E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED SEPT. 9, 1915. RENEWED MAR. 28, 1921.

1,430,669.

Patented Oct. 3, 1922.

12 SHEETS—SHEET 1.

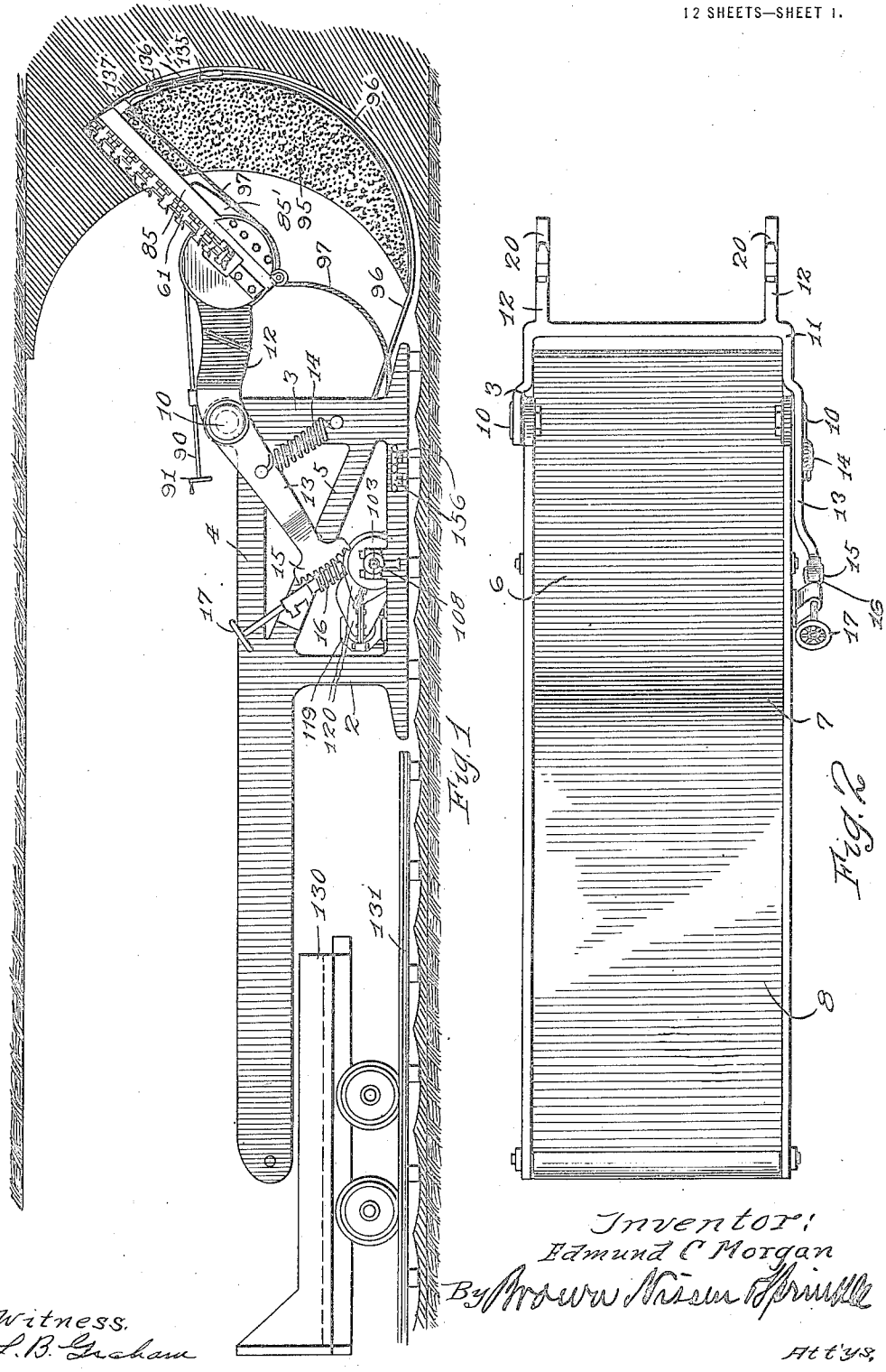


Fig. 1.

Fig. 2.

Witness,
L. B. Graham

Inventor:
Edmund C Morgan
By Brown Wilson & Brinkerhoff
Att'ys.

E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED SEPT. 9, 1915. RENEWED MAR. 28, 1921.

1,430,669.

Patented Oct. 3, 1922.

12 SHEETS—SHEET 2.

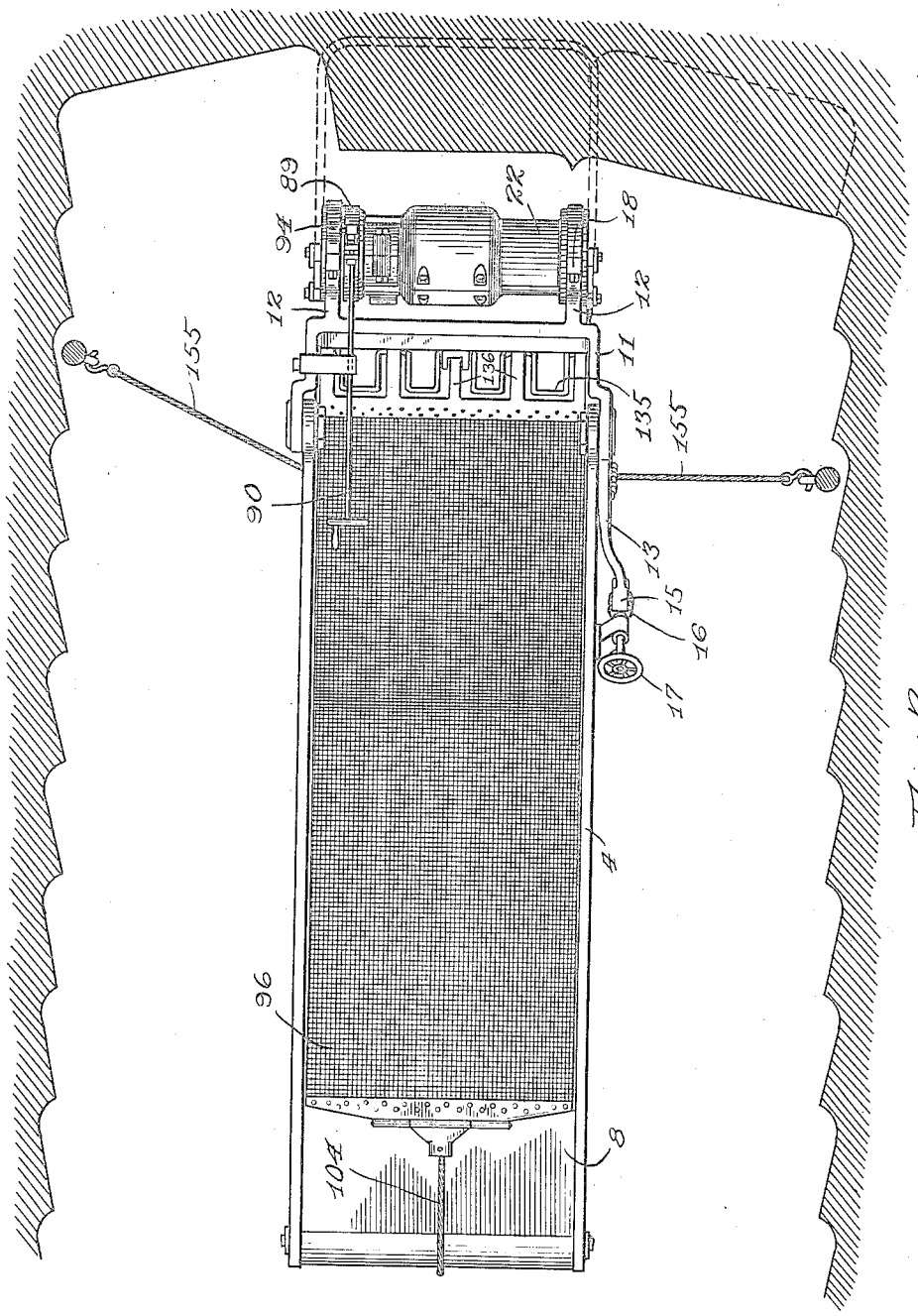


Fig. 3

Witness
L. B. Graham

Inventor:
Edmund C. Morgan.
By Brown Wise & Grinnell
Attys.

E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED SEPT. 9, 1915. RENEWED MAR. 28, 1921.

1,430,669.

Patented Oct. 3, 1922.

12 SHEETS—SHEET 3.

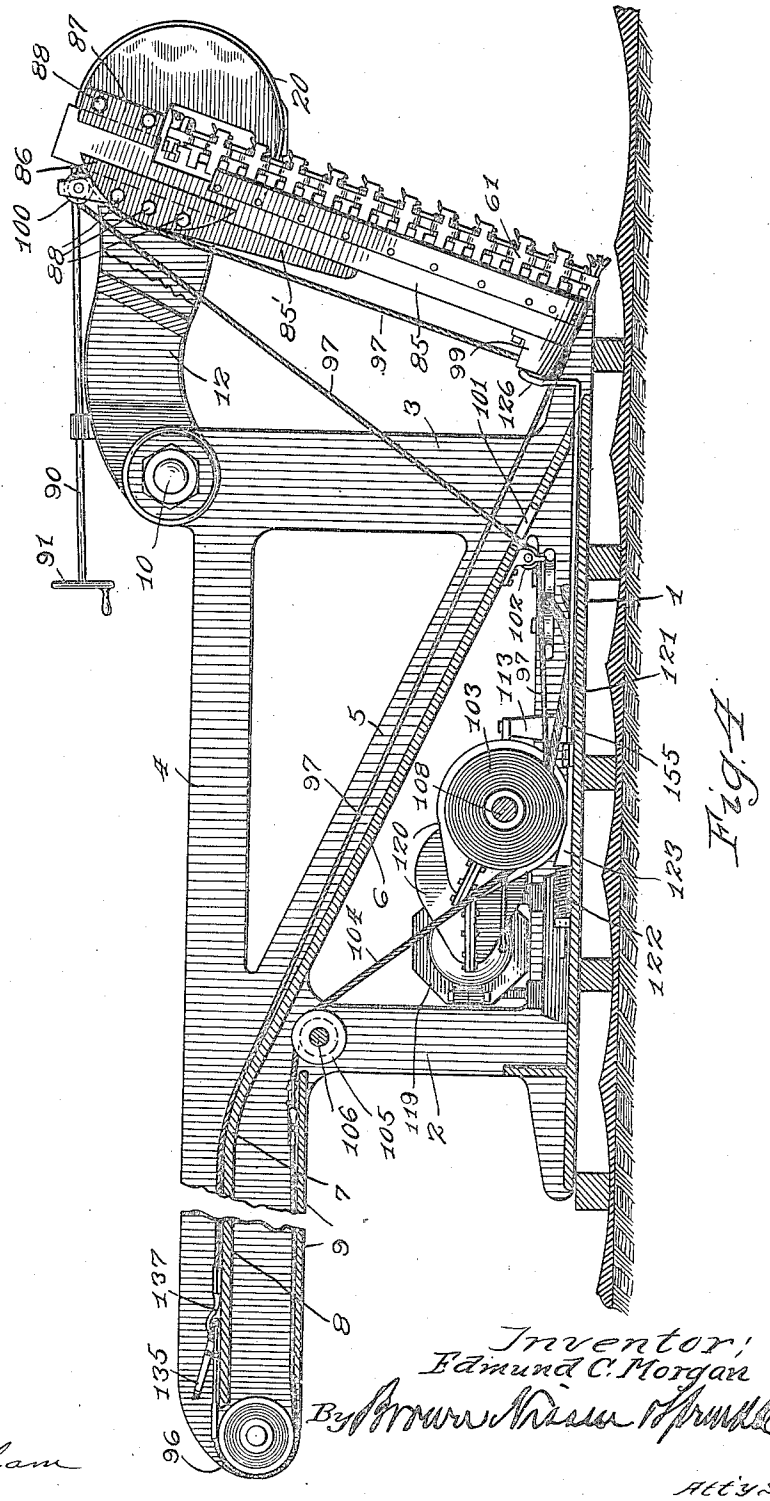


Fig. 1.

Witness,
L. B. Graham

Inventor,
Edmund C. Morgan
By Brown Critchlow & Pruda
Att'ys

E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED SEPT. 9, 1915. RENEWED MAR. 28, 1921.

1,430,669.

Patented Oct. 3, 1922.

12 SHEETS—SHEET 4.

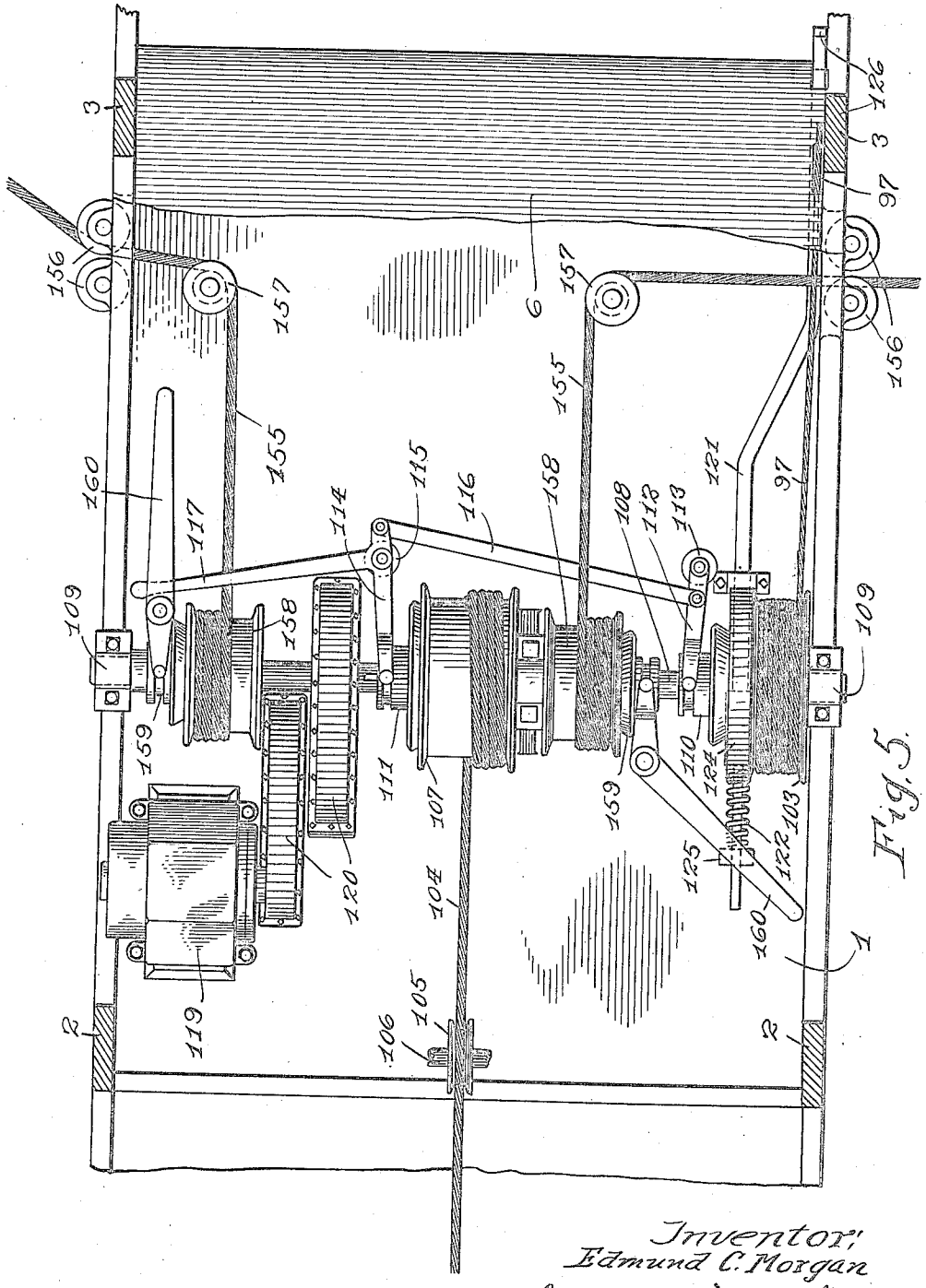


Fig. 5.

