July 3, 1928. 1,675,723

E. C. MORGAN

MINING AND LOADING MACHINE

Filed July 28, 1922 10 Sheets-Sheet 1

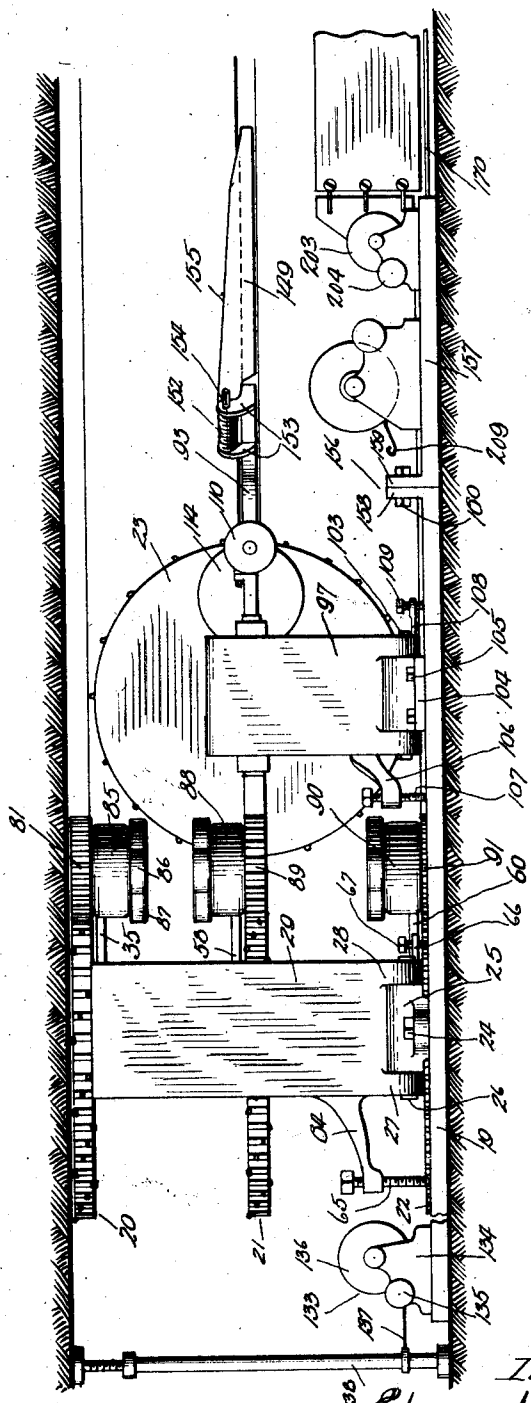


Fig. 1

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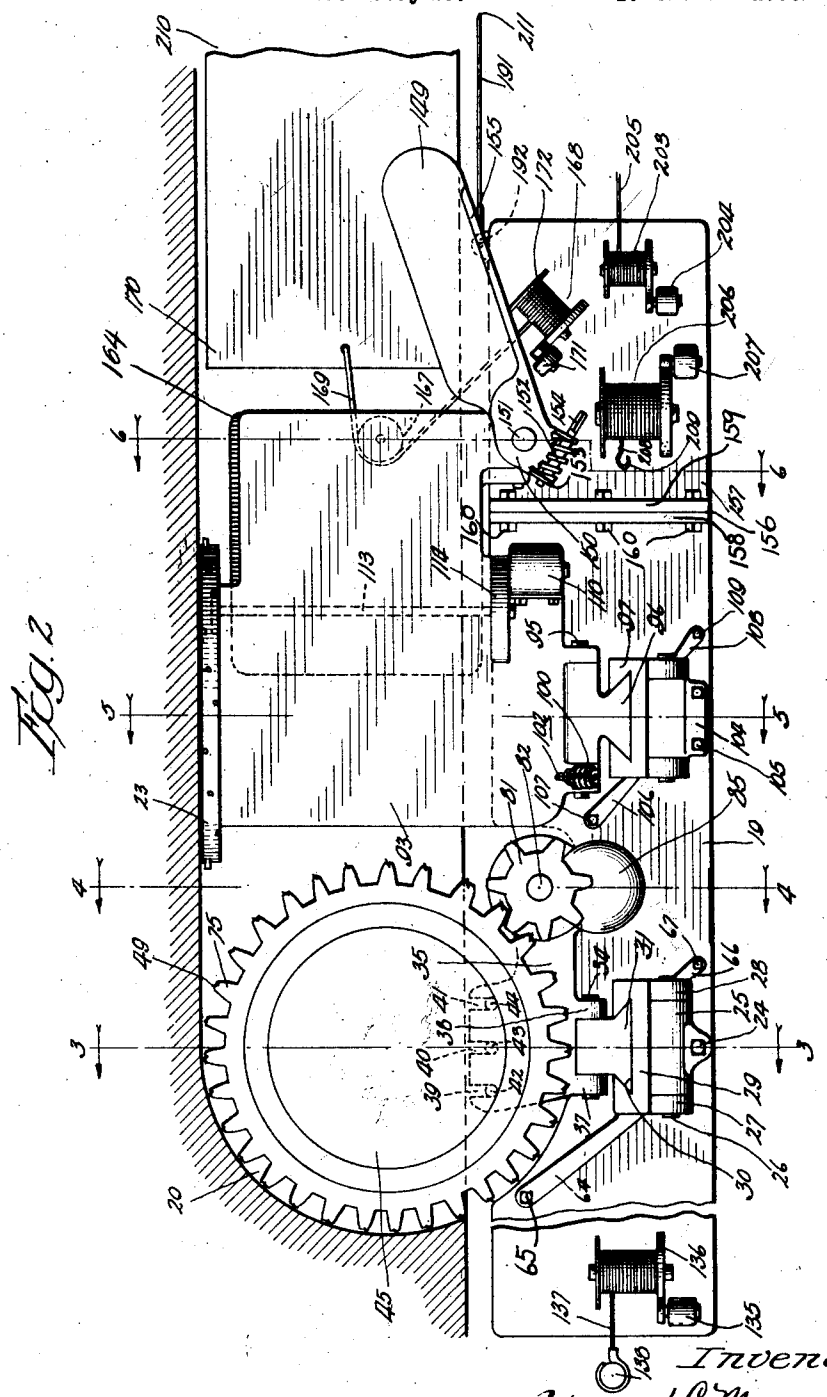


