotally mounted on and overlying said base, said arm structure being swingable in a vertical direction relative to said base, a kerf cutter carried by said arm structure, and motor operated means for swinging said arm structure relative to said base including a screw and nut mechanism located beneath said arm structure between the latter and said base and means mounted on said arm structure and swingable therewith for actuating said screw and nut mechanism.

3. In a mining machine, a portable base, an arm structure pivotally mounted on and overlying said base, said arm structure being swingable in a vertical direction relative to said base, a kerf cutter carried by said arm structure, and motor operated means for swinging said arm structure relative to said base including a screw and nut mechanism located beneath said arm structure between the latter and said base and including relatively rotatable screw and nut elements, a link connecting one of said elements with said base and means mounted on said arm structure and swingable therewith for effecting relative rotation of said screw and nut elements.

4. In a mining machine, a portable base, an arm structure pivotally mounted on and overlying said base, said arm structure being swingable in a vertical direction relative to said base, a kerf cutter carried by said arm structure, and motor operated means for swinging said arm structure relative to said base including a screw and nut mechanism located beneath said arm structure between the latter and said base and including relatively rotatable screw and nut elements, a guideway on the bottom of said arm structure on which one of said elements is guided, and a link connecting said guided element with said base.

5. In a mining machine, a bottom skid, an arm pivotally mounted for vertical swinging movement on said skid, a kerf cutter carried by said arm, and motor operated means for swinging said arm relative to said skid including a screw and nut mechanism located beneath said arm between the latter and said skid and means mounted on said arm and swingable therewith for actuating said screw and nut mechanism.

6. In a mining machine, a bottom skid, an arm pivotally mounted for vertical swinging movement on said skid, a kerf cutter carried by said arm, and motor operated means for swinging said arm relative to said skid including a screw and nut mechanism located beneath said arm between the latter and said skid and including relatively rotatable screw and nut elements and a link connecting said nut element with said skid.

7. In a mining machine, a bottom skid, an arm pivotally mounted for vertical swinging movement on said skid, a kerf cutter carried by said arm, and motor operated means for swinging said arm relative to said skid including a screw and nut mechanism located beneath said

arm between the latter and said skid and including relatively rotatable screw and nut elements, a guideway on the bottom of said arm in which one of said elements is guided, and a link connecting said guided element with said skid.

8. In a mining machine, a portable base, an arm pivotally mounted on said base for swinging movement in a vertical direction relative thereto, a kerf cutter carried by said arm, and motor operated means for swinging said arm relative to said base including a screw shaft arranged beneath and extending longitudinally of said arm, a nut engaging said screw shaft and guided on said arm, and a link connecting said nut to said base.

9. In a mining machine, a portable base, an arm pivotally mounted on said base for swinging movement in a vertical direction relative thereto, a kerf cutter carried by said arm, and motor operated means for swinging said arm relative to said base including a screw shaft arranged beneath and extending longitudinally of said arm, a nut engaging said screw shaft and guided on said arm, a link connecting said nut to said base, and motor operated reversing gearing carried by said arm for rotating said screw shaft in either of opposite directions.

10. In a mining machine, a portable base, an arm pivotally mounted at its rear end on the rearward portion of said base to swing in a vertical direction with respect thereto, said arm overlying said base, a kerf cutter carried by the forward end of said arm and projecting forwardly in advance of said base, and means for swinging said arm vertically about its pivot relative to said base to vary the elevation of said kerf cutter comprising a screw and nut adjusting mechanism arranged between the bottom of said arm and said base and including an element pivotally connected to said base and means mounted on said arm and swingable therewith for actuating said screw and nut mechanism.

11. In a mining machine, a portable base, an arm pivotally mounted at its rear end on the rearward portion of said base to swing in a vertical direction with respect thereto, said arm overlying said base, a kerf cutter carried by the forward end of said arm and projecting forwardly in advance of said base, and means for swinging said arm vertically about its pivot relative to said base to vary the elevation of said kerf cutter comprising a screw and nut adjusting mechanism arranged between the bottom of said arm and said base, said adjusting mechanism including a screw journaled on the bottom of said arm and a cooperating axially movable nut.

12. In a mining machine, a portable base, an arm pivotally mounted at its rear end on the rearward portion of said base to swing in a vertical direction with respect thereto, said arm overlying said base, a kerf cutter carried by the forward end of said arm and projecting forwardly in advance of said base, and means for swinging said arm vertically about its pivot relative to said base to vary the elevation of said kerf cutter comprising a screw and nut adjusting mechanism arranged between the bottom of said arm and said base, said adjusting mechanism including a screw journaled on the bottom of said arm, a cooperating axially movable nut and a link pivotally connected between said nut and said base.