Inventor,
Edmund C. Morgan
By Brown Wilson & Brown
Att'ys.

Witness.
L. B. Graham

E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED SEPT. 9, 1915. RENEWED MAR. 28, 1921.

1,430,669. Patented Oct. 3, 1922.

12 SHEETS—SHEET 5.

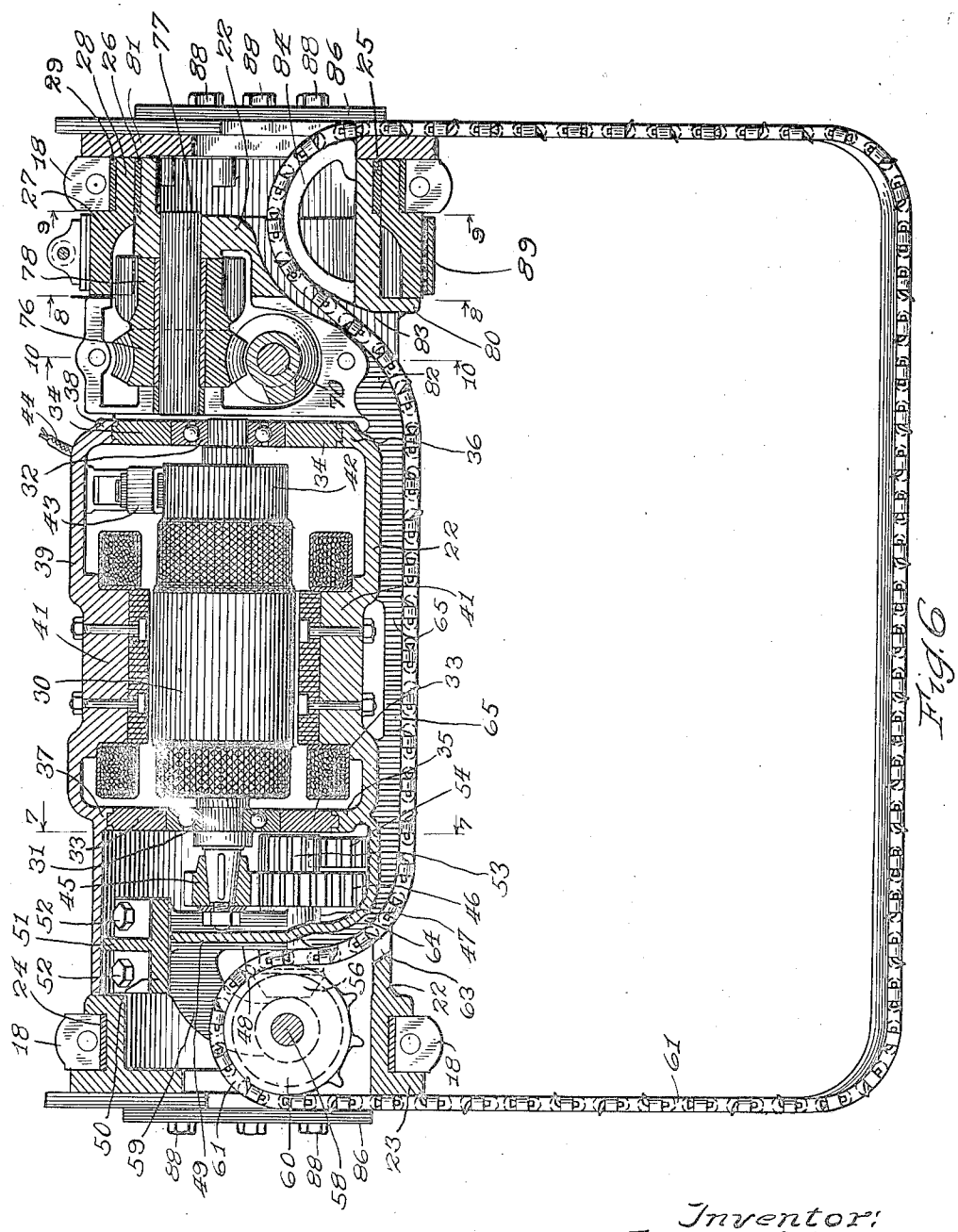


Fig. 9.

Witness,
L. B. Graham

Inventor:
Edmund C. Morgan
By Brown Wilson & Prindle
Att'ys.

E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED SEPT. 9, 1915. RENEWED MAR. 28, 1921.

1,430,669. Patented Oct. 3, 1922.

12 SHEETS—SHEET 6.

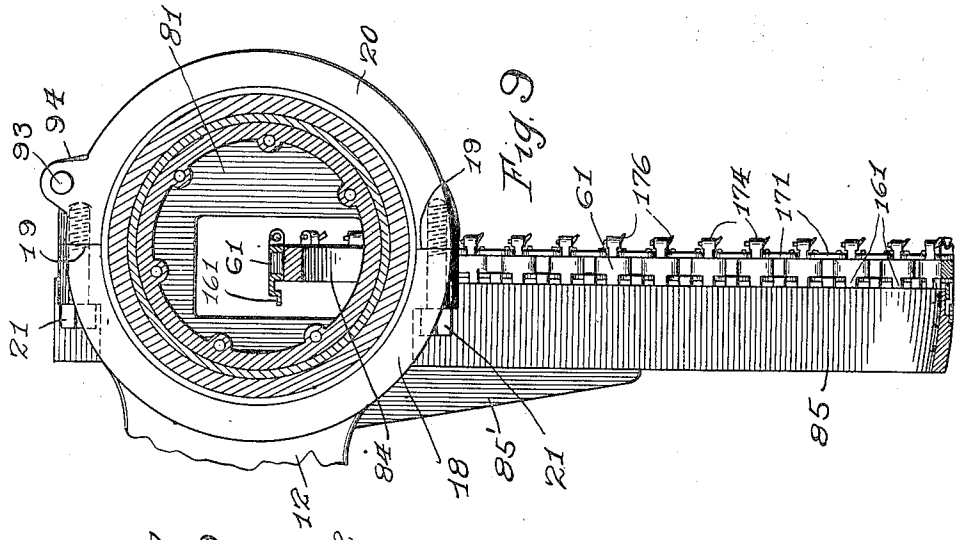


Fig. 9

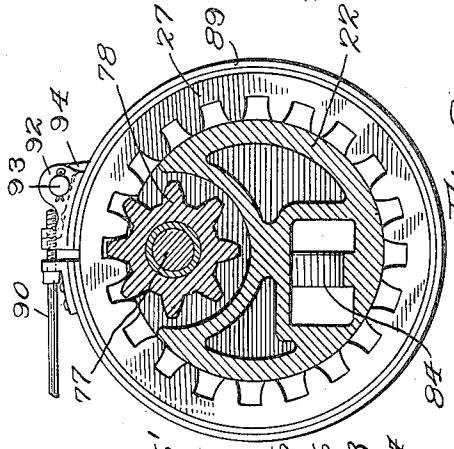


Fig. 8

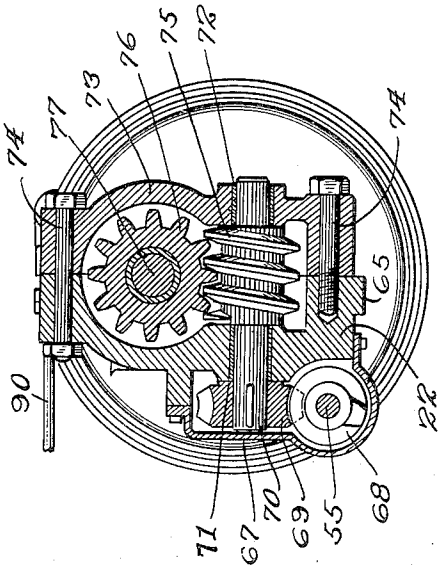


Fig. 10

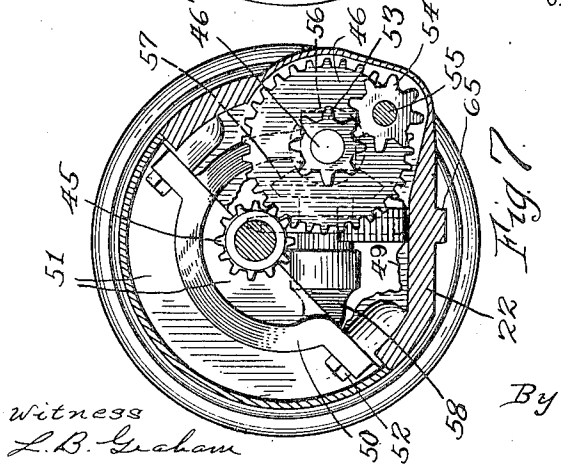


Fig. 7

Witness
L. B. Graham

Inventor:
Edmund C. Morgan.
By Brown Critchlow & Pomeroy
Attys.

E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED SEPT. 9, 1915. RENEWED MAR. 28, 1921.

1,430,669. Patented Oct. 3, 1922.

12 SHEETS—SHEET 7.

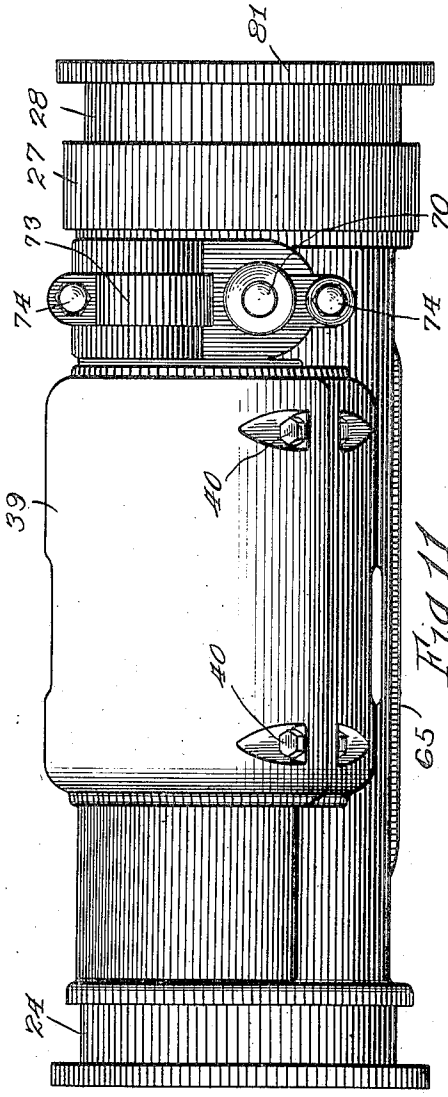


Fig. 11

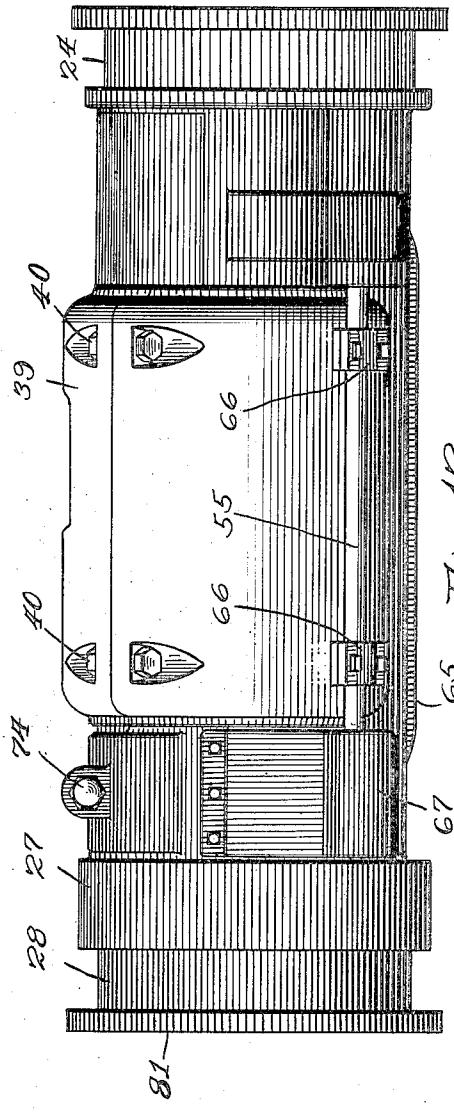


Fig. 12

Witness,
L. B. Graham

Inventor:
Edmund C. Morgan
By Brown Wilson & Sprinkle
Attys.

E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED SEPT. 9, 1915. RENEWED MAR. 28, 1921.

1,430,669. Patented Oct. 3, 1922.

