C. E. DAVIS.

MINING MACHINE.

APPLICATION FILED MAY 25, 1914.

1,244,178.

Patented Oct. 23, 1917.

8 SHEETS—SHEET 1.

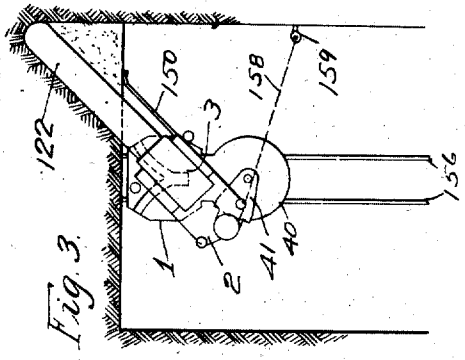

Fig. 3.

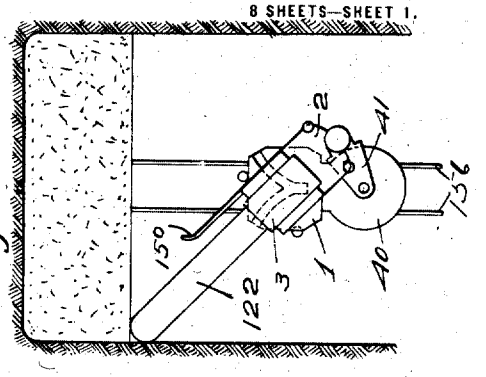

Fig. 6.

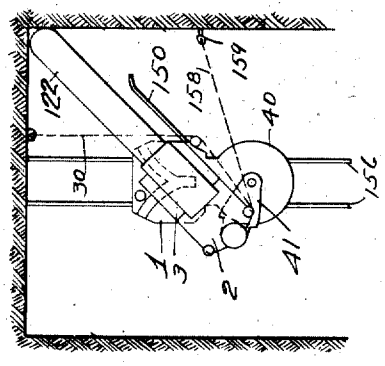

Fig. 2.

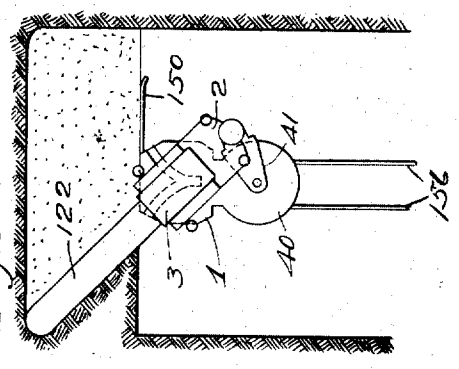

Fig. 5.

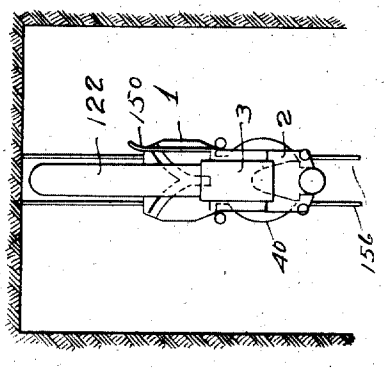

Fig. 1.

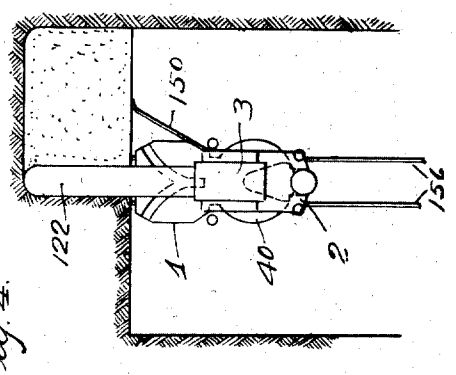

Fig. 4.

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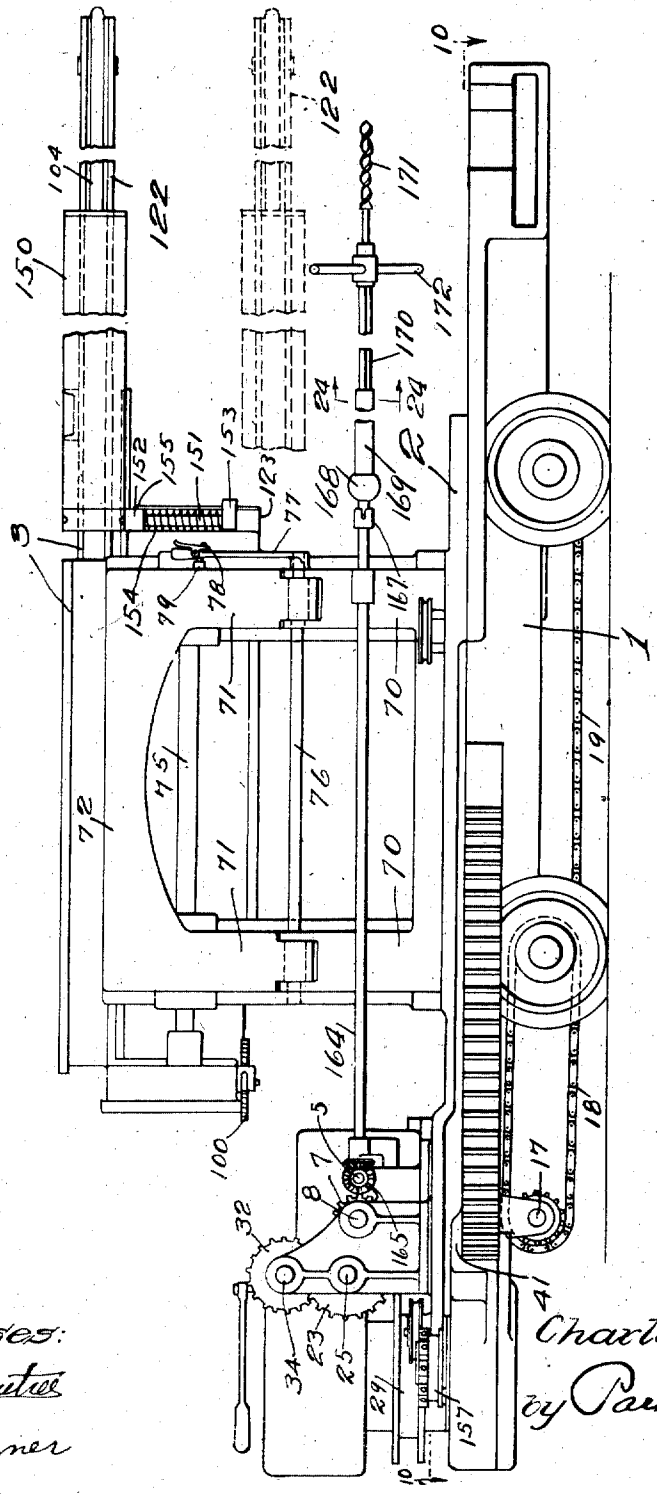

Fig. 7.

Fig. 24.