13. In a mining machine, a skid adapted to rest upon and slide in any direction over the

mine floor, an arm overlying said skid and at its rearward extremity pivotally mounted on the rearward portion of said skid to swing in a vertical direction with respect thereto, a kerf cutter carried at the forward end of said arm and projecting forwardly in advance of said skid, and devices for swinging said arm about its pivot relative to said skid to vary the elevation of said kerf cutter comprising a screw and nut adjusting mechanism underlying said arm between the latter and said skid and including relatively adjustable screw and nut elements and a cooperating element pivotally connected to said skid, and means mounted on said arm and swingable therewith for effecting relative adjustment of said screw and nut elements.

14. In a mining machine, a skid adapted to rest upon and slide in any direction over the mine floor, an arm overlying said skid and at its rearward extremity pivotally mounted on the rearward portion of said skid to swing in a vertical direction with respect thereto, a kerf cutter carried at the forward end of said arm and projecting forwardly in advance of said skid, and motor operated devices for swinging said arm about its pivot relative to said skid to vary the elevation of said kerf cutter comprising a screw and nut adjusting mechanism underlying said arm between the latter and said skid, said adjusting mechanism including a screw journaled on the bottom of said arm, a cooperating axially movable nut, and means carried by said arm for rotating said screw.

15. In a mining machine, a skid adapted to rest upon and slide in any direction over the mine floor, an arm overlying said skid and at its rearward extremity pivotally mounted on the rearward portion of said skid to swing in a vertical direction with respect thereto, a kerf cutter carried at the forward end of said arm and projecting forwardly in advance of said skid, and motor operated devices for swinging said arm about its pivot relative to said skid to vary the elevation of said kerf cutter comprising a screw and nut adjusting mechanism underlying said arm between the latter and said skid, said adjusting mechanism including a screw journaled on the bottom of said arm, a cooperating axially movable nut and a link pivotally connected between said nut and said skid, and means carried by said arm for rotating said screw.

16. In a mining machine, a skid adapted to rest upon and slide in any direction over the mine floor, an arm overlying said skid and pivotally mounted on said skid to swing in a vertical direction relative thereto, a kerf cutter carried by the forward end of said arm and projecting forwardly in advance of said skid, and motor operated means for swinging said arm vertically about its pivot relative to said skid including a screw journaled on said arm beneath the latter, a motor carried by said arm for rotating said screw, a nut threaded on said screw, and a link pivotally connected at one end to said nut and at its opposite end to said skid.

17. In a mining machine, a skid adapted to rest upon and slide in any direction over the mine floor, an arm overlying said skid and pivotally mounted on said skid to swing in a vertical direction relative thereto, a kerf cutter carried by the forward end of said arm and projecting forwardly in advance of said skid, and motor operated means for swinging said arm vertically about its pivot relative to said skid including a screw journaled on said arm beneath the latter, a motor

carried by said arm for rotating said screw, means on the bottom of said arm providing a longitudinal guideway in parallelism with said screw, a nut guided on said guideway and threadedly connected to said screw, and a link pivotally connected at one end to said nut and at its opposite end to said skid.

18. In a mining machine, a portable base, an arm pivotally mounted on said base to swing in a vertical direction with respect thereto, said arm overlying said base, a kerf cutter carried by the forward end of said arm and projecting forwardly in advance of said base, and means for swinging said arm vertically about its pivot relative to said base to vary the elevation of said kerf cutter comprising mutually mechanically interengaging, toothed, arm swinging elements having relative rectilinear movement to effect arm swing and arranged beneath said arm and between the latter and said base, said elements operatively connected to said arm and base re-

spectively, and means mounted on said arm and swingable therewith for effecting relative rectilinear movement between said arm swinging elements.

19. In a mining machine, a portable base, an arm pivotally mounted on said base to swing in a vertical direction with respect thereto, said arm overlying said base, a kerf cutter carried by the forward end of said arm and projecting forwardly in advance of said base, and means for swinging said arm vertically about its pivot relative to said base to vary the elevation of said kerf cutter comprising mutually mechanically interengaging, toothed, arm swinging elements having relative rectilinear movement to effect arm swing and arranged between said arm and base, said elements operatively connected to said arm and base respectively, and one of said elements mounted on the bottom of said arm to swing therewith.

MORRIS P. HOLMES.