Fig. 2

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Fig. 3

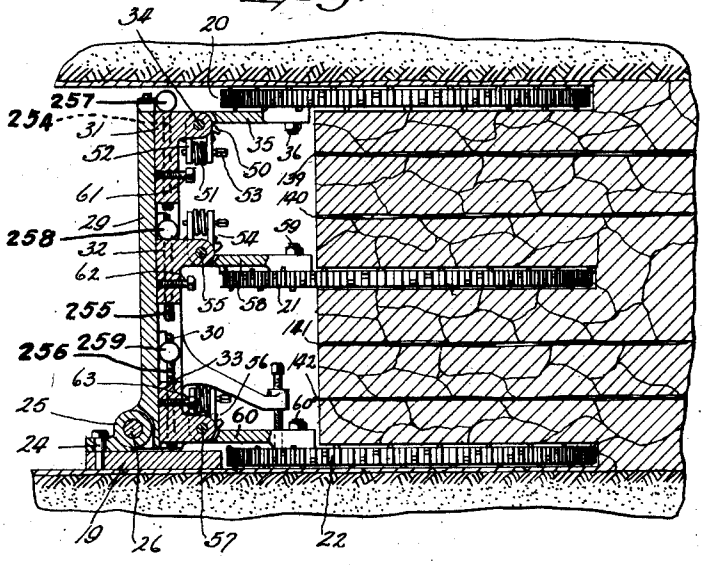
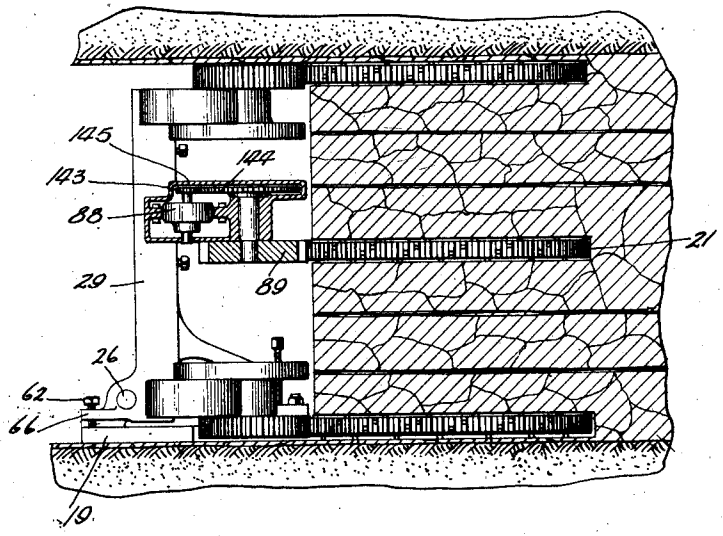


Fig. 4



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Fig. 5

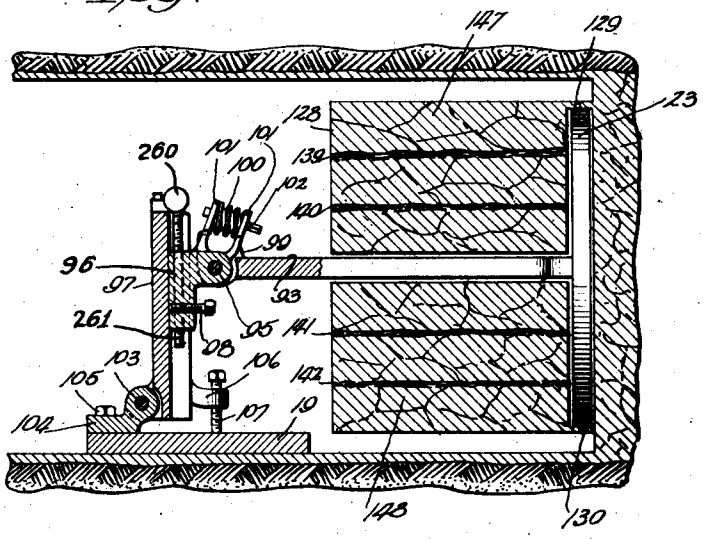
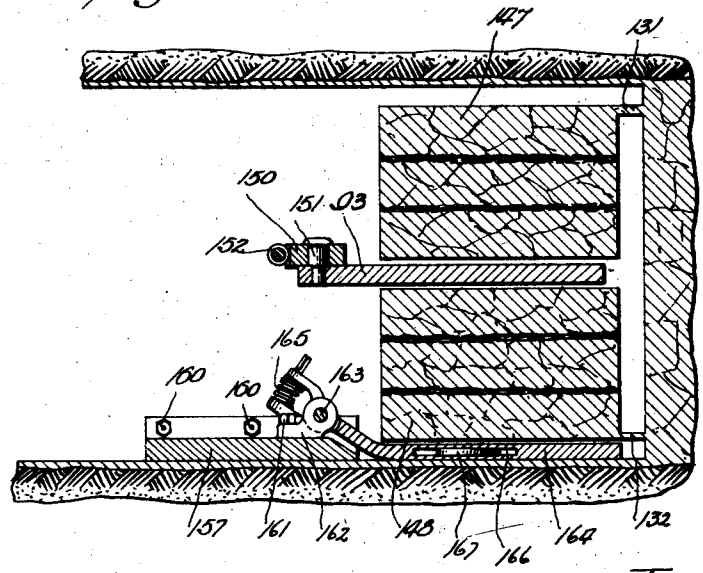