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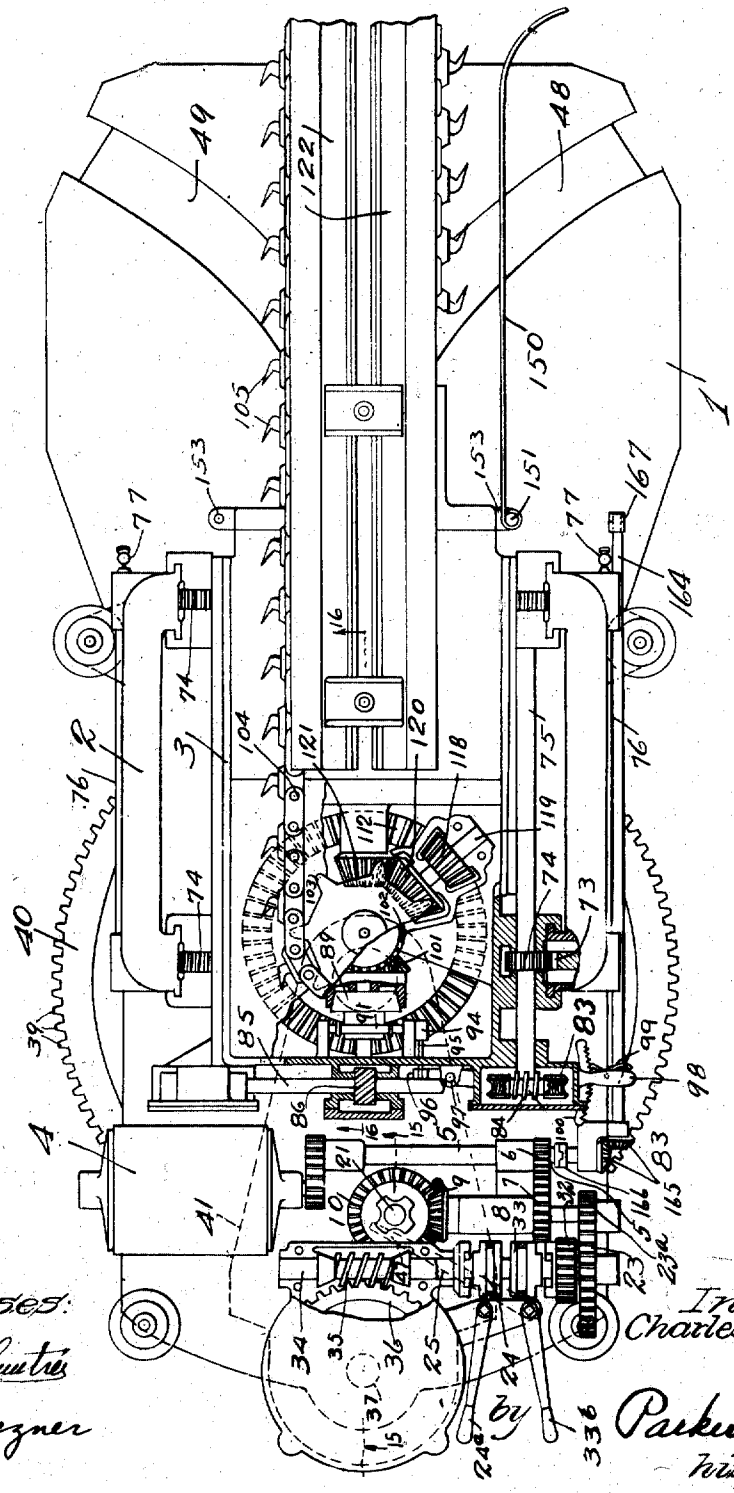
8 SHEETS—SHEET 3.

Fig. 8



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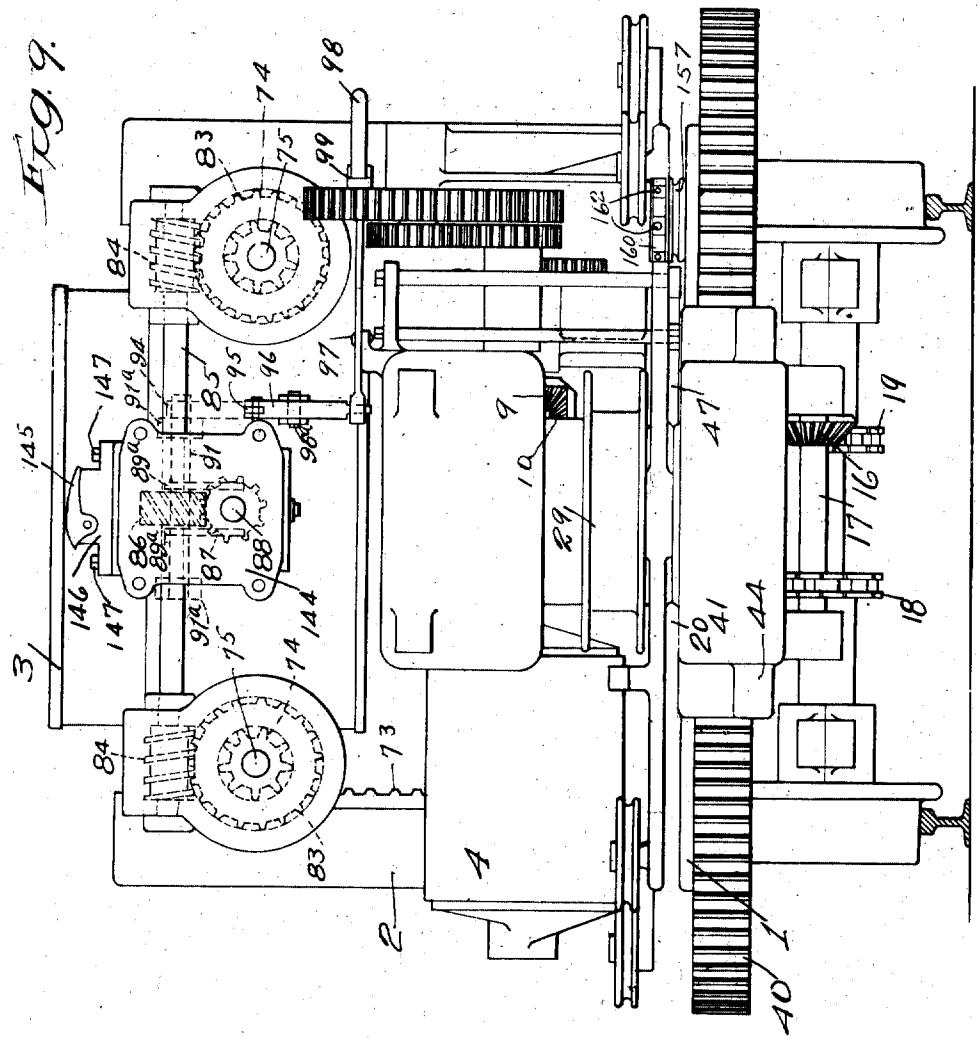
8 SHEETS—SHEET 4.

Fig. 9.



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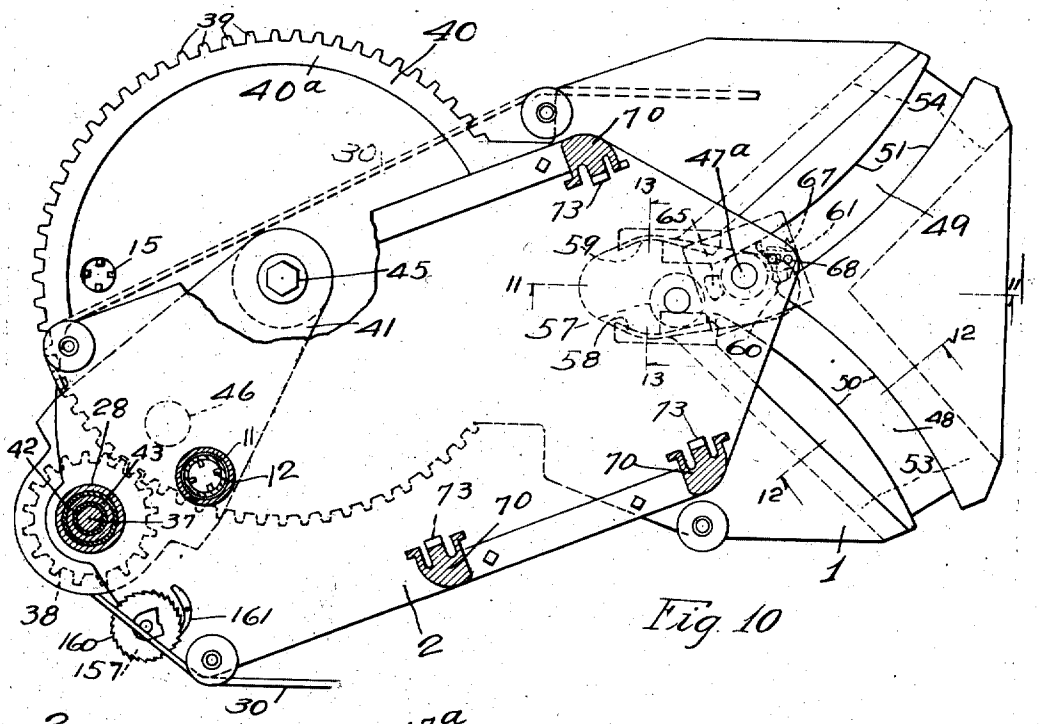

Fig. 10

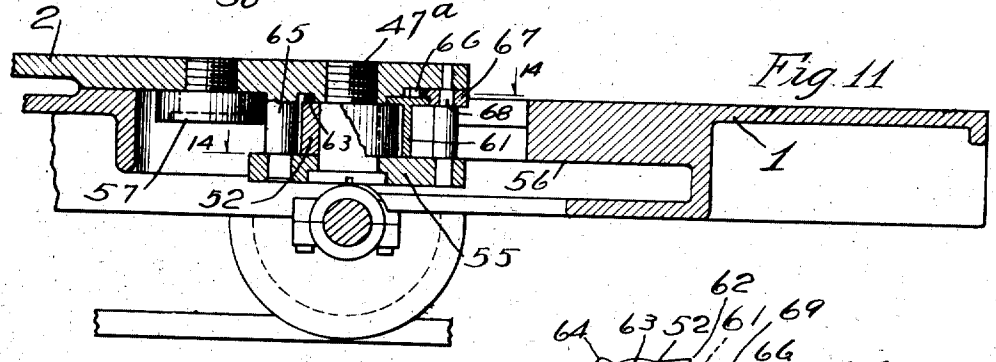

Fig. 11

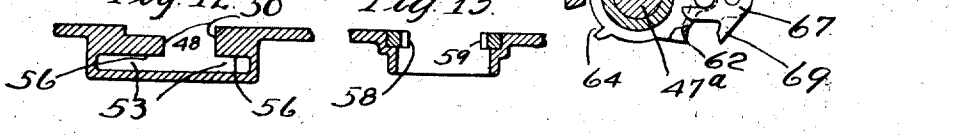

Fig. 14.