12 SHEETS—SHEET 8.

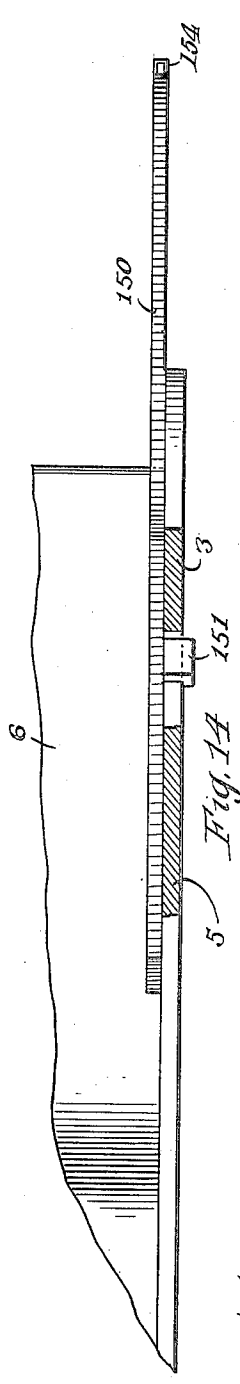


Fig. 14

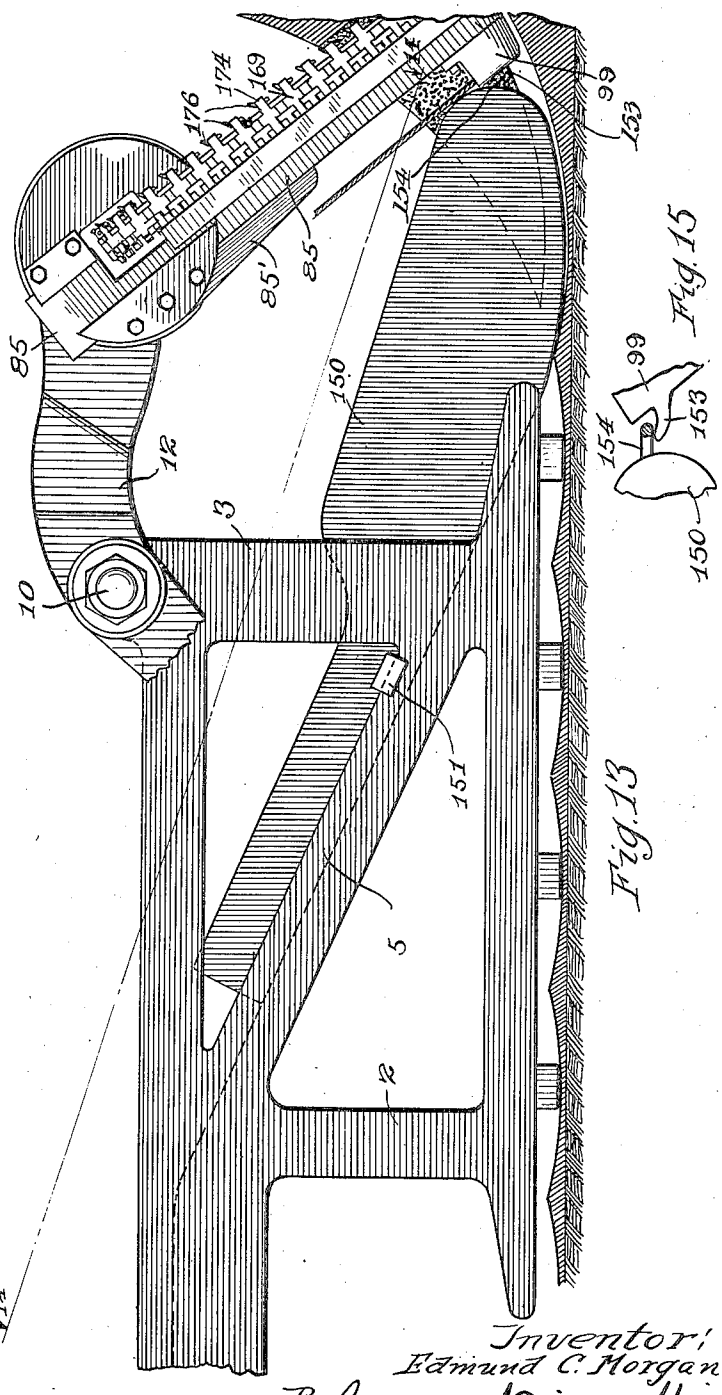


Fig. 13

Fig. 15

Witness
L. B. Graham

Inventor:
Edmund C. Morgan
By Brown Critchlow & Sprinkle
Attys.

E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED SEPT. 9, 1915. RENEWED MAR. 28, 1921.

1,430,669. Patented Oct. 3, 1922.

12 SHEETS—SHEET 9.

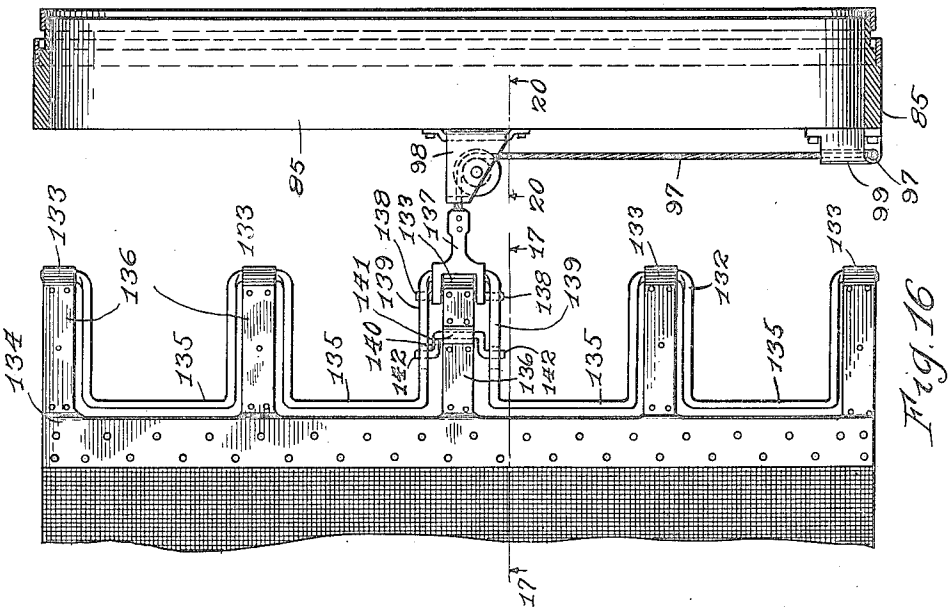


Fig. 16

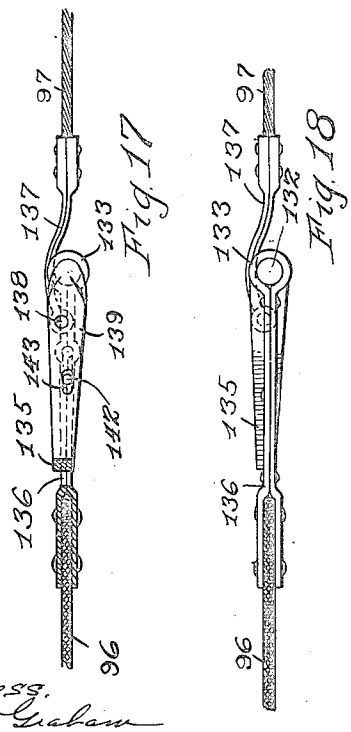


Fig. 17

Fig. 18

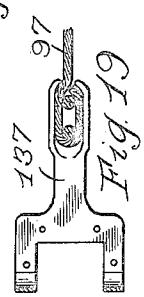


Fig. 19

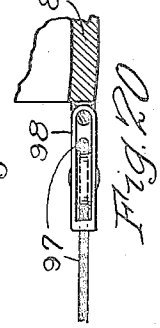


Fig. 20

Fig. 21

Witness,
L. B. Graham

Inventor:
Edmund C. Morgan
By Brown Kiesel & Prindle
Attys.

E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED SEPT. 9, 1915. RENEWED MAR. 28, 1921.

1,430,669. Patented Oct. 3, 1922.

12 SHEETS—SHEET 10.

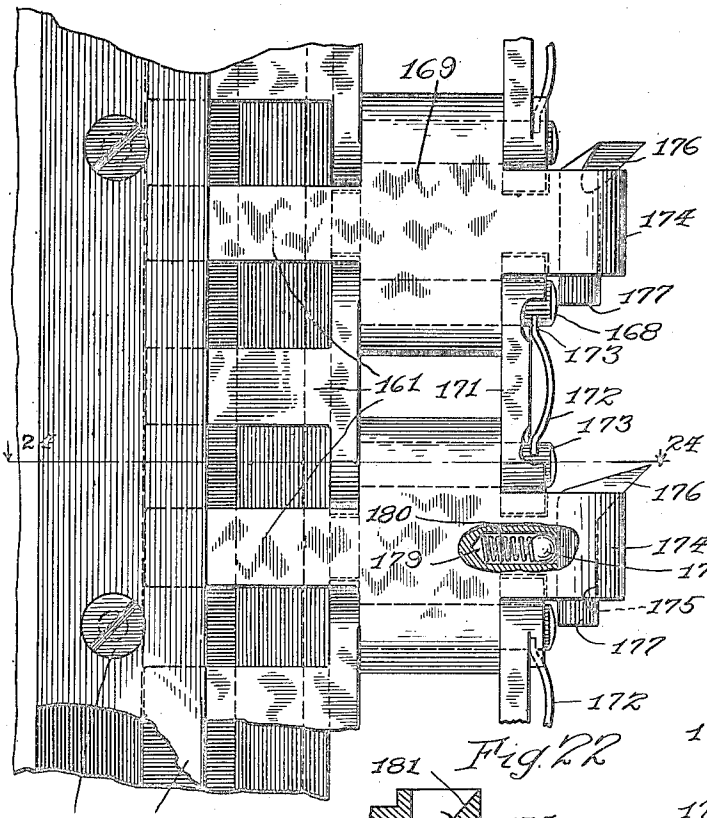


Fig. 22

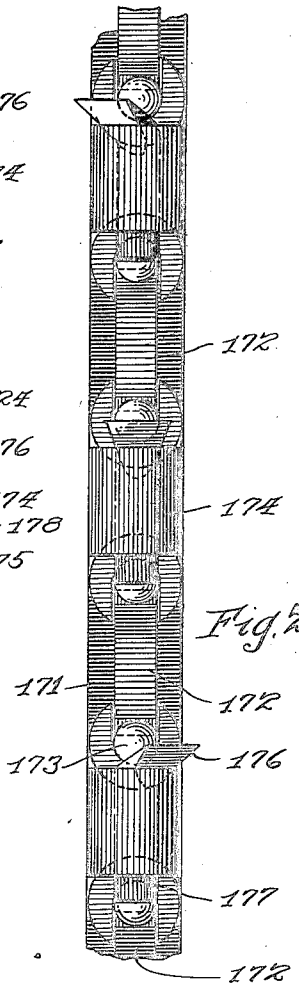


Fig. 23

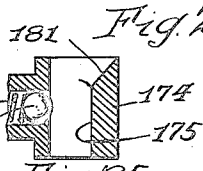


Fig. 25

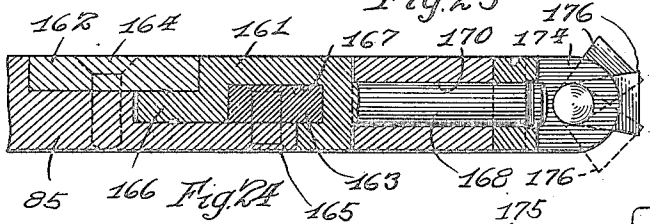


Fig. 24



Fig. 26

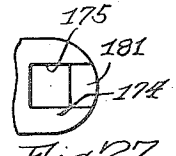


Fig. 27

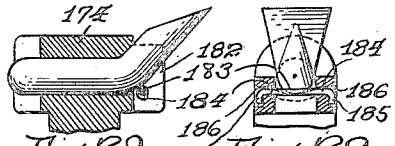


Fig. 29 Fig. 28

Witness.
L. B. Graham

Inventor:
Edmund C. Morgan
By Brown Thacher & Prindle
Att'ys

E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED SEPT. 9, 1915. RENEWED MAR. 28, 1921.

1,430,669. Patented Oct. 3, 1922.

12 SHEETS—SHEET 11.

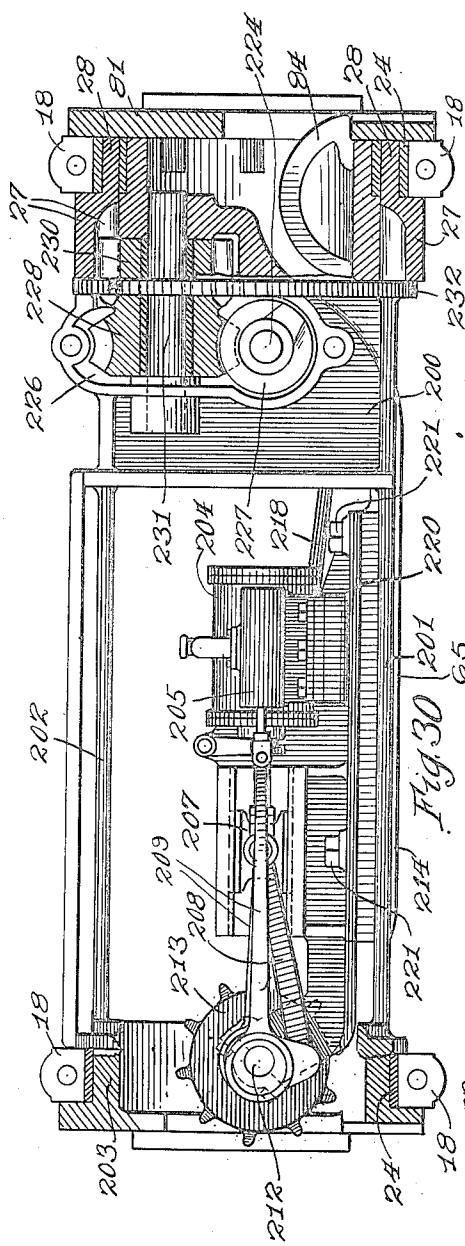


Fig. 30

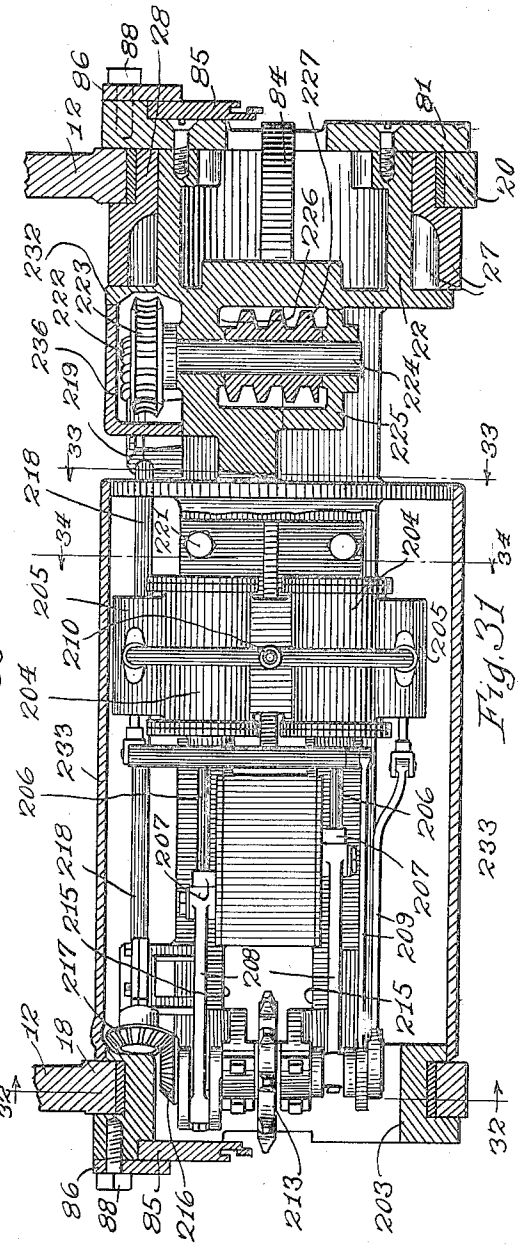


Fig. 31

Witnesses.
L. B. Graham

Inventor,
Edmund C. Morgan
By Brown Wilson & Sprinkle
Att'ys.