Fig. 6



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FIG. 7

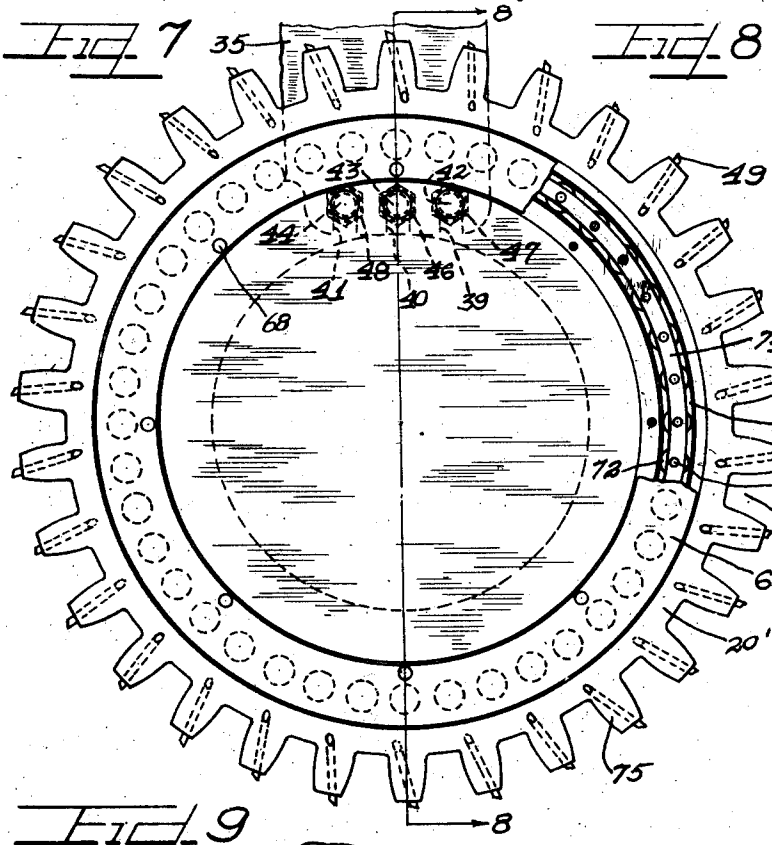


FIG. 8

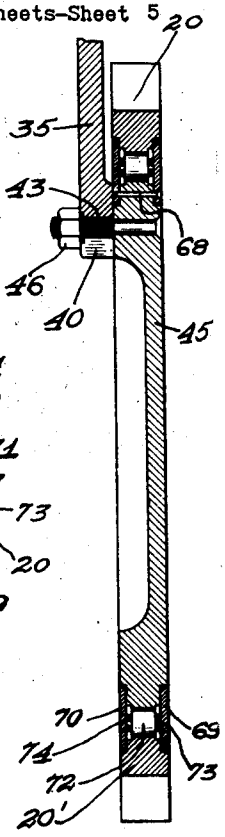


FIG. 9

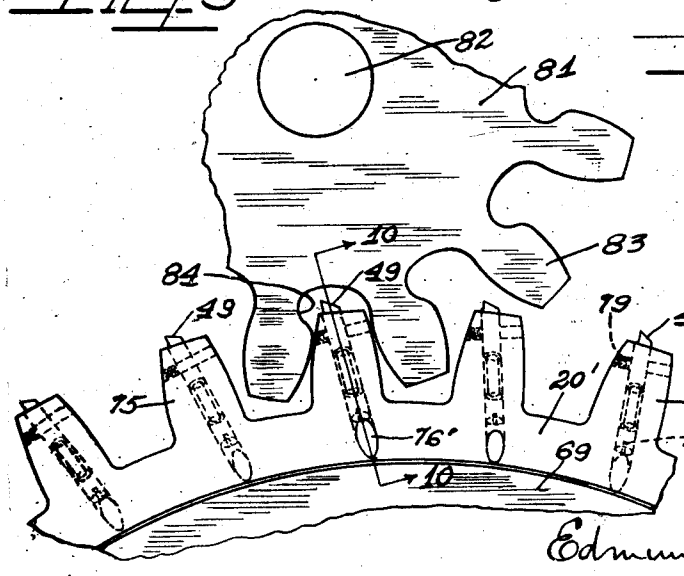
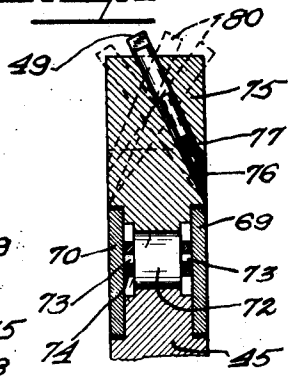