Fig. 12.

Fig. 13.

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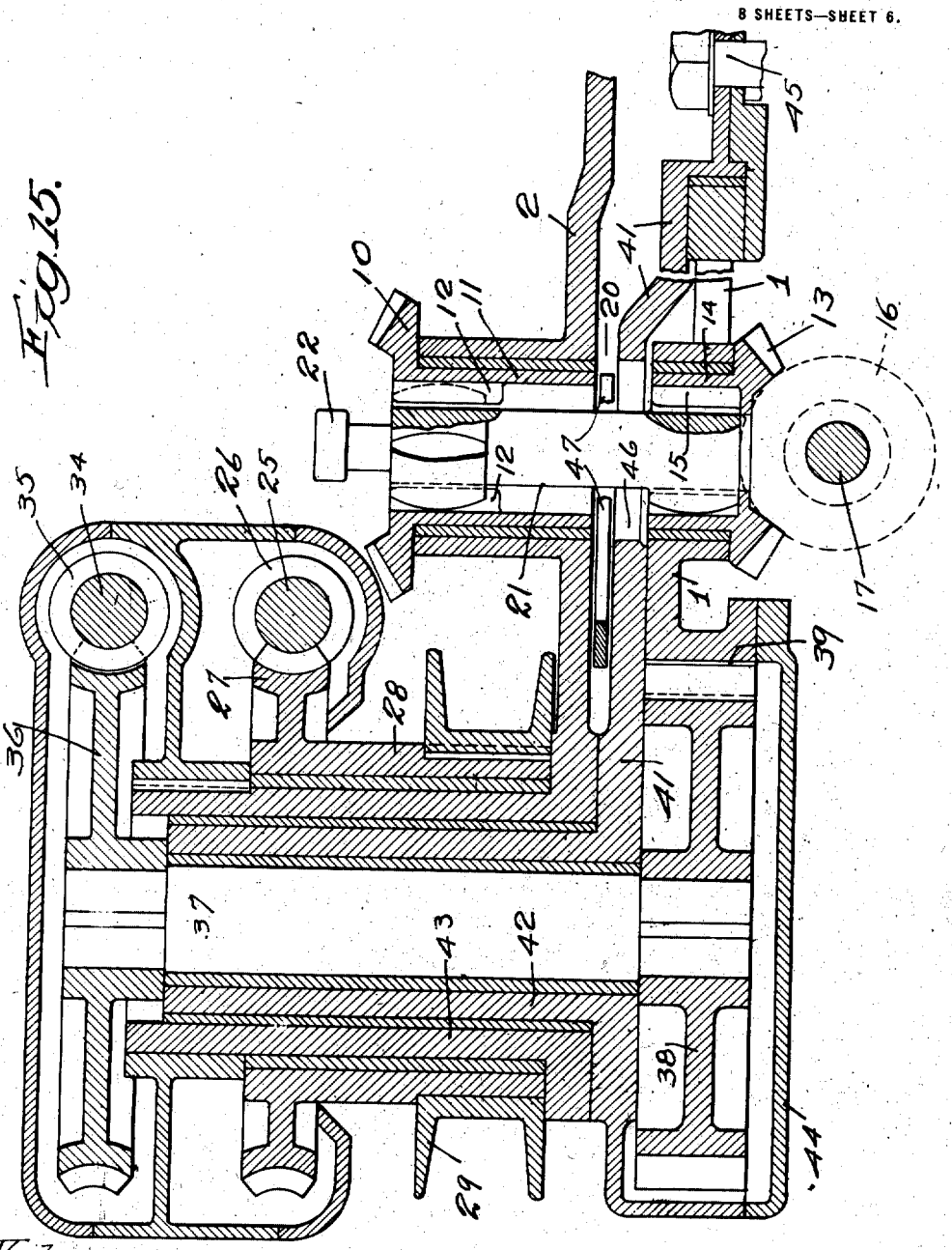
8 SHEETS—SHEET 6.

Fig. 15.



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APPLICATION FILED MAY 25, 1914.

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8 SHEETS—SHEET 7.

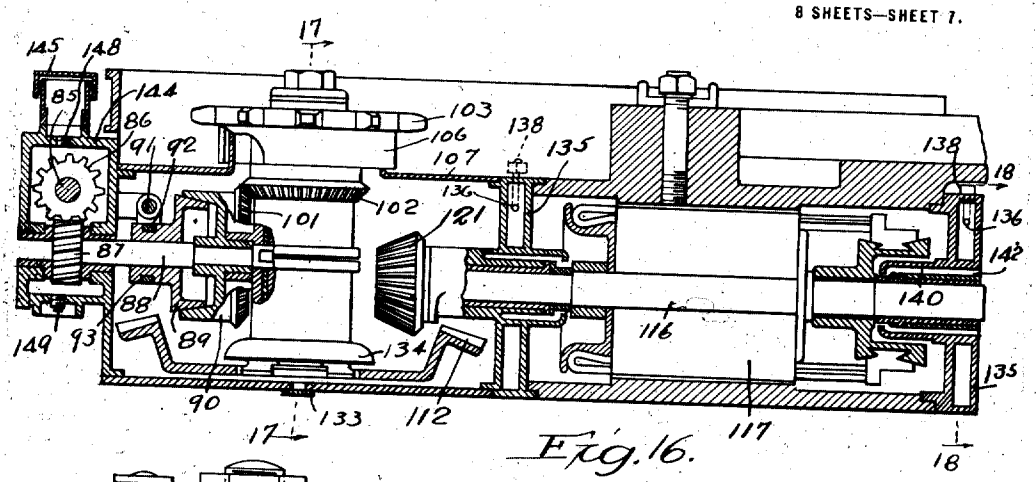

Fig. 16.

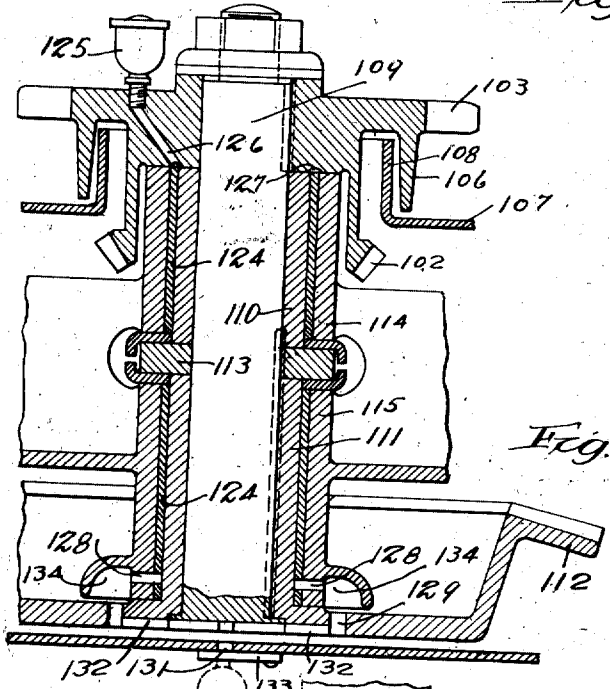

Fig. 17.

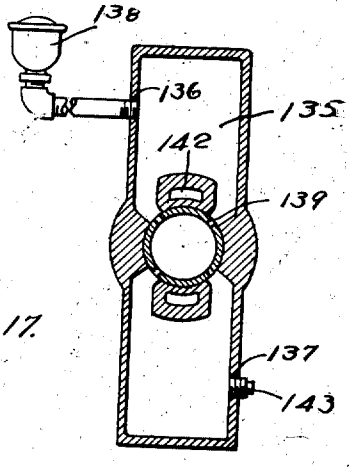

Fig. 18.