E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED SEPT. 9, 1915. RENEWED MAR. 28, 1921.

1,430,669. Patented Oct. 3, 1922.

12 SHEETS—SHEET 12.

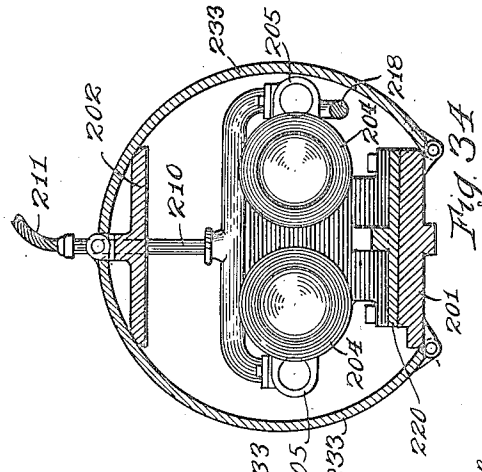


Fig. 34

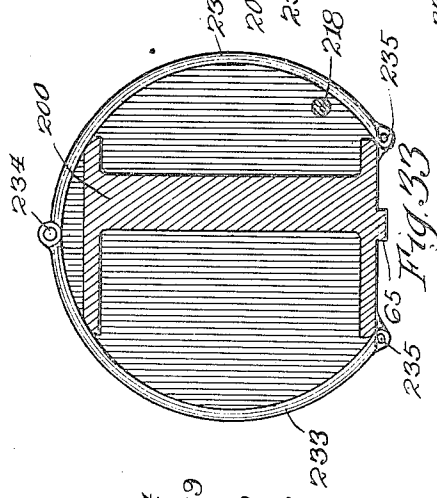


Fig. 33

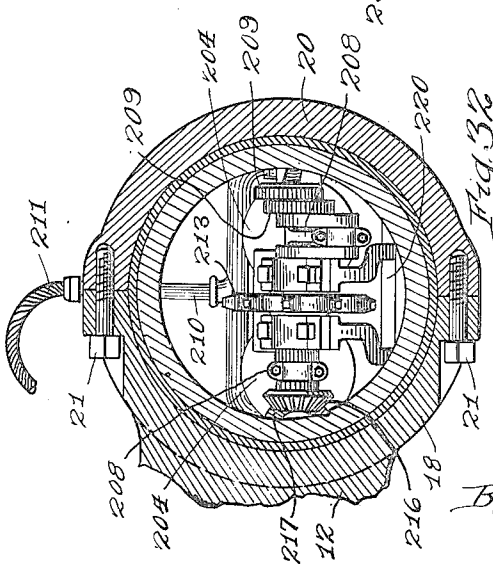


Fig. 32

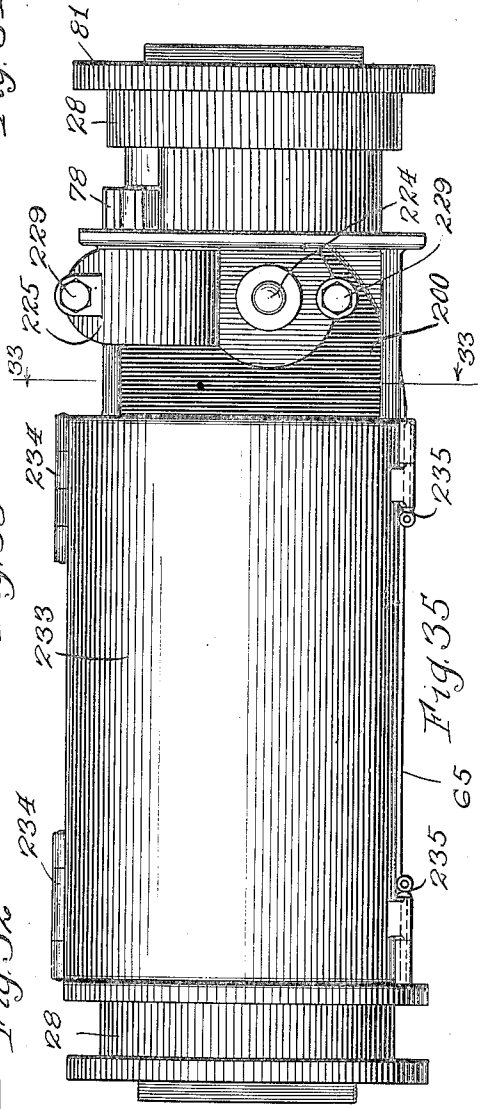


Fig. 35

Inventor:
Edmund C. Morgan
By Brown Critchlow & Pritchard
Att'ys.

Patented Oct. 3, 1922. 1,430,669

UNITED STATES PATENT OFFICE.

EDMUND C. MORGAN, OF NEW YORK, N. Y.

MINING AND LOADING MACHINE.

Application filed September 9, 1915, Serial No. 49,689. Renewed March 28, 1921. Serial No. 456,208.

To all whom it may concern:

Be it known that I, EDMUND C. MORGAN, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Mining and Loading Machines, of which the following is a specification.

This invention relates to mining and loading apparatus whereby material is completely severed from a mine wall and then moved back from the mine wall into position for loading. One of the objects of my invention is to provide improvements on the mining and loading machines disclosed in my copending applications Serial Nos. 848,727, filed July 3, 1914, 864,211, filed September 30, 1914, and 39,986, filed July 15, 1915. Other objects of the invention will appear hereinafter.

The invention comprises the combination and arrangement of parts described in the following specification, shown in the accompanying drawings and more particularly pointed out in the appended claims.

In the drawings—

Fig. 1 is a side elevation of a mining machine embodying the present invention and shown in operative position in a mine chamber.

Fig. 2 is a top plan view of the frame portion of the machine shown in Fig. 1.

Fig. 3 is a top plan view of the entire machine shown in operative position in a mine chamber.

Fig. 4 is a longitudinal sectional view of the machine shown in Fig. 1 with the chain cutter and frame shown in side elevation.

Fig. 5 is a fragmentary top plan view of the machine with the upper part of the frame broken away to show the winding drums and their related parts.

Fig. 6 is a sectional view of the hollow axle which carries the cutter frame showing the operative mechanism enclosed therein.

Fig. 7 is a sectional view taken on line 7—7 of Fig. 6.

Fig. 8 is a sectional view taken on line 8—8 of Fig. 6.

Fig. 9 is a sectional view taken on line 9—9 of Fig. 6.

Fig. 10 is a sectional view taken on line 10—10 of Fig. 6.

Fig. 11 is a top plan view of the hollow axle which carries the cutter frame.

Fig. 12 is a bottom plan view of the axle shown in Fig. 11.

Fig. 13 is a fragmentary side elevation showing an attachment for preventing coal that has been severed from escaping from the sides of the machine.

Fig. 14 is a section on line 14—14 of Fig. 13.

Fig. 15 is a detail of an operating catch for the attachment shown in Figs. 13 and 14.

Fig. 16 is a fragmentary plan view with a portion of the cutter frame in section showing a fragment of the conveyor belt and the means for connecting the conveyor belt to the cutter frame.

Fig. 17 is a section on line 17—17 of Fig. 16.

Fig. 18 is a side elevation of the portion of the conveyor belt shown in Fig. 16.

Fig. 19 is a detail view of the connection between the conveyor belt and the operating rope therefor.

Fig. 20 is a section on line 20—20 of Fig. 16.

Fig. 21 is a fragmentary detail of the cutter frame rope guide.

Fig. 22 is an elevation of a portion of the cutter chain showing the method of attaching the cutters thereto.

Fig. 23 is a front elevation of the chain shown in Fig. 22.

Fig. 24 is a section on line 24—24 of Fig. 22.

Fig. 25 is a fragmentary horizontal view showing the socket for one of the cutters.

Figs. 26 and 27 are fragmentary details of modifications of the socket member.

Fig. 28 is a fragmentary top plan of a modified form of a socket and cutter.

Fig. 29 is a section on line 29—29 of Fig. 28.

Fig. 30 is a longitudinal section of a modified form of cutter frame axle arranged to enclose a reciprocating engine.

Fig. 31 is a horizontal section of the axle shown in Fig. 30.

Fig. 32 is a section on line 32—32 of Fig. 31.

Fig. 33 is a section on line 33—33 of Fig. 31.

Fig. 34 is a section on line 34—34 of Fig. 31.

Fig. 35 is a side elevation of the cutter frame axle shown in Fig. 30.

The frame on which the operating parts

of the machine embodying the present invention are carried is best shown in Figs. 1, 2 and 4, and comprises a bed plate 1, rear uprights 2 and forward uprights 3, upper horizontal beams 4 and diagonal braces 5. Connected to the diagonal braces 5 and standing at an inclination upwardly from the forward portion of the machine is a conveyor bed plate 6 which is bent at 7 and has a horizontal portion 8 which extends rearwardly to the discharge end of the machine. Beneath the portion 8 is a second horizontal web 9 for supporting the underrun of the conveyor belt, as best shown in Fig. 4.

Pivoted to the upper portions of the uprights 3 by heavy pivot bolts 10 is a bracket 11 having forwardly projecting bracket arms 12, and a rearwardly projecting arm 13 for adjusting the bracket about the pivots 10 and for holding it in adjusted position. A heavy coil spring 14 connects the arm 13 to one of the uprights 3 and normally draws the arm 13 downwardly to form a counterbalance for the weight supported on the bracket arms 12. At the end of the arm 13 is a rack 15 which meshes with a worm 16 controlled by a hand wheel 17 by means of which the bracket may be adjusted about the pivots 10 and held in adjusted position. As shown in Figs. 2 and 9, the forward ends of the bracket arms 12 are provided with bearing rings 18 which are split at 19 (Fig. 9) leaving the front half 20 detachable and held in position by bolts 21. In this way a circular bearing is formed in which the cutter frame axle is rotatably carried.

The cutter frame axle is best shown in Figs. 6 to 12 inclusive, and comprises a heavy casting 22 essentially circular in section and of general hollow cylindrical formation. The end of the casting 22, shown at the left in Fig. 6, is provided with a circular groove 23 which is journaled in the bearing 18 of the bracket arm 12. The bearing is provided with a bushing 24. At the opposite end of the axle is a circular bearing 25 in which is positioned a bushing 26, and mounted to rotate on this bushing is an internal gear 27 having a sleeve 28 which surrounds the bushing 26 and is fitted into the bearing 18 of the bracket member 12, as shown at the right-hand side of Fig. 6. A bushing 29 is interposed between the bearing 18 and the sleeve 28. In this way the hollow axle 22 is mounted for rotation in the bearings 18 of the adjustable bracket arms 12.

Centrally located within the interior of the axle 22 is a motor armature 30 having bearings 31 and 32 carried in circular plates 33 and 34 respectively, which are supported at one side by inwardly projecting semi-circular bosses 35 and 36. The plates 33 and 34 are supported on the side opposite the bosses 35 and 36 by similar semi-circular bosses 37 and 38 which are in turn carried by a cover plate 39 held in position to close one side of the opening in the casting 22 by bolts 40, of which there are four shown in Figs. 11 and 12. Field poles 41 are carried by the casting 22 and the cover plate 39, as clearly shown in Fig. 6, and the armature 42 of the motor is provided with brush-holders 43 to which flexible cables 44 conduct the current for driving the armature. A pinion 45 is carried at one end of the armature shaft and meshes with a gear 46 which is mounted on a shaft 46′ supported in a bearing 47 carried on an internally projecting portion 48 of the casting 22 (Figs. 6 and 7). Extending transversely of the axle so as to effectually close the lower half thereof, as viewed in Figs. 6 and 7, is a plate or web 49, shown broken away in Fig. 7 to better show the gearing. The upper portion of the hollow axle is closed at this point by a casting 50 having a web 51 secured thereto which is semi-circular in formation and fits closely against the interior portion of the cover plate 39. The casting 50 is secured to the internally extending portion 48 of the casting 22 by leg screws 52. In this way a completely enclosed chamber is provided in which the gears 45 and 46 operate, which chamber may be filled by any suitable lubricant to overcome the friction of the gearing. Coaxial with the gear 46 and rigidly secured thereto is a pinion 53 (Fig. 7) which meshes with a second pinion 54 rigidly mounted on a shaft 55. The pinions 53 and 54 are also enclosed in the lubricating chamber described above. The shaft 46′ extends through the bearing 47 and carries at the outer end thereof beyond the web 49 a beveled pinion 56. The beveled pinion 56 meshes with a beveled gear 57 mounted on a shaft 58 arranged transversely of the hollow axle and carried by a bracket 59 formed integrally with the internally projecting portion 48 of the casting 22. The shaft 58 has secured thereto a sprocket wheel 60, (as shown best in Fig. 6) about which the cutter chain 61 passes and by which the chain is driven. The chain 61 is guided into the interior of the axle 22 through an opening 63 by an incurved portion 64 of a guideway 65 which extends longitudinally of the casing and along which the chain 61 slides. In this way rotation of the armature 30 is transmitted through the gears 45, 46, 56 and 57 to the sprocket wheel 60 which in turn drives the cutter chain 61; the gearing for transmitting the motion being all contained within the hollow axle of the cutter frame.

The shaft 55 passes through an opening in the extended portion of the casing which surrounds the gears 46 and 54 and extends longitudinally of the casing on the outside thereof, as shown in Fig. 12, and is supported by bearings 66 mounted on the exterior of the casing. Secured to the end of

the casing opposite that which contains the gearing described above is a cover plate 67 (Figs. 10 and 12) into which the shaft 55 extends and which encloses a worm 68 mounted on the shaft 55 and which meshes with a worm gear 69 rigidly mounted on a shaft 70. The shaft 70 is supported at one end in a bearing 71 provided in the casting 22, and at its other end in a bearing 72 provided in a heavy detachable cover plate 73 secured to the casting 22 by bolts 74, as best shown in Fig. 10. Rigidly secured to the shaft 70 and within the chamber provided by the casting 22 and the cover plate 73 is a worm 75 which meshes with a worm wheel 76 which is mounted for free rotation on a shaft 77. The worm wheel 76 has integrally formed therewith a pinion 78 which is arranged to mesh with the teeth of the internal gear 27, previously described. The shaft 77 is securely mounted at one end in the casting 22 and is held rigid with this casting at the other end by means of the cover plate 73 and bolts 74. The worm 75, worm-wheel 76 and pinion 78 are all located in a closed chamber formed by the casting 22, the cover plate 73 and the internal gear 27 so that all these gears may operate in a lubricant contained within this chamber. The lubricant is prevented from escaping at the end of the teeth on the internal gear by a flange 80 extending around the axle 22. A plate 81 is bolted to the end of the axle 22 and is of sufficient diameter to extend beyond the circumference of the bearing 26 and to overlap the circular bearing 18 carried by the bracket arm 12 and thus hold the axle in place relative to the bracket arm.