FIG. 10



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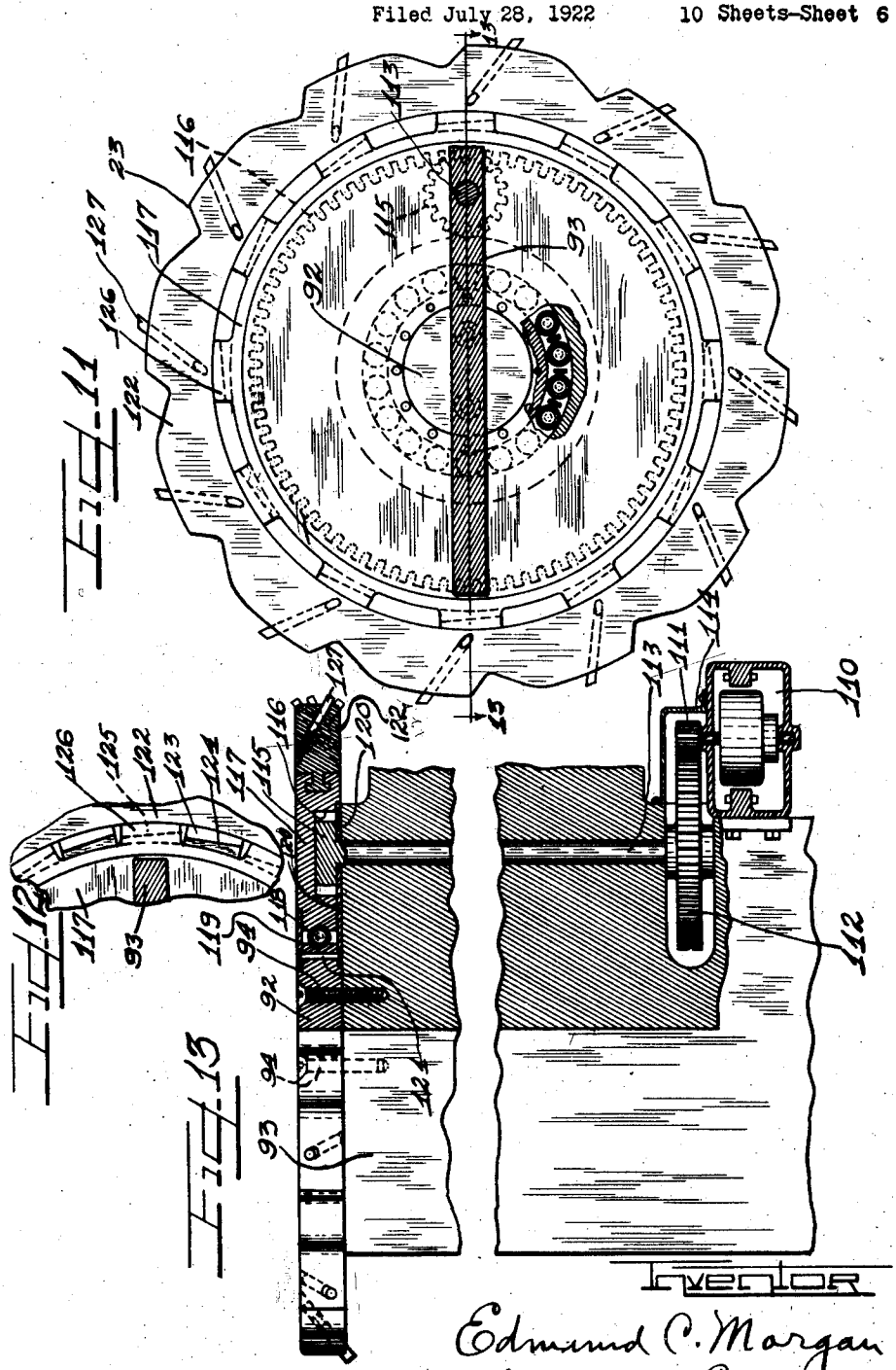
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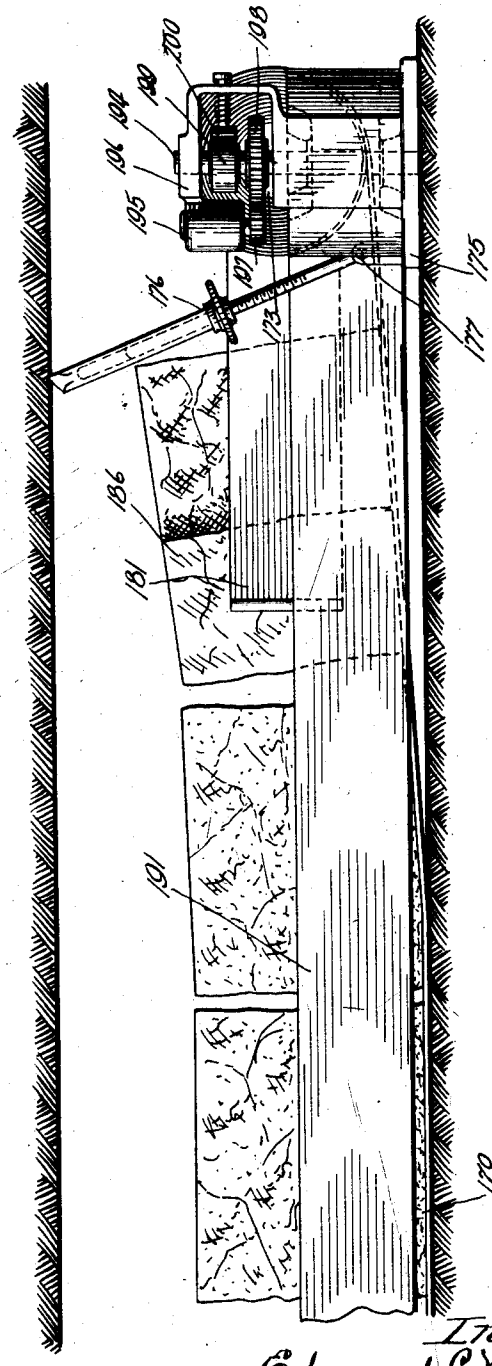