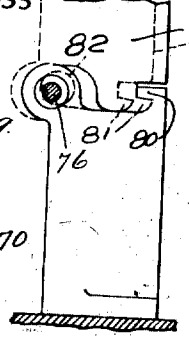

Fig. 19.

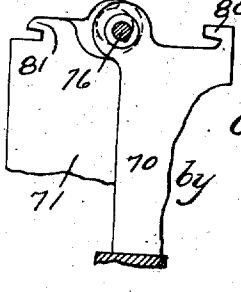

Fig. 20.

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8 SHEETS—SHEET 8.

Fig. 21.

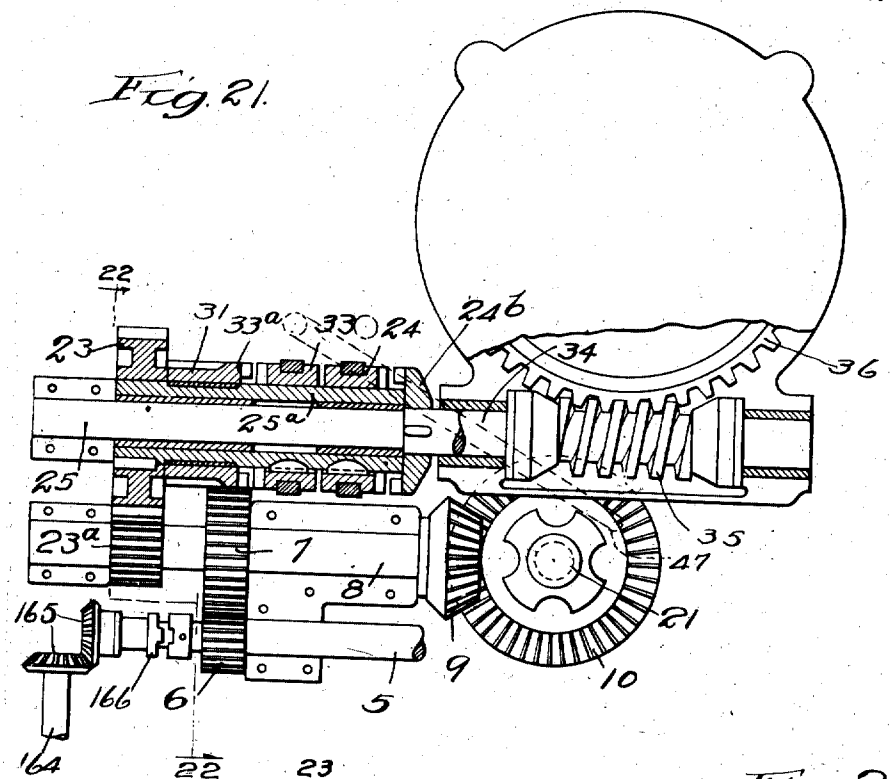


Fig. 22.

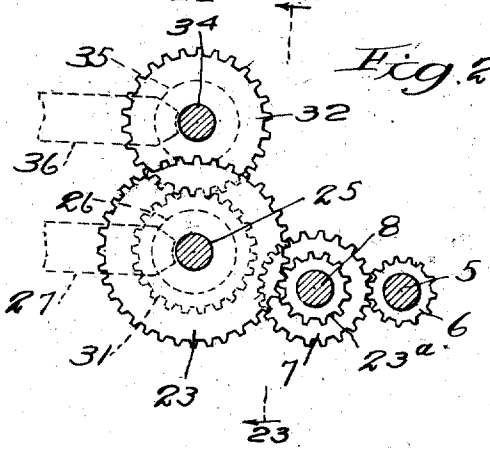
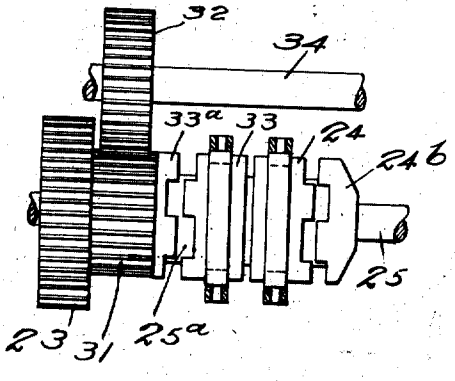


Fig. 23.



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UNITED STATES PATENT OFFICE.

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MINING-MACHINE.

1,244,178. Specification of Letters Patent. Patented Oct. 23, 1917.

Application filed May 25, 1914. Serial No. 840,652.

To all whom it may concern:

Be it known that I, CHARLES E. DAVIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Mining-Machines, of which the following is a specification.

This invention relates to mining machines and has for its object to provide a new and improved device of this description.

One of the objects of my invention is to provide a mining machine particularly adapted to be used in making cuts at various heights as desired.

The invention is illustrated in the accompanying drawings, wherein—

Figures 1, 2, 3, 4, 5 and 6 are diagrammatic views showing the mining machine in various positions during the operation of making the cut;

Fig. 7 is a side elevation with a portion broken away showing one form of mining device embodying the invention;

Fig. 8 is a plan view partly in cross section of the mining machine illustrated in Fig. 7;

Fig. 9 is a rear view of the mining machine illustrated in Fig. 7;

Fig. 10 is a sectional view taken on line 10—10 of Fig. 7;

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

Fig. 12 is a sectional view taken on line 12—12 of Fig. 10;

Fig. 13 is a sectional view taken on line 13—13 of Fig. 10;

Fig. 14 is a sectional view taken on line 14—14 of Fig. 11;

Fig. 15 is a sectional view taken on line 15—15 of Fig. 8;

Fig. 16 is a sectional view taken on line 16—16 of Fig. 8;

Fig. 17 is a sectional view taken on line 17—17 of Fig. 16;

Fig. 18 is a sectional view taken on line 18—18 of Fig. 16;

Fig. 19 is an enlarged view showing the hinged joint in the supporting pieces for the frame of the cutting element;

Fig. 20 is a view similar to Fig. 19 showing the top of the support folded down.

Fig. 21 is a view in part section showing the driving connection from the motor shaft on the moving frame to the parts driven by said motor;

Fig. 22 is a sectional view taken on line 22—22 of Fig. 21;

Fig. 23 is a view taken on line 23—23 of Fig. 22.

Fig. 24 is a sectional view taken on line 24—24 of Fig. 7.

Like numerals refer to like parts throughout the several figures.

As illustrated in the drawing the machine is made up of three general elements comprising a base frame 1, a pivoted or rocking frame 2 and a cutting element 3. The base frame 1 is preferably mounted upon wheels which run upon a track. The rocking or moving frame 2 is mounted on the frame 1 and is arranged so that it may be given both angular and longitudinal movement as the machine is making its cut. The cutting element is movably mounted upon supports which are attached to the rocking frame. The moving frame 2 carries a motor 4 which is arranged so that it may be used to move the entire device along the rails or for rocking the rocking frame. As herein shown, the motor 4 is mounted upon the rear end of the rocking frame and is operatively connected with a cross shaft 5 (see Figs. 7 and 8). The shaft 5 is connected by pinion 6 and gear 7 with a shaft 8, which carries a beveled gear 9. This beveled gear engages a beveled gear 10 (see Figs. 8 and 15), said beveled gear having a hollow hub 11 which works in a bearing on the rocking frame. This hollow hub is provided with the inwardly projecting lugs 12. Located below the hub 11 and mounted upon the base frame 1 is a beveled gear 13 which is also provided with a hollow hub 14 containing the lugs 15, the hubs of the two gears being in alinement. The beveled gear 13 connects with a beveled gear 16 mounted on the shaft 17 carried by the base frame. The shaft 17 is operatively connected with the wheels of the base frame by means of the chains or belts 18 and 19, so that when said shaft is operated, the entire device may be moved by the motor. The gears 10 and 13 are normally disconnected and the hubs thereof are separated by a space 20. The