The chain 61 at the end of the axle just described is guided inwardly by an incurved portion 82 of the track or guideway 65 through an opening 83 in the hollow axle 22 into the interior portion of the axle. An inwardly extending semi-circular guide 84 is positioned within the interior portion of the axle around which the chain slides to change the direction of travel thereof.

The cutter frame itself comprises a U-shaped cutter bar 85, the two arms of which are adjustably secured to the ends of the hollow axle by plates 86 and 87 (Figs. 4 and 6) held in position by lag screws 88. A reinforcement 85′ is secured to the rotating axle 22 at each end thereof and lies directly behind the arms of the cutter bar 85. These reinforcements 85′ are of the same thickness as are the arms of the bar 85 and hence do not interfere with the passage of the arms through the coal. It will readily be seen that the cutter bar may be adjusted relative to its axle by loosening the screws 88 and sliding the bar between the axle and the plates 86 and 87. This adjustment may be made for varying the amount of space included within the U-shaped cutter frame or for tightening or loosening the cutter chain. The construction of the chain itself, together with the means for guiding the chain along the cutter bar, will be described later.

The cutter bar is forced into the coal by the rotation of the hollow axle 22, carrying the bar therewith, in its bearings in the brackets 12. This rotation is controlled by a brake band 89 (Figs. 3, 6 and 8) which surrounds the outer portion of the internal gear 27 and which may be tightened about this gear by a screw rod 90 and hand wheel 91, as indicated in Fig. 4. One end of the brake band 89 has a lug 92 secured thereto through which passes a pin 93 which extends laterally from a lug 94 carried on the bearing member 20 of the bracket arm 12. In this way the brake band 89 is prevented from rotation and when tightened about the internal gear 27 it prevents rotation of this gear. It will be noted that the internal gear 27 meshes with the pinion 78 which is driven through two sets of worms and worm wheels by the shaft 55 geared in turn to the armature 30. By this means the pinion 78 is given a slow and very powerful movement. So long as the gear 27 is free to rotate in its bearings the movement of the gear 78 produces no effect but as soon as the gear 27 is held stationary by the brake band 89 the internal gear 78, in order to rotate under the power of the armature 30, must travel around the interior of the internal gear 27. The gear 78 carries with it in this movement the shaft 77 and hence the hollow casting or axle 22 together with the cutter frame 85. In this way a slow and powerful feeding movement is imparted to the cutter frame 85 to rotate it about the center of the hollow axle 22 and to force it into the wall of the mine. During this movement of the cutter frame the chain 61 is driven in the manner previously described to form the kerf in which the cutter frame moves.

When the cutter bar is moved in the manner described it severs an upright crescent-shaped section of material from the mine wall, indicated by the numeral 95 in Fig. 1 of the drawing. When this mass of material has been loosened from the mine wall its weight causes it to drop downwardly which may break it up to some extent and means must be provided for removing the material thus disengaged in order that the mining operation may continue. To receive the severed material and to carry it backwardly out of the way of the machine to a point where it may be transported from the mine a conveyor belt or apron 96 is provided. The operation of this belt may be best understood by reference to Figs. 1, 3, 4, 5 and 13 to 21 inclusive. As shown in Fig. 1 the belt must be of sufficient length to be drawn forwardly into the kerf formed by the cutter chain and to extend from a posi-

tion substantially adjacent the rear of the cutter bar when it has reached its uppermost position around through the kerf and back upon the inclined portion of the conveyor bed 6. The forward end of the belt 96 is secured, by means to be described, to a cable 97 which extends, as shown in Fig. 16, from the central portion of the belt to a pulley block 98 secured to the rear central portion of the cutter bar 85. The cable 97 passes from the pulley block 98 along a line parallel with the rear portion of the cutter bar 85 to a guide 99 which has a curved opening for guiding the rope around the bend in the cutter bar. The rope extends from the guide 99 parallel with the arm of the cutter bar and directly in the rear thereof to a pulley 100 secured to the hollow rotating cutter bar axle as shown in Fig. 4. The cable 97 extends from the pulley 100 rearwardly through an opening 101 in the conveyor bed 6, and thence over a pulley 102 secured to the under side of the conveyor bed and from the pulley 102 to a drum 103. The end of the belt 96 opposite to that secured to the cable 97 has a second cable 104 secured thereto. The cable 104, as shown in Figs. 4 and 5, is guided over a pulley 105 carried on a transverse shaft 106 to a drum 107. The drums 103 and 107 are both free to rotate on a shaft 108 mounted in bearings 109 suitably supported from the base plate 1 of the frame. A friction clutch 110 is provided for clutching the drum 103 to the shaft 108 to cause the drum to rotate with the shaft, and a similar clutch 111 is provided for the drum 107. The clutch 110 is thrown into and out of engagement with the drum 103 by an arm 112 carried on a pivot block 113 upstanding from the base plate 1. The clutch 111 is operated by a similar arm 114 carried on a pivot block 115. The arms 112 and 114 are connected by a link 116 in such a manner that when one of the drums 103 and 107 is clutched to the shaft 108 the other drum will be free to rotate thereon, as clearly shown in Fig. 5 of the drawings. The clutches 110 and 111 are operated by a hand lever 117 secured to the arm 114. The shaft 108 is driven by a motor 119 mounted on the base plate 1 and connected to the shaft through gears 120. A sliding brake bar 121, shown in Figs. 4 and 5, is arranged for holding the drum 103 from rotation at certain periods in the operation of the machine. The brake bar 121 is provided with a spring 122 which normally forces the wedge-shaped portion 123 of the bar 121 into contact with a brake wheel 124 secured to the drum 103. The spring 122 bears at its other end against a block 125 secured to the base plate 1. At the forward end of the brake bar 121 is an upturned portion 126 adapted to contact with the guide 99 carried by the cutter bar 85 when the cutter bar is in its rearmost position. In this way the cutter bar is enabled to release the brake 123 from the drum 103 at the end of the backward movement of the cutter bar.

Assuming that the parts described are in the position shown in Fig. 4 and that it is desired to make a cut, the operator first throws the lever 117 toward the forward end of the machine, as shown in Fig. 5, thus connecting the drum 103 to the shaft 108. As the drum 103 begins to rotate it will draw on the cable 97 and thus pull the end of the belt 96 into a position closely adjacent the pulley block 98 carried by the cutter bar 85. As soon as the belt is drawn forwardly the lever 117 is moved to its central or neutral position, leaving both drums 103 and 107 disconnected from the shaft 108. The hand wheel 91 is then rotated to tighten the brake band 89 and thus start the cutter bar 85 on its forward movement in the manner previously described. As soon as the cutter bar is moved away from the projection 126 the brake 123 will be forced by the spring 122 into contact with the brake wheel on the drum 103, thus locking the drum against rotation. As the cutter bar moves forwardly a portion of the cable 97 carried by the lower portion of the bar will also be caried forwardly, and since the end of the cable 97 secured to the drum 103 is held from movement the opposite end of the cable secured to the belt 96 will be moved forwardly directly in the rear of the cutter bar and hence caried into the kerf formed by the forward movement of this bar, as shown in Fig. 1. It is true that the movement of the cutter bar will swing the pulley 100 backwardly toward the pulley block 102 during the first part of the motion of the bar thus slacking to some extent the cable 97. This slacking of the cable will permit the belt 96 to lag behind the movement of the cutter bar to some extent but this falling away of the end of the belt from the cutter bar is not sufficient to interfere with the operation of the belt in intercepting the coal loosened from the mine wall. When the cutter bar is swung through the entire arc of movement necessary to sever the section 95 of coal from the mine wall the coal will drop downwardly on the belt 96, breaking up to a greater or less extent, depending on the nature of the coal. After the cut is complete the brake band 89 is loosened to stop the movement of the cutter bar and the clutch 111 is thrown into operation to connect the drum 107 with the shaft 108. As the drum 107 rotates it winds up the cable 104, thus pulling rearwardly on the belt 96. As the belt is drawn backwardly by the cable 104 it draws the severed coal with it and also returns the cutter frame 85 to its original position. The

coal upon the belt 96 is drawn upwardly along the inclined portions 6 of the conveyor table and thence rearwardly to a position to be discharged over the roller at the rear portion of the machine into a car 130 mounted on a track 131 from whence it is transported to the mouth of the mine. Before the belt 96 has reached the discharge position, however, the cutter frame 85 will have struck the projection 126 to release the brake on the drum 103. After the brake has been released the cable 104 is free to unwind from the drum 103 in order to permit the belt 96 to travel upwardly and rearwardly along the conveyor bed 6 to the discharge position. After the discharge of the coal the device is again in the position shown in Fig. 4 and is ready for a second operation.

In order to make sure that the coal will be drawn back with the belt 96 during its backward movement a retainer is provided at the forward end of the belt which consists of a bent bar 132 (Fig. 16) journaled in bearings 133 carried by a metal reinforcement 134 at the forward end of the belt. Rearwardly extending portions 135 of the bent bar 132 normally lie substantially in the same plane as the belt 196 and between the forwardly projecting arms 136 of the metal reinforcement 134. The cable 97 has secured to its end a metal clip 137 which carries projecting pivots 138 which are pivoted to the arms 139 of the bar 132 a short distance back of the central bearing 133. It will be seen from Figs. 16 and 17 that the tension upon the cable 97 and belt 96 will tend to rotate the arms 139 in the bearing 133 and thus raise the rear portion 135 of the bar 132 upwardly out of the plane of the belt 96. The amount of this upward movement is limited by a retainer 140 pivotally carried at 141 on the central rearwardly projecting arm 136. The bent ends 142 are positioned in slots 143 in the arms 139. This retainer 140 when swung upwardly by tension on the rope 97 will be held in about the position shown in Fig. 4. When the belt is being wound forwardly by the cutter frame moving into the kerf the pressure of the coal at either side of the kerf will hold the bars 135 in substantially the same plane as the conveyor belt, but when the return movement is begun the bars 135 will catch on the severed coal and the pressure of the coal against the bars will then tend to move them outwardly away from the belt instead of into the plane of the belt, as was the case during the forward movement of the device. In this way the bars are thrown outwardly until stopped by the retainer 140 and are held in such position that they will bear against the loose coal and insure its being drawn backwardly by the belt to a position where it may be discharged into the car 130.

It may sometimes occur that the coal as it is drawn backwardly by the conveyor belt will fall off the edges of the belt on to the floor of the mine chamber. To prevent this a pair of sliding shields or side boards 150 are mounted at each side of the frame, as shown in Figs. 13 and 14. These side boards rest against the uprights 3 and have overhanging lugs 151 which hook over the top edges of the inclined braces 5. As the cutter frame swings to the rear these bars are pushed backwardly and upwardly in front of the frame and prevent the coal from falling from the edges of the conveyor belt. When the frame is again swung forwardly for a new cut the guards 150 will slide by gravity downwardly along the conveyor bed until the forward portion of the guides strike the floor of the mine. This will bring the forward ends of the guides a considerable distance into the kerf formed by the cutter chain, as shown in Fig. 13. It may be found desirable to positively draw the guards forwardly with the cutter bar, and in Fig. 15 is shown a simple mechanism by which this may be accomplished. A rearwardly and upwardly projecting hook 153 is provided on the rope guide 99 and an eye 154 is secured to the forward end of the guard 150 in such a position that the hook 153 will swing to a position immediately below the eye 154 on the rearward movement of the cutter bar. As the cutter bar is moved farther to the rear the hook 152 will enter the eye 154 and the two will move together in this relation until the cutter bar reaches its extreme rearward position. When the bar is again swung forwardly the hook 153 will positively draw the eye 154, with the guard attached thereto, with it until the bar reaches substantially the position shown in Figs. 13 and 15. The hook 153 will then leave the eye 154 and the cutter bar will continue its movement, leaving the guard in the position shown in Fig. 13. In this way the guard is positively drawn into operative position to prevent coal from falling from the edges of the conveyor belt.

As shown in Fig. 3, the mine chamber is considerably wider than the machine and the machine is enabled to take three separate cuts for each movement of the machine forwardly in the chamber. In order to make these different cuts it is necessary to shift the forward portion of the machine laterally from one side of the chamber to the other. This is accomplished by cables 155 which are guided by pulleys 156 and 157 to the drums 158 carried on the shaft 108 and adapted to be secured for rotation therewith by clutches 159 operated by hand levers 160.

The construction of the cutter chain itself together with the means by which it is guided upon the cutter bar, is best shown in

Figs. 22 to 29 inclusive, and is covered in my copending applications Ser. No. 848,726, filed July 3, 1914; Ser. No. 12,760, filed March 8, 1915; and Ser. No. 860,371, filed September 5, 1914. The cutter chain itself comprises two different forms of links but both forms of links have rearwardly projecting shanks 161 which are slidably carried by the forward edge of the cutter bar 85. The cutter by 85 has two plates 162 and 163 secured thereto by screws 164 and rivets 165 respectively. The plate 162 overlies an offset portion 166 carried by the shank 161, and the plate 163 is adapted to slide in a substantially central opening 167 in the shank 161. By this arrangement it will be seen that the shank of each link is securely held in position for sliding along the forward edge of the cutter bar and yet does not project laterally any further than the bar itself. The links of one set which go to make up the cutter chain 161 are provided with forwardly projecting pivot pins 168. The links of the other set have body portions 169 with openings 170 which are mounted on the pins 168. The portions 169 are held in place by connecting links 171 which are prevented from becoming detached from the ends of the pivot bars 116 by spring retainers 172, the ends of which enter notches 173 in the pins 168. The body portions 169 of the alternate links of the chain have forwardly projecting socket members 174 which are provided with sockets 175 extending longitudinally of the direction of movement of the chain and in which cutter bits 176 are carried. The cutter bits 176 are provided with shanks 177 fitted into the sockets 175, and these shanks are held from accidental displacement by balls 178 carried in recesses 179 in the body members 169 of the links and resiliently pressed into contact with the bit shanks by springs 180. As shown in Figs. 23 and 24 the cutter bits 176 are set at three different angles relative to the chain. The cutting edges of one set of bits project directly forward and the cutting edges of the other sets are turned to each side respective of the chain. This arrangement is made in order to provide a kerf of sufficient width to permit the passage of the chain and cutter bar. The cutter bits are held in respective positions by notches 181 at the upper end of the sockets 175 into which the offset portions of the bits 176 fit when the bits are in place. The only object of the friction spheres 178 is to prevent accidental displacement of the cutter bits and to assist in preventing rattling of the bits. During the operation of the chain the force of the coal against the cutting edges tends to hold the bits in position in their sockets, as will be readily understood. If desired, the sockets 175 may be made of angular formation, as shown in Figs. 26 and 27, in which case the bit shanks will be formed to correspond. If angular sockets are used they will be properly formed to hold the bits in the various angular positions relative to the chain, as indicated by the two Figs. 26 and 27. A modified form of cutter bit and socket is shown in Figs. 28 and 29. In this form the socket members 174 are provided with upstanding flanges 182 for holding the cutter bits in proper angular position and in place of the balls 178 spring wires or rods 183 extend from one of these members 182 to the other These spring rods extend through openings 184 in the members 182 and have their ends bent over as at 185 to hold them in position. Countersunk openings 186 are provided in the members 182 to accommodate the bent-over portions 185 of the rods 183 so that they will not extend laterally beyond the width of the socket members. The spring rods 183 are so located relative to the cutter bit socket that they must be sprung slightly to one side, as indicated in broken lines in Fig. 28, when the bit is inserted in the socket. After the bit has been inserted the rod will spring back to its original position, as shown in Fig. 29, and will slightly overlie the bent portion of the cutter bit to prevent accidental displacement of the bit.