FIG. 14

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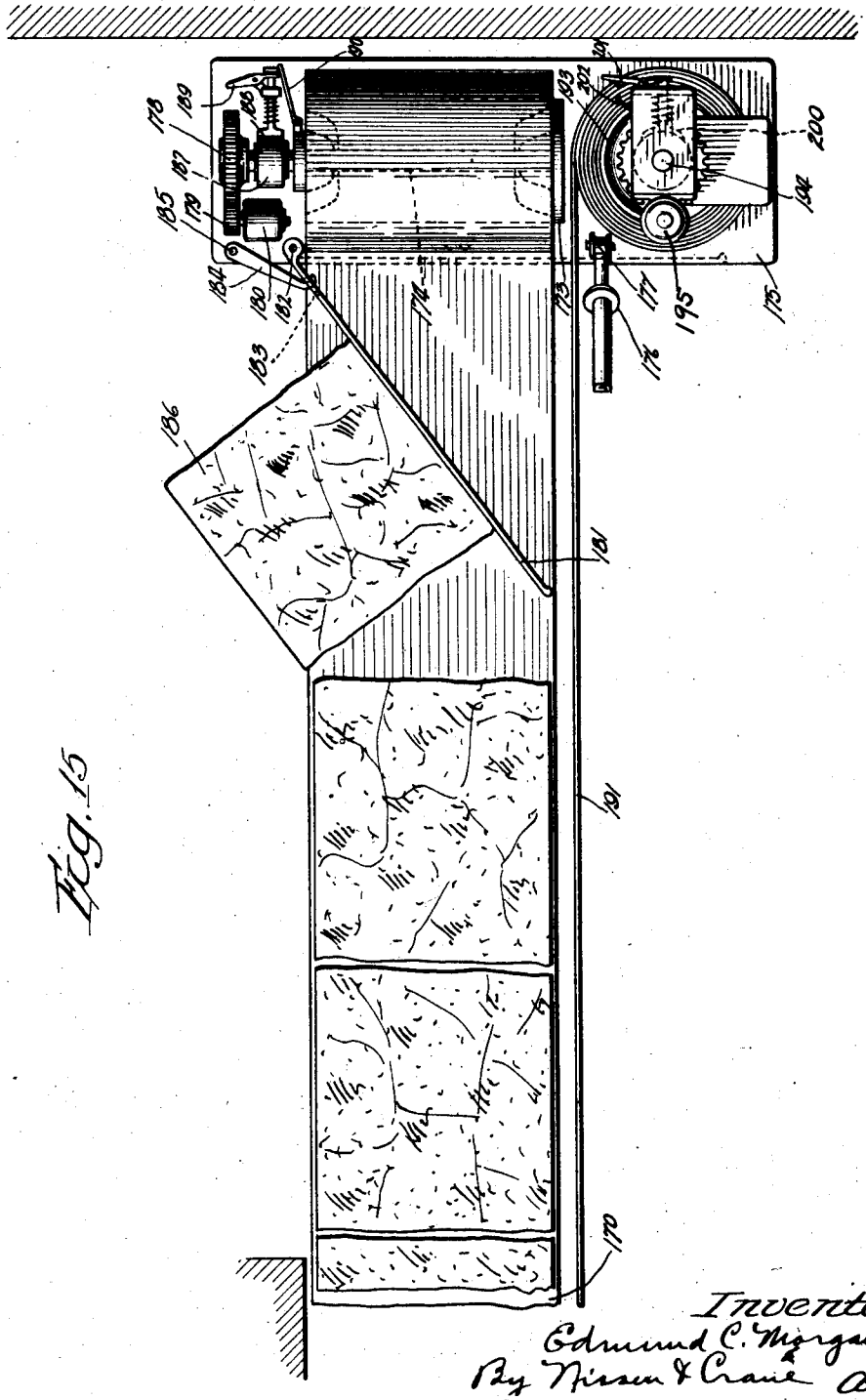