gears 10 and 13 are connected together by a removable connecting piece or post 21, which is provided at each end with grooves for the lugs 12 and 15 on the gear hubs. It will be seen that when the connecting piece is dropped into the hollow hubs it then connects the gears 10 and 13 together and when it is removed it disconnects them. The connecting device is provided with a handle 22 for controlling it. The shaft 8 is connected by the gear 23^a with the gear 23 mounted upon the sleeve 25^a rotatably mounted upon the shaft 25. (See Figs. 8, 15, 21, 22 and 23.) The shaft 25 carries the worm 26 meshing with the worm gear 27 carried by the sleeve 28 on which is mounted the drum 29 to be used for winding the rope or other power transmitting device 30, adapted to be attached to a fixed part to move the cutter of the machine into the coal in making the first part of its cut. Loosely mounted upon the sleeve 25^a is a gear 31 which meshes with the gear 32 on the shaft 34 having a worm 35 which engages a worm gear 36 connected with the shaft 37 mounted upon the moving frame. This shaft is provided with a gear 38 which meshes with the teeth 39 of a rack or gear 40 fixed to the base frame 1. Some suitable means is provided for controlling these connections. As herein shown there is slidably mounted upon the sleeve 25^a a clutch member 24 which is feathered to the sleeve and which is controlled by the handle 24^a. This clutch member is adapted to be brought into engagement with an opposed clutch member 24^b fastened to the shaft 25. It will be seen that when the clutch members 24 and 24^b are brought into engagement, the shaft 25 will be rotated and when they are moved out of engagement the shaft 25 will be disconnected from the motor. There is also slidably mounted upon the sleeve 25^a a clutch member 33. The end 33^a of the gear 31 is formed as a coöperating clutch member so that when the member 33 is slid along the sleeve it will engage the clutch member on the gear and cause said gear to be rotated. This movement of the gear by means of gear 32 causes the rotation of shaft 34. The clutch member 33 is controlled by the handle 33^b. A movable connecting device 41 is connected with the rocking frame 2 and the base frame 1. This connecting device, as herein shown surrounds the shaft 37 and has a sleeve 42 through which the shaft 37 projects. The moving frame 2 as herein shown is also provided with a sleeve 43, which acts as a bearing for the sleeve 42. The part 41 is also provided with a casing 44 in which the gear 38 is inclosed. The connecting device 41 is pivotally connected with the base frame at 45, the pivotal connection being at the center of the gear or curved rack 40. The connecting device 41 passes in the space 20 between the gears 10 and 13 and is provided with an opening 46 adapted to register with the openings in the hollow hubs of said gears when the moving frame is in a predetermined position and in the present case, this is when the moving frame is in the central position parallel with the base frame. When in this position the post 21 can be inserted to connect the two gears and will pass through the opening 46. The clutch 33 has connected therewith a part 47 (see Figs. 8, 9 and 15) arranged so that when the clutch is thrown, to connect gear 38 with the motor, the part 47, which is located in space 20 will project across the openings in the gears 10 and 13, thereby preventing the post 21 from being inserted and making it impossible to connect the motor with the driving wheels of the base frame, while the moving frame is operatively connected with the motor. The gear or curved rack 40 has its middle portion depressed, that is, the part 40^a containing the teeth, projects above the face of the remaining portion and the connecting piece 41 is bent downwardly, as shown in Fig. 15 so that a portion thereof is contained within the depressed portion of this gear. The moving frame 2 carries the cutting element and has a pivotal or rocking connection with the base frame. As herein shown, the moving frame 2 is provided with a pivot 47^a which has a sliding pivotal connection with the base frame 1. This pivot projects into slots 48 and 49 in the base frame, the slots having the guiding faces 50 and 51 which are engaged by the pivot. As herein shown, the pivot is provided with a roller 52 which engages these guiding faces. The slots 48 and 49 are under cut so as to form recesses 53 and 54 beneath the guiding faces 50 and 51. Connected with the pivot 47^a is a removable holding piece 55 which slides along these recesses, the edges of the plate projecting beyond the guiding faces 50 and 51 and engaging the under faces 56 so as to prevent the moving frame from being lifted upwardly so as to disengage it from the base frame. It will be noted that the slots 48 and 49 start from the outer edges of the base frame and meet near the middle thereof and as the moving frame is rocked the pivot 47^a passes along one slot, say for example, the slot 48 going toward the center and is then switched into the slot 49 and moved away from the center. I provide a suitable switching device for this purpose. As herein shown, this switching device consists of a switching cam or part 57 connected with the moving frame back of the pivot 47^a at the point where the slots 48 and 49 meet. At the meeting point of the converging slots there are rearwardly projecting engaging faces, 58 and 59. As the pivot reaches this central position, the further rocking movement of the moving frame causes the switch-

ing part 57 to engage one of these faces and switches the pivot from one slot to the other. For example, if the pivot is moving along slot 48 toward the center, when it reaches the center where the two slots meet, the switching part 57 engages the face 58. At this point the moving frame has reached the limit of its backward movement and then begins to move forward and the switching part 57 engages the face 58 causes the pivot to be moved to avoid the point 60 and pass into the slot 49. If the pivot is moved in the opposite direction, that is, is in slot 49 and is moving toward the center, when it reaches the center the switching part 57 engages the face 59 and switches the pivot into slot 48. The rear end of the machine moves in an opposite direction from the pivot itself as this pivot moves from side to side of the machine. When the pivot for example, moves to the left of the center line the rear end of the machine moves to the right of the center line and vice versa, thereby insuring a proper balance of the machine. In view of the fact that the cut is made above the base frame, the cuttings therefrom fall into the slots 48 and 49 and some suitable means is provided for cleaning out these slots. As herein shown, a cleaner 61 is placed ahead of the pivot 47^a. This cleaner has two projecting arms 62 as shown, the ends of which pass along the faces 50 and 51 (see Fig. 10). The cleaner is pivotally mounted upon the pivot 47^a and has connected with it a part 63 provided with lugs 64 adapted to engage the pin 65 so as to limit the movement of the cleaner (see Figs. 11 and 14). The cleaner is provided with a projection 66, which is engaged by a controlling device 67 mounted upon the pin 68 which connects the plate 55 with the rocking frame. This controlling device is provided with the projecting parts 69 and as the pivot passes from one of the slots 48 or 49 to the other, one of these projecting parts engages the point 60 and causes the cleaner to be moved so that it extends directly across the slot into which it is then being moved, that is, to the position shown in Fig. 10. It will therefore be seen that as the pivot 47^a is transferred from slot 48 to slot 49 or vice versa, the cleaning device is automatically changed to extend across the slot and to move ahead of the pin so as to clear the slot of cuttings, dirt or other material that may be therein.

The pivoted or moving frame 2 is provided with supports upon which the cutting element 3 is movably mounted so that said cutting element may be moved up and down. As herein shown, there are two of these supporting pieces, one on each side, the cutting element 3 being mounted between them. In the construction shown, each supporting piece consists of the stationary upwardly projecting parts 70 which are fixed to the frame 2. Hinged to the projecting parts 70 are the hinged parts 71, the hinged parts 71 being connected together at the top by the piece 72. The parts 70 and 71 are provided with rack teeth 73 on their inner faces, which are engaged by pinions 74 mounted on shafts 75 rotatably mounted upon the cutting element (see Fig. 8). It will be seen that when the pinions 74 are rotated the cutting element may be moved up and down between its supports. The parts 71 are hinged to the parts 70 in any desired manner so that they may be folded downwardly after the cutting element has been moved below them so as to lessen the head room of the entire machine and facilitate its movement into and about the mine and into places having low roofs or obstructions at the top.

In the construction shown a shaft 76 is associated with each supporting device at the opposite sides of the cutting element, each shaft passing through lugs on the parts 70 and 71 (see Figs. 7, 19 and 20). Each shaft is provided with a handle 77 which has a spring lock 78 adapted to lock it to the locking part 79 on one of the parts 71 (see Fig. 7) above the points where the parts 71 engage the parts 70. Suitable interlocking devices are provided to lock them in position. As shown in Figs. 19 and 20 the fixed parts 70 are provided with the projections 80, while the hinged parts 71 are provided with the projections 81. When the parts 70 and 71 are in their operative position in alinement, these parts 80 and 81 interlock as shown in Fig. 19 and hold the two parts in proper rigid relation. When it is desired to fold the parts 71 down, the shaft 76 is rotated. This shaft is provided with the eccentrics 82, one associated with each piece 71. When the locking device 78 is then disconnected from the locking device 79 and the shaft rotated by handle 77, these eccentrics move the parts 71 so as to disengage the interlocking parts 80 and 81 (see Fig. 19). The part 71 may then be folded down so as to be parallel with the part 70 as shown in Fig. 20. When the parts 71 are moved up in alinement with the parts 70 and the shaft is again moved back to its initial position shown in Figs. 7 and 19, the parts 80 and 81 are interlocked and the proper rigidity secured.

The shafts 75 carrying the pinions 74, the rotation of which cause the cutting element to be moved up and down between its supports, are driven in any suitable manner from a motor mounted on the cutting element. As herein shown, the shafts 75 are provided with the worm gears 83 which engage worms 84 on the shaft 85 (see Figs. 8, 9, and 16). The shaft 85 is provided with a worm gear 86 which engages a worm 87 on a shaft 88. This shaft is provided with a friction clutch member 89 feathered on the

shaft and which engages a friction clutch member 90. The clutch member 89 is controlled by a rock shaft 91 rotatably mounted on supports 91ª and carrying the arms 89ª connected with a member 92 which engages the grooved sleeve 93 connected with the clutch member. The shaft 91 is rocked by means of a crank 94 to which is attached a link 95 fastened to the end of a lever 96 pivoted at 96ª, said lever being connected through a pin and slot connection to a lever 98 pivoted to the frame at 97 (see Figs. 8, 9 and 16) and which projects beyond the frame of the machine and is provided with a handle. This handle has a pawl 99 which engages a ratchet 100 so that they may be held in any desired position.