It may sometimes be desirable to use, instead of the electric motor shown in Fig. 6, a reciprocating engine driven either by steam or by compressed air. An arrangement by which such an engine may be used is shown in Figs. 30 to 35 inclusive. Where a reciprocating engine is used the main casting of the rotary axle is modified, as illustrated in these views there being a portion of the casting 200 shown near the right hand end of Figs. 30 and 35 and in cross section in Fig. 33 which has the general characteristic of an I-beam. Extending to the left of the part 200, as shown in Fig. 30, are two horizontal plates 201 and 202, respectively. These plates appear in cross section in Fig. 34 and are spaced from one another to provide an opening in which the engine is mounted. The left hand end of the plates 201 and 202, as shown in Figs. 30 and 31, unite with an open ring 203 which is provided with a bearing channel 24 which fits into the bearing 18 in the pivoted bracket arm 12 in the same way as the corresponding bearing of the form previously described. The motor may be of any well known and approved form of reciprocating engine having cylinders 204, steam-chests 205, piston rods 206, cross-heads 207, connecting rods 208 and valve rod 209. Either steam or compressed air may be admitted to the cylinders 204 through the pipe 210 and flexible connecting tube 211. The main shaft 212 of the engine

carries a sprocket wheel 213 which corresponds in every way to the sprocket wheel 56 of the form of device previously described. The cutter chain in this device is guided along the guideway 214 and passes through an opening 215 in the base plate 201 and thence upwardly and over the sprocket wheel 213 in the same way as that shown in Fig. 6. One end of the main shaft 212 is provided with a bevel gear 216 which meshes with a second bevel gear 217 carried on the end of a shaft 218 which extends longitudinally of the casing and has a bearing 219 secured to the I-beam shaped part 200 of the casting 22. The engine itself is carried on its own base plate 220 which is secured to the lower plate 214 of the casting 22 by means of lag screws 221. The shaft 218 carries at its end adjacent the bearing 219 a worm 222 which meshes with a worm wheel 223 secured to the end of the shaft 224 which extends transversely through the portion 200 of the casting 22. An irregular cover plate 225 (Fig. 35) is secured to the part 200 of the casting 22 and cooperates with the said casting to form a chamber 226 into which the shaft 224 projects and within which the shaft carries a worm 227. The worm 227 meshes with a worm wheel 228 also within the chamber 226. The cover plate 225 is held in place by bolts 229 thus completely enclosing the chamber 226 so that it may be filled with a lubricant. Integral with the worm wheel 228 is a pinion 230 which meshes with the internal gear 27 in the same manner as the pinion 78 in the form of the device previously described. The gears 228 and 230 are carried on a shaft 231 and the gear 230 extends through an opening in a transverse flange 232, which flange fits against the face of the internal gear 27 to prevent escape of the lubricant at the end of the teeth of this gear. The internal gear 27 has a bearing portion 28 which fits into the bearing 18 of the bracket arm 12 in the manner previously described in connection with Fig. 6. The cutter chain 61 passes up over the guide member 84 in this form in exactly the same manner as in the form previously described. The part of the casting which carries the engine is provided with cover plates 233 carried on a rod 234 and detachably secured in place at their lower edges by pins 235. The worm 222 and worm wheel 223 are completely enclosed by a cover plate 236, as shown in Fig. 31. In this way there is provided a hollow axle member in which a reciprocating instead of a rotary motor is completely enclosed and the operation of this form of device will be exactly the same as the form previously described except that a reciprocating engine driven by steam or compressed air is employed instead of an electric motor as in the other form.

While I have shown one embodiment of the present invention it will be obvious to one skilled in the art that various changes may be made in the details and arrangement of the parts without departing from the spirit of the invention. I therefore do not wish to be restricted to the exact construction disclosed in the drawings and the foregoing description.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a mining machine, the combination with a supporting frame, of core cutting mechanism having an unobstructed core opening therethrough, a hollow axle journalled for rotation on said supporting frame, an operating motor positioned within said axle, and means carried by said axle for driving said core cutting mechanism from said motor independently of said supporting frame, and means carried within said axle for feeding said cutting mechanism by rotating said hollow axle relatively to said supporting frame.

2. In a mining machine, the combination with kerf cutting mechanism having an unobstructed core opening therethrough, of a frame for supporting said kerf cutting mechanism for partial rotation on a horizontal axis, a motor carried by said frame approximately on the axis of rotation thereof and movable bodily therewith, operating connections between said motor and said kerf cutting mechanism and carried by said frame, and an additional frame for pivotally supporting said first named frame together with the parts carried thereby for partial rotation during the cutting of an upright core in a mine wall.

3. In a mining machine, the combination with a supporting frame, of a hollow axle mounted on said frame for partial rotation relatively thereto, kerf-cutting mechanism comprising means for cutting spaced apart kerfs and connected to said axle to rotate therewith relatively to said supporting frame, a motor located within said axle, means mounted on said axle for driving said kerf-cutting mechanism, and means mounted on said axle for effecting partial rotation of said axle and said kerf-cutting mechanism relatively to said supporting frame to feed said cutting mechanism arcuately relatively to said supporting frame and while the latter remains stationary.

4. In a mining machine, the combination with kerf cutting mechanism having an unobstructed core opening therethrough, of a frame for carrying said kerf cutting mechanism, and comprising an axle, a pivotal support for said frame and engaging the exterior of said axle, a motor carried by said axle, and operating connections between said motor and said kerf cutting mechanism including means for feeding said kerf cut-

ting mechanism by partially rotating said axle in said pivotal support.

5. In a mining machine, the combination with kerf cutting mechanism having an unobstructed core opening therethrough, of a frame for supporting said kerf cutting mechanism and comprising an axle, a motor carried by said axle, operating connections between said motor and said kerf cutting mechanism including means for swinging said frame on the axis of said axle, and spaced apart bearing supports engaging the exterior end portions of said axle.

6. In a mining machine, the combination with a supporting frame, of a hollow axle mounted on said frame and journalled for rotation relatively thereto, a cutter frame connected to said axle for rotation therewith and having an unobstructed core opening therethrough, an endless chain cutter mounted on said cutter frame and axle to travel around the cutter frame and longitudinally of said axle, a motor mounted within said axle, mechanism within said axle between said motor and said chain cutter for driving the latter, and means carried by said axle for operation by said motor to effect the rotation of said axle and the feeding of said chain cutter during the driving of the latter.

7. In a mining machine, a loop chain cutter, a frame on which said cutter travels, a hollow axle on which said frame is mounted, bearings for said axle, and a motor positioned within said axle for imparting a rotary movement thereto on said bearings whereby said chain is fed into the material to be mined.

8. In a mining machine, the combination with a supporting frame, of a hollow axle carried thereby and journalled for rotation relatively thereto, an endless chain cutter, a cutter frame having an unobstructed core opening therethrough and rigidly connected to said hollow axle in position for movement therewith in spaced apart planes substantially at right angles to the axis of said axle, a motor located within said axle, means within said axle and located within said motor and said endless chain cutter for driving the latter around said cutter frame and longitudinally along said axle, and means carried by said axle for rotating the same, together with the parts carried thereby relatively to said supporting frame to effect arcuate feeding movement of said chain cutter to cut a core of material between the spaced apart plane kerfs extending substantially at right angles to the axis of said axle.

9. In a mining machine, a loop chain core cutter, a frame on which said cutter travels, a hollow axle for supporting said frame, and a motor positioned within said axle for causing said chain to travel on said frame and for imparting a pivotal movement to said frame.

10. In a mining machine, a loop chain core cutter, a U-shaped frame for guiding said cutter, said frame having an unobstructed core opening therethrough, a hollow axle on which said frame is mounted, a motor within said axle, means driven by said motor for causing said cutter to travel on said frame, and means driven by said motor for imparting a rotary movement to said frame.

11. In a mining machine, the combination with an endless chain cutter, of a frame comprising a hollow axle and a loop having an unobstructed core opening therethrough, for guiding said endless chain cutter, means located within said axle for actuating said cutter to cause the same to travel around said loop guide frame, a main supporting frame, means for pivotally supporting said axle together with said guide frame, cutter and actuating means on said main frame at end portions of said axle, and means also located within said axle for effecting the feed of said cutter arcuately on the axis of said axle.

12. In a mining machine, the combination with a supporting frame, of a hollow axle carried by said supporting frame and journalled for rotation relatively thereto, a chain cutting frame having an unobstructed core opening therethrough and rigidly connected to said axle for sole support thereby, a chain cutter mounted on said axle and said cutter frame, a sprocket wheel located within said axle in position to drive said chain cutter, means for driving said sprocket wheel to effect the driving of said chain cutter, and means for moving said axle relatively to said supporting frame to secure arcuate feed of said chain cutter.

13. In a mining machine, the combination with a supporting frame, of a hollow axle pivotally mounted thereon, a cutter frame supported wholly by said axle but being rigidly connected thereto for movement therewith and having an unobstructed core opening therethrough, an endless chain cutter mounted on said cutter frame, means for guiding said chain cutter along the exterior of said axle at the inner side of the loop formed by said chain cutter frame, means for guiding said chain cutter into the interior of said axle at one end thereof, means for driving said chain cutter, and means for rotating said axle relatively to said supporting frame to effect arcuate feeding of said chain cutter.

14. In a mining machine, the combination with a supporting frame, of a hollow axle pivotally mounted thereof, a cutter-frame rigidly connected to said axle and deriving its sole support therefrom, said cutter-frame having an unobstructed core open-

ing therethrough, an endless chain cutter adapted to travel around said cutter-frame and longitudinally along said axle, means for guiding the chain cutter into the interior of said axle, means for driving said chain cutter along said cutter-frame and along said axle, and means for rotating said axle, together with said cutter-frame, to effect arcuate feeding movement of said chain cutter.

15. In a mining machine, a loop chain core cutter, a hollow axle on which said cutter is carried, means for guiding said cutter along the exterior of said axle at one side of the loop formed by said cutter, and a curved guide located within said axle around which said chain passes at one corner of the loop formed by said cutter.

16. In a mining machine, a loop chain core cutter, a hollow axle on which said cutter is carried, means for guiding said cutter along the exterior of said axle at one side of the loop formed by said cutter, a curved guide located within said axle at one end thereof for guiding the chain at one corner of the loop formed by said cutter, and a sprocket wheel located within said axle for guiding the chain at another corner of the loop formed by said cutter and for driving said cutter.

17. In a mining machine, a loop chain core cutter, a U-shaped frame for guiding said cutter, a hollow axle for supporting said frame, means for guiding said cutter along said axle at one side of the loop formed by said cutter, a curved guide located within said axle at one end thereof for changing the direction of movement of said cutter at one corner of the loop formed thereby, a sprocket wheel located within said axle at the end thereof opposite said curved guide for guiding said cutter at another corner of the loop formed thereby and for operating said cutter, and means located within said axle in the space between said guide, said sprocket and said cutter guiding means for driving said sprocket wheel.

18. In a mining machine, an endless chain cutter, having an unobstructed core opening therethrough, a frame for guiding said cutter, a hollow axle for supporting said frame, a sprocket wheel located with said axle in a plane parallel with the axis thereof for driving said cutter, a motor located within said axle having its axis of rotation parallel with the axis of said axle, and gearing connecting said motor and said sprocket wheel for driving said sprocket wheel and said cutter.

19. In a mining machine, a cutter frame having an unobstructed core opening therethrough, a hollow axle on which said frame is mounted for rotary movement, a motor located within said axle, a pinion carried by the shaft of said motor, a gear meshing with said pinion and having its axis of rotation parallel with the axis of rotation of said motor and of said cutter frame axle, a shaft located within said axle at right angles to the axis thereof, bevel gears for driving said shaft from said last mentioned gear, a sprocket wheel carried by said shaft, and a cutter chain carried by said cutter frame and passing over said sprocket wheel to be driven thereby.

20. In a mining machine, the combination with a supporting frame, of an axle pivotally mounted on said frame and having a closed chamber, a motor located within said closed chamber, a cutter-frame rigidly connected to said axle to derive its sole support therefrom, said cutter-frame having an unobstructed core opening therethrough, an endless chain cutter mounted on said axle and said cutter-frame to travel relatively thereto, driving connections carried by said axle between said motor and said endless chain cutter, and mechanism for moving said axle, together with said cutter-frame, to effect arcuate feeding movement of the chain cutter relatively to said supporting frame.

21. In a mining machine, the combination with a supporting frame, of an axle journalled for pivotal movement relatively to said frame, said axle having a closed chamber therein, a motor in said closed chamber, an additional closed chamber in said axle, a cutter-frame rigidly connected to said axle to derive its sole support therefrom, said cutter-frame having an unobstructed core opening therethrough, an endless chain cutter mounted on said cutter-frame and said axle for travel along said cutter-frame and along said axle outside of said chambers, means for driving said chain cutter comprising gearing located in said additional chamber, and means for rotating said axle on its pivot relatively to said supporting frame, together with said cutter-frame, to secure arcuate movement of said chain cutter.

22. A mining machine comprising core cutting mechanism and operating means therefor, hollow axle structure for supporting both said core cutting mechanism and said operating means, said hollow axle structure comprising a removable transverse wall located within said hollow axle structure for forming a closed chamber therein, means for holding said wall in fixed position within said axle, said mining machine comprising also supporting framework for said hollow axle structure and the mechanism carried thereby.

23. A mining machine comprising supporting framework, hollow axle structure mounted on said framework, cutting mechanism and operating means therefor supported by said hollow axle structure, removable transverse walls located within said hol-

low axle structure for forming closed chambers therein, and a removable cover plate for holding said walls in fixed position.

24. A mining machine comprising supporting framework, hollow axle structure mounted thereon, cutting mechanism and operating means therefor supported by said hollow axle structure, transverse walls within said axle structure for forming closed chambers therein, one for the motor of said operating means and the other for a part of the operating connection between said motor and the cutting mechanism, and bearings carried by said walls.