Fig. 15

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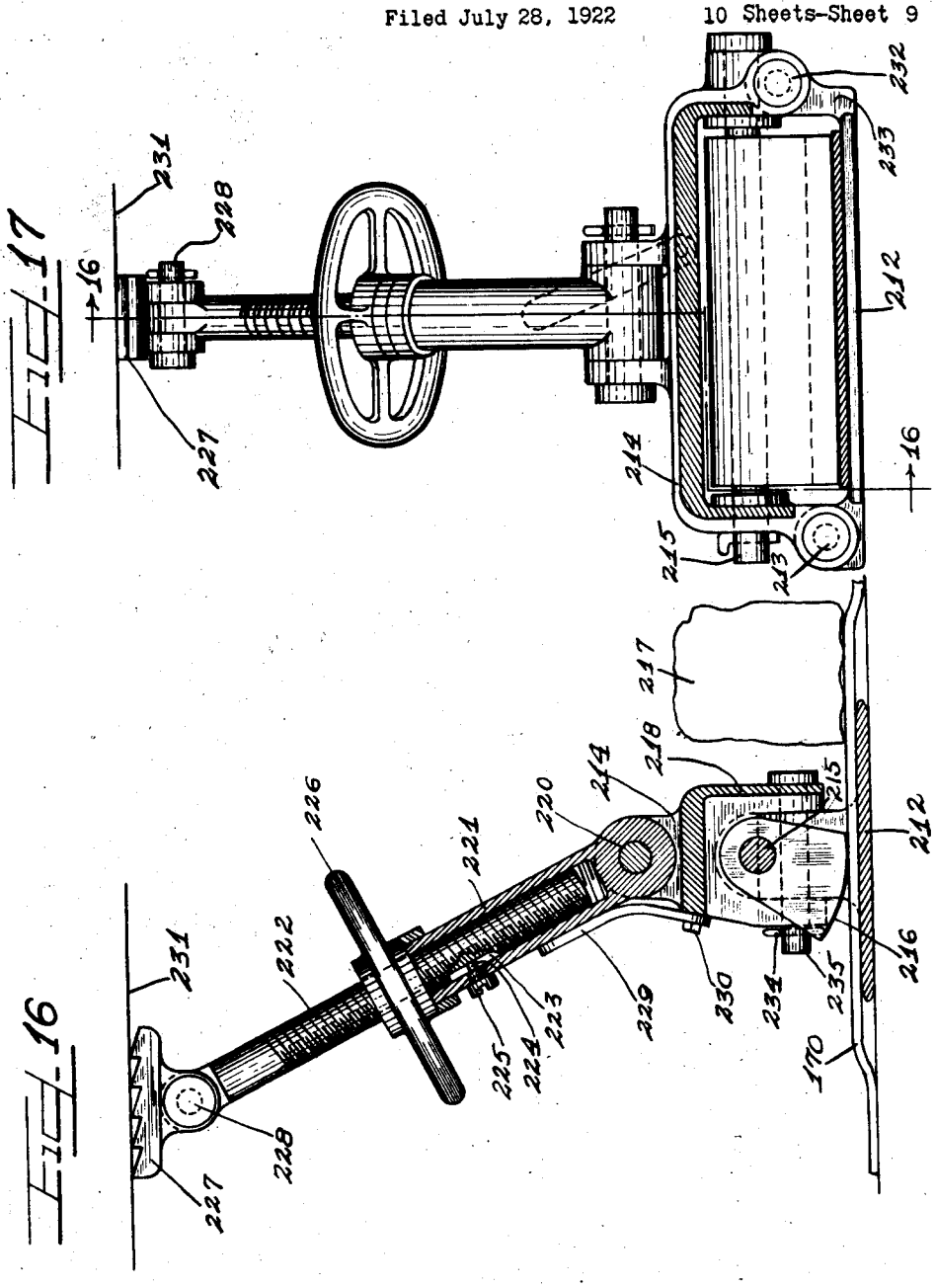