It will be seen that since the link 95 is connected with the lever 96 beyond its pivot, the shaft 91 will be rocked when the handle 98 of the lever is moved so as to move the clutch member 89 into and out of engagement with the clutch member 90. The clutch member 90 is rotatably mounted on the shaft 88 and is connected with beveled gear 101 which engages another beveled gear 102 which is operatively connected with the motor shaft. In the construction shown, the beveled gear 102 is fastened to the sprocket wheel 103 about which passes the connecting chain 104 carrying the cutters 105 which make the cut in the coal or other material. Connected with the sprocket wheel is a downwardly projecting flange or annulus 106. A fixed part 107 is provided with an upwardly turned flange or annulus 108, which projects between the part 106 and the hub of the sprocket wheel 103 and beveled gear 102, thereby acting as a shield to prevent dirt from cutting into the bearings. The sprocket wheel 103 and beveled gear 102 are keyed to a shaft 109. This shaft has keyed to it a sleeve 110. Another sleeve 111 is also keyed to the shaft, said sleeve being, in fact, the hub of a beveled gear 112. Fastened to the shaft 9 between the sleeves 110 and 111 is a bearing piece 113 which projects into an opening between the sections 114 and 115 of the stationary bearing in which the said shaft and sleeves rotate. This bearing piece permits a proper bearing for the parts when the cutting element is reversed or turned upside down. The beveled gear 112 is operatively connected with the shaft 116 of the motor 117. This connection is preferably made through some reducing gear. As herein shown, the beveled gear 112 engages the beveled gear 118 (see Fig. 8) connected with the short shaft 119. A second beveled gear 120 is also connected with this shaft, such latter beveled gear meshing with the beveled gear 121 on the armature shaft 116 (see Figs. 8 and 16).

The height of the cutter which makes the cut in the coal or other material may be varied by moving the cutting element up or down on its supports as before stated. It will be noted, however, that the cutter arm 122 projects from the cutting element eccentrically, that is, from one face thereof. Since, therefore, the other boundary of the cutting element shown at 123 Fig. 7 is at a distance from the plane of the cutting arm, it will be seen that when the cutting element is moved to its lowest position, the cutting arm will be some distance above the pivoted rocking frame 2. In order to secure a greater range through which the cutter may act, I make the cutting element reversible so that when it is desired to cut low down, the cutting element can be reversed so that the cutter arm will be at the bottom instead of at the top. This reversing is done by moving the cutting element out from between its supports and turning it over so that the cutting arm takes the position shown in dotted lines in Fig. 7. Since the parts of the cutting element must be properly oiled at all times, it is necessary to provide some means for oiling such parts when in their reversed position as well as when in their normal position. In the construction herein shown, this is provided for in the following manner: When the cutting element is in its normal or upright position, the main driving shaft 109 for the cutter is in the position shown in Fig. 17. The bearing surfaces are then between the sleeve 110 and the section 114 of the bearing and between the sleeve 111 and the section 115 of the bearing and between the bearing piece 113 and the end of the section of the bearing 115. In the construction shown, there is located between the bearing surfaces the wearing elements 124. Both sides of these wearing elements are oiled by means of an oil cup 125 which connects with an oil passage 126 and an oil chamber 127 extending around the upper end of the space between the sleeve 110 and bearing 114. It will thus be seen that the oil passes down between these parts. When it reaches the bearing piece 113 it then passes out around this bearing piece and back in between the sleeve 111 and bearing 115, thus oiling all of the bearing surfaces. The oil then passes out at the bottom through the openings 128 and 129.

When the element is reversed, the beveled gear 112 is at the top. An oil cup 130 in opening 131 then supplies oil to the oil passageway 132. The opening 131 may be closed by the gate 133 when the oil cup 130 is not in position. The oil passes from cup 130 to passageway 132, thence through openings 129 into the receptacle 134 formed on the bearing piece 115. The oil then passes through openings 128 into the space between parts 111 and 115, and when it reaches the part 113 passes out around said part and

o the space between parts 110 and 114. It then passes into chamber 127 and out through passage 126.

The bearings for the armature shafts of the motor must also be provided with oiling means which will operate when the element is in its upright position or in its reversed position. These two bearings are similar and I have shown one of them in detail in Fig. 18. In this construction there is an oil receptacle 135 which extends on opposite sides of the armature shaft. This oil receptacle is provided with two openings 136 and 137. When the cutting element is in its upright position, an oil cup 138 is connected with the opening 136. The oil passes into the oil chamber 135 and then passes through openings 139 to the bearing surface of the armature shaft. Associated with each armature shaft oiling device is a sleeve 140 (see Fig. 16) which has its end nearest the armature bent inwardly so as to catch any oil that may escape from the bearing and prevent it from getting onto the commutator or other part of the armature. This oil then escapes through the passageway 142. When the cutting element is reversed, the plug 143 is removed from the opening 137 and placed in opening 136 and the oil cup 138 connected with opening 137. The worm 87 and worm gear 86 and the journal of shaft 88 are inclosed within a casing 144 into which oil is inserted at the top by lifting the hinged part or door 145 (see Figs. 9 and 16). The part 145 is hinged to a section 146 which is removably attached to the rest of the casing by means of bolts 147 (see Fig. 9). The casing section 146 is connected to the main casing by the opening 148 through which the oil passes to the main casing. There is a similar hole at the bottom of the main casing which is closed by a plug 149. When it is desired to reverse the cutting element the casing section 146 is removed and is placed on the opposite side of the main casing, the plug 149 being removed and being placed in the other hole. A suitable guard is provided for the cutting device so that the operator cannot accidentally get against the cutting device and thereby be injured. As herein shown, this guard consists of a guard piece 150 (see Figs. 1–8). The guard piece is mounted on a supporting rod 151 which passes through supporting pieces 152 and 153 on the frame of the cutting element. A spring 154 is connected at one end with a part of the frame and at the other end with a part connected with the guard piece, the torsion of the spring tending to normally press the guard piece toward the cutter. The movement of the guard piece in this direction is limited by the stop 155 so that it cannot come into contact with the cutters. This guard may be placed on either side of the cutter arm, as there are supporting pieces 152 and 153 on each side thereof. The guard piece 150 engages the face of the coal when the cutter arm is in certain of its positions, and being hinged springs away from the cutter arm to permit the relative movement of the cutter arm and the guard piece. This guard piece is shown in various positions in Figs. 1–6.

When the machine is in use, it is moved up to a position in front of the wall to be cut as shown in Fig. 1, the wheels of the main frame 1 resting upon the track rails 156. The cable 30 is then fastened to a fixed point in front of the machine and the cutter is turned to the position shown in Fig. 2. The two motors are then set in operation, one of them actuating the cutter and the other rotating the drum about which the cable 30 passes, thus forcing the cutter into the coal as shown in Fig. 3. During this cut, it will be seen that there is a great lateral pressure tending to push the machine off of the track rails and some means is provided for preventing this. As herein shown, a drum 157 is mounted on the machine and a cable 158 is connected with said drum, the other end of the cable being connected to a fixed point 159 at the side of the machine as shown in Figs. 2 and 3. The drum 157 is provided with the ratchet wheel 160 which coöperates with the pawl 161. This ratchet wheel is provided with some means for turning it, as for example, with the openings 162 (see Fig. 9). By placing a rod in these holes it will be seen that the ratchet wheel and drum may be turned to tighten or loosen the cable 158. The fixed part 159 is preferably placed forward a distance about equal to one-half the straightforward movement of the machine in making the first cut. This is shown in Fig. 2. As the machine moves in, it will be seen that it moves past this point and the cable 158 therefore varies in length. This cable must therefore be tightened as the machine moves toward the fixed point 159 and loosened as it moves away from it during the last part of the cut. This cable 158 takes the lateral strain and prevents the machine from being forced sidewise from the track.

I have described in detail a particular construction embodying my invention, but it is, of course, evident that the parts may be varied in many particulars without departing from the spirit of the invention, and I therefore do not limit myself to the particular construction shown.