25. A mining machine comprising supporting framework, hollow axle structure mounted thereon, cutting mechanism and means for operating the same supported by said hollow axle structure, said hollow axle structure comprising an enclosing casing, and transverse walls located within said casing and forming closed chambers within said axle structure, one chamber for the motor of said operating means and another chamber for gearing of said operating means.

26. In a mining machine, the combination with a supporting frame, of an axle pivotally carried by said frame, a cutter-frame rigidly secured to said axle to derive its sole support therefrom, said cutter-frame having an unobstructed core opening therethrough, an endless chain cutter mounted on said cutter-frame and said axle, a ring having internal gear teeth and mounted on one end of said axle concentrically of the axis of said axle, a pinion meshing with said internal gear teeth, means mounted on said axle for driving said pinion, means mounted on said axle for driving said chain cutter, and means for holding said ring stationary to impart arcuate feeding movement to said chain cutter when said pinion is driven.

27. In a mining machine, the combination with a supporting frame, of cutting mechanism, operating means therefor, a hollow axle mounted on said supporting frame and carrying said operating means, said operating means comprising gearing within said hollow axle to control the feed of said cutting mechanism, and a brake for holding a part of said gearing stationary relative to said supporting frame for controlling the feed of said cutting mechanism.

28. In a mining machine, the combination with a supporting frame, of a core cutter frame having an unobstructed core opening therethrough, a supplemental frame mounted on said supporting frame to swing on an axis of a hollow axle portion of said supplemental frame, a motor within said hollow axle, a chain cutter mounted on said cutter-frame and said supplemental frame, driving mechanism between said motor and said chain cutter, means driven by said motor and comprising gearing within said axle for feeding said chain cutter, and a brake associated with said gearing to hold a part thereof stationary relative to the supporting frame to control the arcuate feed of said chain cutter.

29. In a mining machine, a swinging cutter frame having an unobstructed core opening therethrough, a hollow axle for supporting said cutter frame, a motor within said hollow axle, gearing within said hollow axle driven by said motor, and means located on the exterior of said axle to cause said gearing to impart a rotary movement to said cutter frame.

30. In a mining machine, the combination with an endless chain cutter, of a frame having an axle and a loop with an unobstructed core opening therethrough for guiding said endless chain cutter, mechanism carried by said axle for driving said chain to cause it to travel around said loop frame, feeding mechanism mounted on said axle for moving said endless chain cutter in an arc on an axis extending through said axle, and means associated with said axle for holding a part stationary for controlling said feeding means.

31. In a mining machine, the combination with a supporting frame, of a hollow axle pivotally mounted on said frame, a cutter-frame, cutting mechanism mounted on said cutter-frame, a motor mounted within said hollow axle, a brake, a train of gearing between said motor and said brake, and means for applying said brake to one of said gears to effect rotary movement of said axle and the feed of said cutting mechanism.

32. In a mining machine, a cutter frame, a hollow axle for supporting said cutter frame, a gear located within said hollow axle eccentrically of the axis thereof, means for supporting said hollow axle, a second gear mounted on said hollow axle for rotation relative thereto and relative to said axle support and meshing with said eccentrically mounted gear, and means for holding said second gear stationary for causing said eccentrically mounted gear to impart a rotary movement to said axle and said cutter frame.

33. In a mining machine, a cutter frame, an axle for supporting said frame, a gear concentrically mounted on said axle, means located within said axle for rotating said gear relative to said axle, and means for holding said gear stationary to cause a rotary movement to be imparted to said axle and said cutter frame.

34. In a mining machine, a cutter frame, a hollow axle for supporting said cutter frame, a gear mounted concentrically with said hollow axle for rotation relative thereto, a motor within said hollow axle, reduction gearing between said motor and said gear for causing said gear to move relative to

said axle, and a brake for holding said gear stationary to cause said motor to impart a slow rotary movement to said axle and said cutter frame.

35. In a mining machine, core cutter mechanism, an axle for supporting said cutter mechanism, a frame for said cutting mechanism having an unobstructed core opening therethrough, an adjustable pivoted bracket for supporting said axle, means for moving said bracket about its pivot and for holding said bracket in adjusted position, and a counterbalancing spring for counteracting the strain upon said brackets.

36. In a mining machine, a pivoted cutter bar, a conveyor belt, a cable secured to one end of said conveyor belt and slidably secured to said cutter bar near the outer end thereof, and means for holding the end of said cable opposite to that secured to the said conveyor belt stationary during the movement of said cutter bar about its pivot for causing said cutter bar to move said belt during said pivotal movement.

37. In a mining machine, a cutter frame pivoted for movement about an axis for cutting a kerf in material to be mined, a conveyor belt, a cable having one end thereof secured to one end of said conveyor belt and slidably connected with said cutter frame near the outer end thereof, and means for holding the opposite end of said cable stationary during movement of said cutter frame about its axis to prevent sliding of said cable relative to said frame whereby said belt is drawn after said cutter frame into the kerf formed thereby.

38. In a mining machine, a cutter frame, a cable slidably connected with said cutter frame, a conveyor belt secured to one end of said cable, and means for holding the opposite end of said cable stationary during the movement of said cutter frame to prevent sliding of said cable relative to said cutter frame whereby said conveyor belt is moved substantially in unison with said cutter frame.

39. In a mining machine, a movable cutter frame, a cable slidably secured to said cutter frame, a conveyor belt secured to one end of said cable, means for exerting tension on the opposite end of said cable for moving said cable relative to said cutter frame to draw said conveyor belt into position adjacent said cutter frame, and means for holding the last mentioned end of said cable stationary during the movement of said cutter frame for preventing retrograde movement of said conveyor belt relative thereto.

40. In a mining machine, a cutter frame, a conveyor belt, extensible means for connecting said cutter frame and conveyor belt, and mechanism independent of said extensible connecting means for moving said cutter frame.

41. In a mining machine, a cutter frame arranged for pivotal movement about an axis, a conveyor belt, a cable secured at one end to said conveyor belt and slidably connected with said cutter frame, and mechanism independent of said cable for moving said cutter frame about its axis.

42. In combination, a mining machine having a cutter frame carried thereby for pivotal movement about an axis, a conveyor belt, a cable having one end thereof secured to the end of said conveyor belt and being slidably connected with said cutter frame, means for moving said cable relative to said cutter frame for changing the position of said conveyor belt relative to said frame, and means independent of said cable for rotating said frame about its axis.

43. In a mining machine, a cutter frame pivotally supported for movement about an axis, a conveyor belt, a cable slidably connected with said cutter frame and having one end thereof secured to said conveyor belt, a winding device for moving said cable and conveyor belt relative to said cutter frame, and means for holding stationary the end of said cable opposite that secured to said conveyor belt for preventing movement of said cable and conveyor belt relative to said cutter frame whereby movement of said cutter frame about its axis will impart a corresponding movement to the end of said conveyor belt.

44. In a mining machine, a cutter frame pivoted for movement about an axis, a guide secured to said cutter frame near the outer end thereof, a second guide secured to said cutter frame near the axis thereof, a cable slidably held by said guides, a conveyor belt, connection between said conveyor belt and one end of said cable, and means for holding the other end of said cable stationary to prevent movement of said cable relative to said guides whereby pivotal motion of said cutter frame about its axis will transmit a corresponding movement to the end of said conveyor belt.

45. In a mining machine, a movable cutter frame, a conveyor belt, a cable slidably connected to said cutter frame and having one end thereof secured to said conveyor belt, means for holding the other end of said cable stationary during forward movement of said cutter frame to cause said conveyor belt to be drawn by said frame, and means for releasing said holding means to permit said conveyor belt to be moved relative to said cutter frame.

46. In a mining machine, a pivoted cutter frame, a conveyor belt, a cable slidably connected with said cutter frame and having one end thereof secured to said conveyor

belt, a winding drum secured to the other end of said cable, means for automatically holding said winding drum stationary during forward movement of said cutter frame about its pivot whereby said conveyor belt will be moved by said cutter frame, and means for automatically releasing said holding means to permit said cable and conveyor to move relative to said cutter frame.

47. In a mining machine, a pivoted cutter, means for moving said cutter about its pivot for forming a kerf in material to be mined, a conveyor belt, a cable slidably secured to said cutter frame and having one end thereof attached to said conveyor belt, a winding drum secured to the opposite end of said cable whereby movement may be imparted to said cable relative to said cutter frame for drawing said conveyor belt into close proximity to said frame, means for automatically holding said winding drum stationary during the forward movement of said cutter frame whereby said conveyor belt is caused to move with said cutter frame in the kerf formed thereby, means for returning said cutter frame to its original position after a cut has been made, and a device for automatically releasing said holding means at the close of said return movement to permit movement of said conveyor belt relative to said cutter frame for transporting material severed by said cutter frame.

48. In a mining machine, a movable cutter frame, a conveyor belt, a cable slidably connected with said cutter frame and having one end thereof secured to said conveyor belt, a winding drum secured to the opposite end of said cable, and automatic means operated by said cutter frame for controlling the movement of said winding drum.

49. In combination, a frame, a cutter frame mounted for oscillation on said frame, a conveyor belt, a cable slidably connected with said cutter frame and having one end thereof secured to said conveyor belt, a winding drum secured to the opposite end of said cable, means for oscillating said conveyor frame, and automatic means controlled by said conveyor frame for preventing movement of said winding drum during the forward stroke of said frame and for releasing said winding drum at the end of the return stroke of said frame.

50. In combination, a pivotally mounted cutter frame, a conveyor belt, a cable slidably connected with said cutter frame and having one end thereof secured to said conveyor belt, a winding drum secured to the opposite end of said cable for exerting tension on said cable to move said conveyor belt into close proximity to said cutter frame, means for oscillating said cutter frame about its pivot to cause said cutter frame to form a kerf in material to be mined, automatic means for preventing movement of said winding drum during the forward stroke of said cutter frame to prevent said cable from moving relative to said cutter frame and to cause said conveyor belt to be drawn by said frame into the kerf formed thereby, means for returning said conveyor belt and cutter frame to their initial position, and automatic means for releasing said winding drum at the close of said return movement for permitting the said conveyor belt to be moved relative to said cutter frame for transporting material deposited upon said conveyor belt.

51. In a mining machine, a cutter for forming a kerf in material to be mined, a frame for said cutter, a conveyor belt, means for connecting said belt and said cutter frame for drawing said belt into the kerf formed by said cutter by the movement of said frame, means for changing the length of the connection between said belt and cutter frame whereby said belt may be drawn away from said frame to transfer material severed by said frame, and mechanism independent of said connecting means for feeding said cutter frame into the kerf formed by said cutter.

52. In combination a mining machine frame, an inclined conveyor supported by said frame, a cutter frame movably carried on said frame and adapted to form a kerf in the material to be mined in advance of and in alinement with said conveyor, and guards supported on said frame at the sides of the receiving portion of said conveyor and movable into and out of the kerf formed by said cutter frame while being maintained at the sides of said conveyor, for preventing accidental discharge of material.

53. In combination, a mining machine frame, kerf cutting mechanism mounted on said frame, and spaced apart guards slidably supported on said frame and movable thereon by the movement of said cutter during a portion of the complete path of travel of the latter, into shielding positions at the sides of the space within which said cutting mechanism cuts material in a mine wall.

54. In combination, a mining machine frame, a conveyor supported by said frame, a kerf cutter pivotally carried by said frame, and guards positioned to be maintained at the edges of said conveyor and arranged to be slid longitudinally of said conveyor by the movement of said cutter upon its pivot into shielding positions at the sides of the space occupied by said cutting mechanism.

55. In combination, a mining machine frame, a cutter pivotally carried by said frame for forming a kerf in the material to be mined, a conveyor, a guard supported by said frame at the edge of said conveyor for preventing accidental discharge of ma-

terial, means for causing said guard to move into the kerf formed by said cutter during the forward stroke thereof, and means for moving said guard rearwardly during the return stroke of said cutter.

56. In combination, a mining machine frame, an inclined conveyor supported by said frame, a guard slidably carried by said frame at each edge of said conveyor, a cutter pivotally mounted on said frame, means for moving said cutter in an arc about its pivot, and means for positively moving said guards forwardly during the forward stroke of said cutter into shielding positions at the sides of the space occupied by said cutting mechanism.

57. In combination, a mining machine frame, a conveyor supported on said frame, guards for said conveyor, cutting mechanism carried by said frame, means for operating said cutting mechanism, and a hook connection between said cutting mechanism and said guards for positively drawing said guards forwardly during a portion of the forward movement of said cutter.

58. In combination, a mining machine frame, an inclined conveyor supported on said frame, a cutter pivotally mounted on said frame, means for moving said cutter arcuately on its pivot for cutting a kerf in the material to be mined, a guard supported by said frame at the side of said conveyor for preventing accidental discharge of material therefrom, and a connection between said guard and said cutter for positively drawing said guard forwardly into the kerf formed by said cutter during the forward movement of said cutter.

59. In a mining machine, a cutter for forming a kerf in the material to be mined, a conveyor belt, means for securing said conveyor belt to said cutter whereby said conveyor belt is drawn by said cutter into the kerf formed thereby, stops carried by said conveyor belt and adapted to be pressed substantially into the plane thereof by forward movement of said belt into said kerf and to be forced away from the plane of said belt by rearward movement of said belt in said kerf, and a connection between said stops and said cutter whereby the tension exerted by said cutter upon said belt tends to force said stops away from said belt.

60. In a mining machine, a conveyor belt, a cutter, means for moving said cutter to form a kerf in the material to be mined, stops pivoted to said conveyor belt and extending backwardly from said pivots relative to the direction of movement of said cutter for forming said kerf, a connection between said cutter and conveyor belt pivotally secured to said stops and arranged to give said stops a tendency to move about their pivots away from the plane of said conveyor belt when tension is exerted by said cutter upon said belt, and means for limiting the movement of said stops about their pivots.

61. In a mining machine, a conveyor belt, a cutter for forming a kerf in the material to be mined, means for drawing said conveyor belt into the kerf formed by said cutter, stops carried by said conveyor belt and adapted to be forced into inoperative position by forward movement of said conveyor belt through said kerf and into operative position by rearward movement of said conveyor belt in said kerf, and means operated by the connection between said cutter and said conveyor belt for normally moving said stops into operative position when tension is exerted upon said conveyor belt.

62. In a mining machine, a cutter, a conveyor belt, means secured to said cutter for exerting tension on said conveyor belt, stops carried by said conveyor belt and normally pressed into operative position by the tension exerted by said cutter, and means for limiting the movement of said stops caused by said tension.

63. In a mining machine, the combination with a movable cutter frame, of a conveyer belt, a cable connected to said cutter frame and to said conveyer belt, means for moving said conveyer belt, and means operated by said cutter frame for controlling said moving means.

64. In a mining machine, the combination with cutting mechanism, of a conveyer belt, a cable connected to the rear end of said belt, winding mechanism for said cable, an additional cable having one end connected to the forward end of said belt, additional winding mechanism to which the other end of said additional cable is connected, means for connecting the intermediate portion of said additional cable with said cutting mechanism to cause the belt to be pulled forward when the cutting mechanism is fed forward, brake mechanism associated with said additional winding mechanism, and means operated automatically by the cutting mechanism for controlling said brake mechanism.