FIG. 17

FIG. 16

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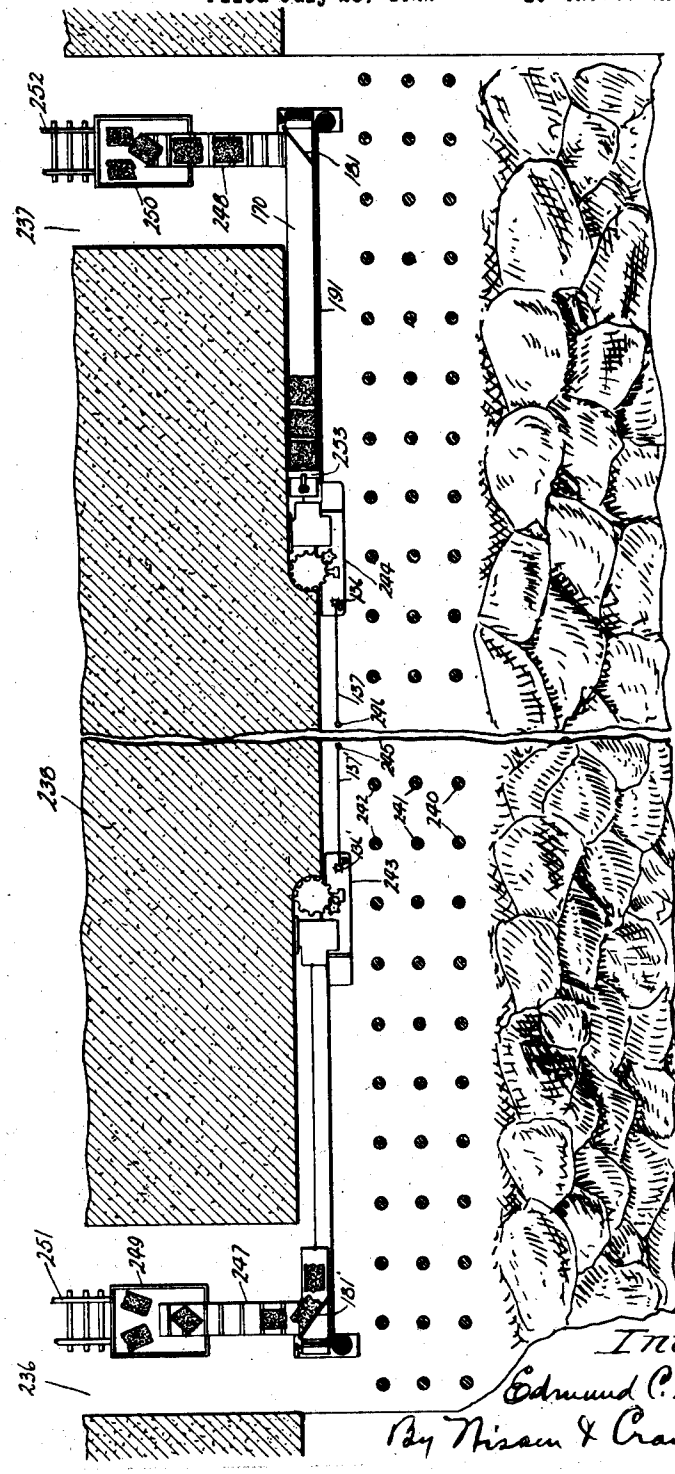


Fig. 18

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Patented July 3, 1928. 1,675,723

UNITED STATES PATENT OFFICE.

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MINING AND LOADING MACHINE.

Application filed July 28, 1922. Serial No. 578,027.

My invention relates to mining and loading machines adapted for mining and loading coal and one of its objects is the provision of mechanism for dislodging coal from a mine vein combined with extensible conveyer mechanism which is adapted to occupy positions varying in length and which may be folded or rolled up when not in use so as to occupy a small amount of space.

A further object of the invention is the provision of loading apparatus particularly adapted for use in connection with mining mechanism and which may be extended to various distances so as to convey dislodged material to varying loading positions.

A further object of the invention is the provision of improved kerf-cutting mechanism comprising detachable cutter frames to provide for the quick renewal of the cutting elements.

A further object of the invention is the provision of improved means for detachably mounting a horizontal kerf-cutter which has the cutter bits in the gear teeth so that a narrow kerf may be cut and the kerf-cutter projected into a mine vein a distance approximately two-thirds of its diameter.

A further object of the invention is the provision of improved means for mounting cutter bits in the teeth of a large gear in staggered relation and so that the cutter bits may be inserted and withdrawn from opposite lateral faces of the gear teeth.

A further object of the invention is the provision of improved supporting mechanism for a kerf-cutter which has the cutting bits in its teeth and which is driven by a pinion meshing with such teeth, such supporting mechanism being located distant from the center of the kerf-cutter so that the kerf-cutter may be supported with maximum strength and so that such kerf-cutter may cut a narrow kerf deeply into a mine vein.

A further object of the invention is the provision of a plurality of spaced-apart horizontal kerf-cutters each adjustable in inclination on a horizontal axis independent of each other and each adjustable in elevation independent of each other and all of them adjustable in inclination as a whole on a horizontal axis.

A further object of the invention is the provision of adjusting mechanism for an upright kerf-cutter which is adapted to cut a kerf spaced back from the face of a mine vein, such adjusting mechanism permitting said kerf-cutter to be varied in elevation and also in inclination on two different horizontal axes spaced from each other.

A further object of the invention is the provision of means for detachably connecting a ring cutter holder from an upright kerf-cutter which is adapted to extend nearly from the plane of the floor to the plane of the roof to cut a kerf spaced back from the face of a mine wall.

A further object of the invention is the provision of a flexible extensible vertical wall adapted to cooperate with an extensible traveling conveyer to hold blocks of coal on the latter.

Another object of the invention is the provision of means adapted to travel with a reciprocable sliding belt conveyer in one direction of movement of such conveyer and be automatically gripped between the floor and roof of a mine chamber to act as an abutment to prevent the coal from returning when the belt is reciprocated for another load.