In making the initial cut with the machine, it is desirable to set an anchor in the face of the coal to which the cable 30 is attached. I have illustrated in the drawings a device for drilling this hole by means of the machine itself. For this purpose a shaft

164 (see Figs. 7, 8 and 21) is mounted upon the machine and is operated by the beveled gears 165 from the shaft 5, there being a clutch 166 by means of which the said shaft 164 may be connected or disconnected from the shaft 5. A removable extension device is adapted to be connected with the shaft 164 so as to rotate therewith, said connection being made in any desired manner as by means of a socket 167 into which the end of the extension device fits. The extension device is provided with the universal joint 168 and a telescopic member consisting of a hollow part 169 and a non-circular part 170 which slides in and out of said hollow part but which rotates therewith. A boring tool 171 is connected with the end of the extension device for boring the hole. Said extension device is provided with a handle 172 which is free to rotate with relation to the part 170 and by means of which the tool may be controlled. It will be seen that by this device the tool may be moved up and down or sidewise to secure the proper location and may then be used to bore the proper hole.

It will be noted that in this construction the rear end of the moving frame projects from the main frame on the side thereof opposite to that from which the front end projects, and that the relative position of the moving frame and the fixed frame during all the various movements of the fixed frame is such as to keep the mechanism in a balanced condition.

The use and operation of my invention are as follows:

When it is desired to use the machine, it is run along the track to a substantially central location in front of the coal to be cut as illustrated in Fig. 1. The cutter is then moved to the position shown in Fig. 2 and the cable 158 connected with the fixed part 159. The motor which runs the cutter is then set in motion and the entire machine is moved forward so as to make the first cut as shown in Fig. 3. The moving frame is then rocked by its proper motor and the cut completed as shown in Figs. 4, 5 and 6.

It will be seen that by this arrangement the machine may be held at a fixed point and will yet make a cut with a substantially straight face.

I claim:

1. A mining machine comprising a base frame, a moving frame mounted thereon having an annular motion in a plane substantially parallel with the surface upon which the machine is supported and a cutting element mounted upon said moving frame, said cutting element provided with a projecting cutter arm, a cutter chain movably mounted on said cutter arm, a motor for operating said cutter chain and a separate motor for giving said moving frame and cutter arm an angular movement to feed the cutter chain to the coal whereby the feeding movement and cutter chain movement are independent of each other.

2. A mining machine comprising a base frame, a moving frame mounted thereon, a support connected with said moving frame, a reversible cutting element connected with said support, means for supporting said cutting element at different points along said support, a cutter forming a part of said cutting element and projecting eccentrically therefrom, a motor on said cutting element for driving said cutter, said cutting element and motor reversible with relation to said support so as to vary the position of said cutter.

3. A mining machine comprising a base frame, a moving frame mounted thereon, a cutting element carried by said moving frame, a pivot connecting with said moving frame, said base frame provided with two converging and intersecting slots along both of which said pivot is adapted to move and mechanism for moving said moving frame.

4. A mining machine comprising a base frame, a moving frame mounted thereon, a cutting element carried by said moving frame, a pivot connected with said moving frame, said base frame provided with two converging slots along both of which said pivot is adapted to move and mechanism for moving said moving frame, said mechanism located at a distance from said pivot.

5. A mining machine comprising a base frame, a moving frame mounted thereon, a cutting element carried by said moving frame, a pivot connected with said moving frame, said base frame provided with converging slots along which said pivot is adapted to move and mechanism for moving said moving frame, said mechanism comprising a connecting piece pivotally connected with the moving frame and the base frame, two toothed parts, one connected with each frame, the teeth engaging, and means for driving one of said toothed parts.

6. A mining machine comprising a base frame, a moving frame mounted thereon, a pivot connected with said moving frame, said base frame provided with two converging and intersecting slots along both of which said pivot is adapted to move and mechanism for moving said moving frame, and a cutting element movably connected with said moving frame.

7. A mining machine comprising a base frame, a moving frame mounted thereon, a pivot connected with said moving frame, said base frame provided with converging slots along which said pivot is adapted to move and mechanism for moving said moving frame, said mechanism comprising a connecting piece pivotally connected with the moving frame and the base frame, two

toothed parts, one connected with each frame, the teeth engaging, and means for driving one of said toothed parts, a cutting element carried by said moving frame, said cutting element provided with a cutter and means for driving said cutter, said means being independent of the first mentioned driving means.

8. A mining machine comprising a base frame, a moving frame supported thereon, a cutting element carried by said moving frame, a pivot connected with said moving frame, said base frame provided with converging and intersecting slots along which said pivot moves when the moving frame is moved, and means for switching said pivot from one slot to the other.

9. A mining machine comprising a base frame, a moving frame supported thereon, a cutting element carried by said moving frame, a pivot connected with said moving frame, said base frame provided with converging slots along which said pivot moves when the moving frame is moved, and means for switching said pivot from one slot to the other, and a cleaner associated with said pivot and adapted to clean the slot ahead of it as the pivot moves along.

10. A mining machine comprising a base frame, a moving frame carried thereby, a cutting element carried by said moving frame, a pivot connected with said moving frame, said base frame provided with two converging and intersecting slots extending from the outer faces thereof toward the middle and meeting at the middle and rocking mechanism for rocking said frame so as to move said pivot back and forth along said slots.

11. A mining machine comprising a base frame, a moving frame carried thereby, a pivot connected with said moving frame, said base frame provided with two converging and intersecting slots extending from the outer faces thereof toward the middle and meeting at the middle and rocking mechanism for rocking said frame so as to move said pivot back and forth along both of said slots, and a cutting element mounted upon said rocking frame, said cutting element provided with a cutter and means for operating said cutter while the moving frame is being rocked.

12. A mining machine comprising a base frame, a moving frame carried thereby, a power actuated cutter carried by said moving frame which cuts by a lateral movement, means for forcing said cutter into the material to be cut the full depth of the cut to be made, a pivot connecting the moving frame with the base frame, a motor operatively connected with said moving frame so as to rock it when the cutter is in its innermost position to move said cutter laterally against the material to be cut, to cut said material, and means for moving said pivot to and from the face of the material being cut while the cutter is making the lateral cut.

13. A mining machine comprising a base frame, a moving frame carried thereby, a chain cutter carried by said moving frame, said cutter being moved laterally to cut the coal and exerting a lateral strain on said moving frame when cutting said coal, a pivot connecting the moving frame with the base frame, a motor for rocking said moving frame and means for guiding said pivot to and from the face of the coal when the moving frame is rocked to feed the chain cutter to the material to be cut, and a connection between the rear part of the machine and a fixed part to serve as an abutment.

14. A mining machine comprising a base frame, wheels upon which said frame is supported, said wheels adapted to move along a track, a moving frame on the base frame, a power actuated cutting device mounted upon said moving frame which cuts by a lateral movement, means for forcing said cutter into the material to be cut the full depth of the cut to be made, means for imparting angular movement to the moving frame to move said cutter laterally when in its innermost position against the material to be cut to cut said material, and automatic controlling means for automatically controlling said angular movement while the cutting device is cutting the material to be cut, so that the outer end of the cutting device is compelled to describe a straight line at the full depth of the cut substantially at right angles to the track upon which said wheels rest.

15. A mining machine comprising a base frame, a moving frame carried thereby, a cutting element carried by said moving frame, a cutter arm projecting from said cutting element, a cutter chain on said cutter arm and two flexible connections between said moving frame and fixed frame located at different points along its length, both of said flexible connections movable laterally crosswise of the base frame in opposite directions.

16. A mining machine comprising a base frame, a moving frame mounted thereon, a cutting element carried by said moving frame, a driving pinion on said moving frame, teeth on said base frame with which the teeth of said pinion engage, a connecting piece, two pivots connected therewith, one connected with the base frame and the other with the moving frame, and a connection between the two frames at a distance from said pinion about which said moving frame moves.

17. A mining machine comprising a base frame, a moving frame mounted thereon, a cutting element carried by said moving

frame, a driving pinion on said moving frame, teeth on said base frame with which the teeth of said pinion engage, a connecting piece pivotally connected with both frames and working about a fixed connection at a distance from said pinion, a second center about which said moving frame moves, said latter center being located nearer the point of resistance than the first mentioned center so as to increase the lever arm and reduce the forces on the teeth of the pinion and the teeth which they engage.

18. A mining machine comprising a base frame, a moving frame mounted thereon, a cutting device mounted on said moving frame, a pivot connected with said moving frame, said main frame provided with converging and intersecting slots which meet near the middle of the frame, separated guiding pieces at the point where said slots meet, said pivot adapted to work in said slots, a driving pinion at a distance from said pivot connecting with the moving frame, teeth on the main frame engaged by the teeth of said driving pinion, a connecting piece connecting the base frame and the moving frame, whereby the said pivot moves along one of said slots toward the meeting point and then moves along the other slot away from the meeting point when the driving pinion is operated.