65. In a mining machine, the combination with cutting mechanism, of a conveyer belt, cables connected to the ends of said belt, means for exerting pulls on said cables to effect movement of said belt in opposite directions, and means associated with the cutting mechanism for automatically controlling such pulls and the movements of the belt.

66. In a mining machine, the combination with cutting mechanism, of a conveyer, means for moving said conveyer in one direction, means for moving said conveyer in the opposite direction, and means operated by said cutting mechanism for controlling said additional moving means.

67. In a mining machine, the combination with cutting mechanism, of a conveyer, a

cable connected to the rear end of said conveyer, winding mechanism for exerting a pull on said cable to move said conveyer, an additional cable connected at one end to the forward end of said conveyer, additional winding mechanism connected to the other end of said additional cable, devices for connecting intermediate portions of said additional cable with said cutting mechanism to cause said conveyer to be drawn forward when said cutting mechanism is fed forward, brake mechanism associated with said additional winding mechanism, and a device extending from said brake mechanism into position to be moved by said cutting mechanism when the latter is restored to initial position, to release said additional winding mechanism.

68. In a mining machine, the combination with core cutting mechanism having an unobstructed core opening therethrough, of an axle for carrying said cutting mechanism, means mounted on said axle for both actuating and feeding said cutting mechanism, and means for pivotally supporting said axle.

69. In a mining machine, the combination with core cutting mechanism having an unobstructed core opening therethrough, of a substantially horizontal axle for carrying said cutting mechanism, means mounted on said axle for operating said cutting mechanism including the feeding thereof, and spaced apart journal bearings for said axle.

70. In a mining machine, the combination with cutting mechanism, of a stirrup frame having an unobstructed core opening therethrough, an axle for supporting said cutting mechanism and said stirrup frame, means carried by said axle for operating said cutting mechanism including the feeding thereof, and means for pivotally supporting said axle.

71. In a mining machine, the combination with core cutting mechanism having an unobstructed core opening therethrough, of an axle for supporting said core cutting mechanism, a motor mounted on said axle, transmission gearing on said axle between said motor and said cutting mechanism, gearing mounted on said axle and connected to said motor for effecting the feed of said cutting mechanism, an enclosed chamber for said transmission gearing, said enclosed chamber being adapted to contain lubricating material, and an additional enclosed chamber adapted to contain lubricating material to lubricate the feed gearing.

72. In a mining machine, the combination with core cutting mechanism having an unobstructed core opening therethrough, of an axle for carrying said cutting mechanism, means mounted on said axle for actuating said cutting mechanism, feed gearing mounted on said axle and connected to said motor, brake mechanism associated with said feed gearing to control the feeding of said cutting mechanism, and means for pivotally supporting said axle.

73. In a mining machine, the combination with cutting mechanism, of an axle carrying the same, means carried by said axle for actuating said cutting mechanism, spaced apart journal bearings for supporting said axle, feed gearing mounted on said axle and connected to said motor, said feed gearing comprising a gear mounted directly in one of said journal bearings, and brake mechanism associated with said last named gear for controlling the feeding of said cutting mechanism.

74. In a mining machine, the combination with cutting mechanism, of an axle for supporting the same, means for pivotally supporting said axle, a motor mounted on said axle, means on said axle connected between said motor and said cutting mechanism for actuating the latter, feed gearing mounted on said axle and connected to said motor, said feed gearing comprising an internal gear, a brake associated with the exterior surface of said internal gear, and means for operating said brake for controlling the feeding of said cutting mechanism.

75. In a mining machine, the combination with core cutting mechanism having an unobstructed core opening therethrough, of an axle for supporting said cutting mechanism, a motor mounted on said axle, transmission gearing between said motor and said cutting mechanism, feed gearing mounted on said axle and connected to said motor, said feed gearing comprising an internal gear, spaced apart journal bearings for said axle, and brake mechanism associated with said internal gear for holding the same stationary relatively to said journal bearings to effect feeding of said cutting mechanism,

76. In a mining machine, the combination with a loop chain core cutter, of a U-shaped frame for guiding said cutter, an axle for supporting said frame, a motor carried by said axle, means for guiding said cutter along said axle at one side of the loop formed by said cutter, to provide sufficient space for the mounting of said motor, a guide located at one end of said axle for changing the direction of movement of said cutter at one corner of the loop formed thereby, a sprocket wheel located on said axle at the end thereof opposite said guide, for guiding said cutter at another corner of the loop formed thereby, and for operating said cutter, and means on said axle between said guide and said sprocket for driving the latter.

77. In a mining machine, the combination with an axle for supporting cutter mechanism, of a frame for such cutter mechanism

having an unobstructed core opening therethrough, an adjustable pivoted bracket for supporting said axle, means for moving said bracket to adjust the position of said axle and said frame, and counterbalancing mechanism for counteracting strain upon said bracket.

78. In a mining machine, the combination with a loop chain core cutter, of a U-shaped frame having an unobstructed core opening therethrough, an axle for supporting said frame, a motor mounted on said axle means for guiding said cutter along a part of said axle at one side of the kerf formed by said cutter to provide sufficient space for mounting said motor on said axle, a guide located at one end of said axle for changing the direction of movement of said cutter at one corner of the loop formed thereby, a sprocket wheel located at the end of the axle opposite said guide, for guiding said cutter at another corner of the loop formed thereby and for operating said cutter, and means carried by said axle for driving said sprocket wheel to cause said cutter to travel along the aforesaid guiding means.

79. In a mining machine, the combination with core-cutting mechanism having an unobstructed core opening therethrough, of an axle for supporting said core-cutting mechanism, means comprising a motor and power transmission mechanism mounted on said axle for operating said core-cutting mechanism, and an enclosed chamber for the gearing of said power transmission mechanism, said enclosed chamber being adapted to be filled with a lubrication to effect immersion of said gearing.

80. In a mining machine, the combination with core-cutting mechanism having an unobstructed core opening therethrough, of an axle for supporting said core-cutting mechanism, means comprising power tranmission gearing for operating said core-cutting mechanism including the feeding thereof, and a plurality of enclosed chambers adapted to contain lubricating material for immersing such gearing.

81. In a mining machine, the combination with core-cutting mechanism, of a horizontal axle on which said core-cutting mechanism is mounted, separate closed chambers in said axle, a motor located within one of said chambers, and gearing driven by said motor and located within another chamber, the latter being adapted to contain lubricating material to immerse said gearing.

82. In a mining machine, the combination with loop chain core-cutting mechanism having an unobstructed core opening therethrough, of a horizontal axle for supporting said core-cutting mechanism, a gear carried by said axle eccentrically of the axis thereof, means for supporting said axle, a second gear mounted on said axle for rotation relatively thereto and relative to said axle support and meshing with said eccentrically mounted gear, and means for holding said gear stationary for causing such eccentrically mounted gear to impart a rotary movement to said axle and said loop chain core-cutting mechanism.

83. In a mining machine, the combination with a loop chain core cutter having an unobstructed core opening therethrough, of an axle for supporting said loop chain core cutter, means for supporting said axle for rotary movement together with said loop chain core cutter on a horizontal axis, a motor carried by said axle, a closed chamber in said axle and adapted to contain lubricating material, and gearing immersed in such lubricating material and operated by said motor for driving said loop chain core cutter.

84. In a mining machine, the combination with loop chain core-cutting mechanism having an unobstructed core opening therethrough, of a hollow axle for supporting said loop chain core-cutting mechanism, means supported within said hollow axle for operating said core-cutting mechanism, said operating means comprising gearing within said hollow axle to control the arcuate feeding movement of said cutting mechanism, and braking mechanism associated with said gearing for controlling said arcuate feeding movement of said cutting mechanism.

85. In a mining machine, the combination with loop chain core-cutting mechanism having an unobstructed core opening therethrough, of a hollow axle for supporting said loop chain core-cutting mechanism, a frame for supporting said hollow axle and said loop chain core-cutting mechanism for swinging movement on a horizontal axis, a motor within said hollow axle, driving mechanism between said motor and said cutting mechanism, means driven by said motor and comprising gearing within said axle for feeding said cutting mechanism by swinging the same on said horizontal axis, and braking mechanism associated with said gearing to control the arcuate feeding movement of the cutting mechanism.

86. In a mining machine, the combination with loop chain core-cutting mechanism having an unobstructed core opening therethrough, of a hollow axle for supporting said loop chain core-cutting mechanism, a motor in said axle, means in said axle to form a closed chamber for said motor, operating mechanism carried by said axle to transmit power from said motor to said loop chain core-cutting mechanism to drive the latter, and mechanism for pivotally supporting said axle for feeding movement of said loop chain core-cutting mechanism.

87. In a mining machine, the combination with a supporting frame, of an axle mount-

ed thereon for rotation on a horizontal axis, loop chain core-cutting mechanism having an unobstructed core opening therethrough and connected to said axle to move therewith on such horizontal axis, a motor entirely enclosed within said axle, and operating mechanism also enclosed within said axle and connected between said motor and said loop chain core-cutting mechanism to operate the latter.

88. In a mining machine, the combination with a supporting axle, of loop chain core-cutting mechanism having an unobstructed core opening therethrough and mounted on said axle to move bodily therewith, a motor located within said axle, and mechanism connected between said motor and said loop chain core-cutting mechanism for operating the latter including arcuate feed thereof.

89. In a mining and loading machine, the combination with core-cutting mechanism, of means for operating the same, mechanism comprising spaced-apart side walls for directing the dislodged material from said core-cutting mechanism, and means comprising an apron conveyer for transferring the dislodged material toward loading position.

90. In a mining and loading machine, the combination with a supporting frame, of a motor mounted thereon, a plurality of rope drums mounted on a single transverse shaft on said supporting frame and geared to said motor, a conveyer, and a plurality of ropes connected to said rope drums for shifting the position of the supporting frame, for operating said conveyer, and for feeding said core-cutting mechanism.

91. In a mining machine, the combination with a supporting frame, of kerf-cutting mechanism mounted thereon for operation in advance of said frame, means for operating said kerf-cutting mechanism including feeding movement thereof relatively to said frame and in advance thereof, and an upright guard movable into position relative to said frame to confine the material when dislodged by said kerf-cutting mechanism to a predetermined space adjacent said upright guard.

92. In a mining machine, the combination with a supporting frame, of cutting mechanism comprising an axle pivotally mounted on said frame, and means for operating said kerf-cutting mechanism including the feed thereof by partial rotation of said axle, said operating means comprising a gear and brake mechanism partially applied thereto to hold said gear stationary normally but to permit movement thereof for relieving the strain on said kerf-cutting mechanism when the latter engages material beyond the predetermined capacity of said cutting mechanism.

93. In a mining machine, the combination with a supporting frame, of kerf-cutting mechanism mounted thereon to cut a kerf in a mine wall in an upright plane, means for operating said kerf-cutting mechanism including feeding movement thereof relatively to said frame, and a guard plate connected to said kerf-cutting mechanism to trail back of the same in the kerf produced thereby.

94. In a mining machine, the combination with a supporting frame, of core-cutting mechanism mounted thereon, means for operating said core-cutting mechanism including feed thereof relatively to said supporting frame to cut an upright core of material in its native bed, and a guard plate attached to said core-cutter to move bodily therewith during the feed thereof and extending back therefrom for confining the cut material when dislodged against movement beyond the upright plane of said plate.

95. In a mining machine, the combination with a supporting frame, of a loop chain core-cutter mounted on said frame to swing on a horizontal axis, means for operating said loop chain core-cutter including feed thereof to cut an upright crescent-shaped core in a mine wall, and a pair of spaced-apart guard plates connected to opposite sides of said loop chain core-cutter and movable bodily therewith into spaced-apart kerfs on opposite sides of the core to confine the material dislodged from the core from movement laterally from the space between the upright planes of said guard plates.

96. In a mining and loading machine, the combination with a frame having a rear horizontal portion adapted to overhang a mine car and a forward downwardly inclined portion adapted to extend to receiving position adjacent the base of a mine wall, of means mounted on the forward end of said frame for dislodging material from an upright mine wall in advance of said frame and to a position at the base of the mine wall in advance of the forward open end of the chute, and mechanism extensible beyond the forward open end of said chute for catching, carrying and transferring dislodged material from the mine wall to the mine car under the overhanging rear portion of said chute.

97. In a mining machine, the combination with a supporting frame, of core-cutting mechanism having an unobstructed core-opening therethrough and mounted on said frame for feeding movement on a horizontal axis, a pair of spaced-apart guard plates mounted on said frame independently of said cutting mechanism at the sides of the space occupied by said cutting mechanism, and means for operating said core-cutting mechanism including upright feed-

ing movement thereof on said horizontal axis and between said guard plates and relatively thereto.

98. In a mining machine, the combination with a supporting frame, of spaced-apart guard plates connected to said frame, core-cutting mechanism having an unobstructed core-opening therethrough and mounted on said frame between the planes of said spaced-apart guard plates, and means for operating said core-cutting mechanism including arcuate feeding movement thereof between said guard plates and relatively thereto.

99. In a mining machine, the combination with a supporting frame, of a hollow axle mounted on said frame for arcuate movement in spaced-apart bearings on a substantially horizontal axis, core-cutting mechanism having an unobstructed core-opening therethrough and mounted on said axle for arcuate movement therewith on said horizontal axis, mechanism mounted within said axle for actuating said core-cutting mechanism, means for moving said axle arcuately to effect arcuate feed of said core-cutting mechanism in an upright direction to cut an upright crescent-shaped core in a mine wall between the floor and roof of a mine chamber, and means for adjusting the elevation of said hollow axle to center said horizontal axis substantially midway between the floor and roof of the mine chamber.

100. In a mining machine, the combination with a supporting frame, of a supplemental frame mounted for pivotal movement on said supporting frame, core-cutting mechanism mounted on said supplemental frame and having an unobstructed core-opening therethrough, means mounted on said supplemental frame for operating said core-cutting mechanism, and a drum on said supplemental frame enclosing said operating means.

101. In a mining machine, the combination with a supporting frame, of a chain kerf-cutter mounted thereon for movement relatively thereto, means capable of moving said kerf-cutter bodily in feeding direction, separate means capable of moving said kerf-cutter only in the reverse direction, and a motor mounted on said kerf-cutter to move bodily therewith and drive the chain thereof independently of said feeding means.

102. In a mining machine, the combination with a supporting frame, of a chain kerf-cutter mounted thereon for feeding movement relatively thereto, means for moving said kerf-cutter in feeding direction, separate means connected to the distant end of said kerf-cutter capable of moving the latter only in the reverse direction, and a motor mounted on said kerf-cutter to move bodily therewith and drive the chain thereof independently of said feeding means.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 7th day of September A. D. 1915.

EDMUND C. MORGAN.

Witnesses:
A. J. CRANE,
THOMAS COLSON.