19. A mining machine comprising a base frame, wheels upon which said base frame is mounted, a moving frame mounted on the base frame, a motor mounted on the moving frame, moving mechanism for moving the moving frame with relation to the base frame while the machine is being operated, an operative connection between said moving mechanism and said motor, driving mechanism for the wheels of said main frame, an operative connection between said motor and said driving mechanism, and a safety device for automatically preventing the connection between the motor and the said driving mechanism when the motor is connected with said moving mechanism.

20. A mining machine comprising a base frame, supported at a series of separated points, a moving frame mounted on said base frame, a cutter connected with said moving frame which cuts by a lateral movement, means for forcing the cutter into the material to be cut the full depth of the cut to be made, moving means connected with a fixed point on the moving frame for moving said point in a predetermined path, and means for constraining the moving frame so that the ends thereof move transversely of the main frame in opposite directions and longitudinally thereof in the same direction, so as to keep the line of direction of the center of mass of the machine within said separated points of support, during all the various positions of said cutter, the movement of said moving frame moving said cutter laterally against the material to be cut to cut said material.

21. A mining machine comprising a base frame, a moving frame mounted thereon, a cutter carried by said moving frame, means for imparting motion to the moving frame, a pivot on said moving frame, a slot in the main frame in which said pivot moves to constrain the outer end of the cutter to move in a substantially straight line, and means ahead of said pivot for cleaning the slot as the pivot moves along the same.

22. A mining machine comprising a base frame, a moving frame mounted thereon, a cutting element carried by said moving frame, a pivot connected with said moving frame, said base frame provided with converging slots along which said pivot is adapted to move, mechanism for moving said moving frame and a cleaning device for cleaning said slots in order that the pivot may freely pass therealong, said cleaning device comprising two projecting arms and means for moving said arms as the cleaner passes from one slot to the other so as to bring them in proper relation to the faces of the slot.

23. A mining machine comprising a base frame, a moving frame mounted thereon, a cutting element carried by said moving frame, a pivot connected with said moving frame, said base frame provided with two substantially horizontal converging slots along which said pivot is adapted to move, said pivot passing from one slot to the other, mechanism for moving said moving frame and a cleaning device for cleaning said slots in order that the pivot may freely pass therealong, said cleaning device comprising a part adapted to pass along the slot, said part movably connected with said pivot.

24. A mining machine comprising a base frame, a moving frame mounted thereon, a cutting element carried by said moving frame, a pivot connected with said moving frame, said base frame provided with converging slots along which said pivot is adapted to move, mechanism for moving said moving frame and a cleaning device for cleaning said slots in order that the pivot may freely pass therealong, said cleaning device comprising a part adapted to pass along the slot, said part movably connected with said pivot, a controlling device connected therewith adapted to move the cleaner as it passes from one slot to the other so as to bring it into proper relation with the slot in o which it passes.

25. A mining machine comprising a main frame, a moving frame supported thereby, means for moving one end of said moving frame longitudinally of the main frame and crosswise of the main frame in one direction, and a connection between the main frame and the other end of the moving

frame for simultaneously guiding said other end of said moving frame crosswise of said main frame in the opposite direction and longitudinally of said main frame in the same direction, a cutting element carried by said moving frame, a cutter arm projecting therefrom, a cutter chain connected with said cutter arm, the cutter chain being fed to the coal by the rocking of said moving frame.

26. A mining machine comprising a frame, supports thereon, a cutting element connected with said supports and adapted to move up and down thereon, a cutter arm projecting from the top of said cutting element, a cutter chain on said cutter arm, means for moving said cutting element and supports to force the cutting chain against the coal during its cutting movement, means for moving said cutting element up and down along said supports to vary the point at which the cutting arm engages the material to be cut, and means for inverting said cutting element so that the cutter arm projects from the bottom thereof, whereby the vertical range of the cutter arm is increased.

27. A mining machine comprising a moving frame, a cutter mounted thereon, means for moving said cutter into the face of the material to be cut in a direction transverse thereto, a guard pivoted to the moving frame and normally extending along the cutter, and means for retaining the guard in protective relation with respect to the cutter while the cutter enters into the material to be cut.

28. A mining machine comprising a moving frame, a cutter mounted thereon, means for moving said cutter into the face of the material to be cut in a direction transverse thereto, a guard pivoted to the moving frame and normally extending along the cutter, means for elastically pressing said guard toward said cutter so as to retain the guard in protective relation with respect to the cutter while the cutter enters into the material to be cut, and a stop device for limiting the movement of the guard toward the cutter so as to prevent it from coming in contact therewith.

29. A mining machine comprising a supporting frame, a cutter supported on said supporting frame, two independent feeding mechanisms for feeding said cutter to the material to be cut, one of said feeding mechanisms comprising a flexible element, means for anchoring it outside of the moving frame, the other feeding mechanism comprising a rack and pinion, one of said feeding mechanisms feeding the cutter forward substantially parallel with itself, the other feeding mechanism feeding the cutter to the material to be cut by bringing the cutter into new angular positions, and a single motor for actuating both of said feeding mechanisms.

30. A mining machine comprising a base, a moving frame mounted thereon, a cutting element carried by said moving frame, a pivot connected with said moving frame, means for moving said moving frame so as to move said pivot, said base provided with a guiding device along which said pivot is constrained to move, said guiding device comprising two disconnected faces adapted to successively receive the pressure of the pivot.

31. A mining machine comprising a base, a moving frame mounted thereon, a cutting element carried by said moving frame, a pivot connected with said moving frame, means for moving said moving frame so as to move said pivot, said base provided with a guiding device along which said pivot is constrained to move, said guiding device comprising two disconnected faces adapted to successively receive the pressure of the pivot, and means for switching the pivot from one of said faces to the other.

32. A mining machine comprising a base, a moving frame mounted thereon, a cutting element carried by said moving frame, a connecting piece pivotally connected with both the base and the frame and swinging about a center fixed with reference to the base, a power device between said base and said moving frame and connected with both so as to produce relative motion between them, a moving pivotal connection about which the moving frame moves, means for constraining the movement of said pivotal connection along a predetermined path, said pivotal connection being located nearer the point of resistance than the first mentioned center so as to reduce the pressure on said power device.

33. A mining machine comprising a main frame, a moving frame mounted thereon, separated upstanding supports connected with said moving frame, a cutting element between said supports and adjustably connected therewith so that it may be moved up and down along said supports, said supports hinged intermediate their ends, whereby when the cutting element is moved down below the hinge, the upper ends of said supports may be moved downwardly to vary their height.

34. A mining machine comprising a main frame, a moving frame mounted thereon, separated vertically adjustable upstanding supports connected with said moving frame, a cutting element located between said supports and adjustably connected therewith so that it may be moved up and down therealong.

35. A mining machine comprising a main frame, a moving frame mounted thereon, separated vertically adjustable upstanding supports on said moving frame, racks on said supports, guides of said supports, a

cutting element between said supports, pinions connected with said cutting element and engaging the said racks, means for driving said pinions to raise and lower the cutting element, guides on said cutting element engaging the guides on said supports.

36. A mining machine comprising a main frame, a moving frame mounted thereon, separated vertically adjustable upstanding supports on said moving frame, racks on said supports, guides on said supports, a cutting element between said supports, pinions connected with said cutting element and engaging the said racks, means for driving said pinions to raise and lower the cutting element, guides on said cutting element engaging the guides on said supports, said supports made in separated sections and movable with relation to each other so that the upper parts thereof may be lowered, and means for rigidly connecting said sections together so that the portions of the guides on the sections will be in alinement.

37. A mining machine comprising a main frame, a moving frame, upstanding supports connected with said moving frame, a cutting element adjustably mounted upon said supports so that it may be moved to different horizontal planes, a pivotal connection between the moving frame and said main frame, means for moving said moving frame about said pivotal connection, and for simultaneously moving said pivotal connection.

38. A mining machine comprising a main frame, a moving frame mounted upon said main frame, a cutting element mounted upon said moving frame and provided with a projecting cutter arm, a cutter chain on said cutter arm, a sprocket wheel for driving said cutter chain, means for rocking said cutter arm about a point intermediate said sprocket wheel and the outer end of said cutter arm, and for moving said point with relation to the face of the material to be cut, whereby a substantially straight cut is produced.

In testimony whereof, I affix my signature in the presence of two witnesses this 30th day of April, 1914.

CHARLES E. DAVIS.

Witnesses:
GENEVA HEITH,
LAUREL M. DOREMUS.