A still further object of the invention is a system of mining comprising the cutting of horizontal columns of coal and the provision of extensible reciprocating sliding belt conveyers for delivering the dislodged coal from a mine wall to supplemental conveyers in spaced-apart lateral entries for loading into mine cars on tracks in such entries.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawings—

Fig. 1 represents an elevational view of my improved mining mechanism with a part of the loading apparatus attached thereto;

Fig. 2 is a plan view of the mining and loading mechanism shown in Fig. 1;

Fig. 3 is a sectional elevation taken on the line 3—3 of Fig. 2 looking in the direction of the arrows;

Fig. 4 is a sectional elevation of Fig. 2 taken on the line 4—4 looking in the direction of the arrows;

Fig. 5 is a sectional elevation of Fig. 2 taken on the line 5—5 looking in the direction of the arrows;

Fig. 6 is a sectional elevation of Fig. 2 taken on the line 6—6 looking in the direction of the arrows;

Fig. 7 is an enlarged detail plan view, partly broken away, showing the construction of each of the horizontal kerf-cutters in plan view;

Fig. 8 is a sectional elevation on the line 8—8 of Fig. 7 looking in the direction of the arrows;

Fig. 9 is an enlarged detail view showing the preferred construction of the driving mechanism which meshes with the gear teeth of the large horizontal spaced-apart kerf-cutters;

Fig. 10 is a sectional view on the line 10—10 of Fig. 9 looking in the direction of the arrow;

Fig. 11 is an enlarged elevational view of the details of the upright kerf-cutter for cutting a kerf extending approximately from the plane of the floor to the plane of the roof, the supporting plate for said kerf-cutter being shown in section;

Fig. 12 is a detail view showing the ring cutter carrier in position for detachment from the disc cutter-frame;

Fig. 13 is a plan view of a portion of Fig. 2, partly in horizontal section, to show details of the power transmitting mechanism for driving the upright kerf-cutter;

Fig. 14 is an elevational view of the loading apparatus which is adapted to be connected to the mining mechanism shown in Fig. 1; Fig. 1 and Fig. 14 placed end to end showing the complete mining and loading machine;

Fig. 15 is a plan view of the loading mechanism shown in Fig. 14 and when placed end to end with Fig. 2 shows a complete mining and loading apparatus in plan;

Fig. 16 is a sectional side elevation of the abutment mechanism for preventing the coal from being returned with the conveyer when the latter is reciprocated;

Fig. 17 is an end view of the mechanism shown in Fig. 16, partly in section, to show details of the belt gripping mechanism; and

Fig. 18 is a digrammatic plan view illustrating a system of mining employing the mining and loading apparatus illustrated in Figs. 1 to 17, inclusive.

Referring to Figs. 1 and 2 of the accompanying drawings, 19 designates a base frame which is adapted to rest on and slide over a mine floor adjacent a mine wall. This base frame is elongated, as shown in Fig. 2, and is adapted to support the three horizontal spaced-apart rotary kerf-cutters 20, 21 and 22, and also the upright rotary kerf-cutter 23 which is in position to cut a kerf spaced back from the face of a mine wall. Secured to the base plate 19 as by means of a bolt 24 is a bracket 25, as shown in Figs. 1 and 3. This bracket is secured rigidly to the base plate 19 and is provided with a journal bearing for the rock shaft 26 which is connected at its ends to the hinge eyes 27, 28 at the lower end of the vertical standard 29. The latter is provided with a vertical guideway 30 into which extends with a dovetail fit the three spaced-apart brackets 31, 32 and 33. These dovetail brackets 31, 32 and 33 are each independently adjustable in elevation either manually or by means of vertical screw-threaded rods 254, 255 and 256 connected to the standard 29 and extending vertically through screw-threaded openings in said brackets, said screw-threaded rods being rotated by means of separate electric motors 257, 258 and 259 respectively, shown diagrammatically in Fig. 3, thus securing independent power-actuated mechanism for adjusting the elevation of each of the brackets 31, 32 and 33.

Pivotally connected at 34 to the bracket 31 is a cutter-carrying arm 35 to which is detachably connected at 36 the uppermost rotary kerf-cutter 20. By referring to Figs. 2 and 3 it will be seen that the cutter-carrying arm 35 is provided with spaced-apart perforated ears 37 and 38 on opposite sides of the bracket 31 with the pivot rod 34 passing through said ears and an opening in the bracket 31. The bracket 35 is provided with spaced-apart slots 39, 40 and 41 which are adapted to fit over bolts 42, 43 and 44 which extend downwardly from the cutter-frame 45. By loosening the nuts 46, 47 and 48 the rotary cutter 20 may be easily detached from the support 35 and replaced by another cutter in which all of the cutter bits 49 are sharpened and adjusted in proper positions.

As shown in Fig. 3, the cutter-carrying arm 35 has secured thereto a segment of a worm gear 50 with which meshes a worm 51 mounted in the brackets 52 which are secured rigidly to the bracket 31. By applying a socket wrench to the squared shaft 53 the worm 51 may be turned so as to rotate the worm gear 50 on the pivot 34 and thus vary the inclination of the cutter-carrying arm 35 and thereby adjust the inclination of the plane of operation of the kerf-cutter 20.

In a similar manner the kerf-cutter 21 may be adjusted by the worm gearing 54 on the axis 55. Also in a similar manner the kerf-cutter 22 may be adjusted by the worm gearing 56 on the axis 57. The kerf-cutter 21 is carried by the cutter-carrying arm 58 and is detachably connected to the latter by means of bolts 59 similar to the construction shown in Figs. 7 and 8. The cutter 22 is likewise supported by a cutter-carrying arm 60 to which is detachably connected the cutter 22 by means of the bolt 60′ and slot connections similar to that illustrated in Figs. 7 and 8. Set screws 61, 62 and 63 may be provided for the respective brackets 31, 32 and 33 to hold them at adjusted ele-

vations along the dovetail groove 30 of the vertical standard 29.

It will thus be seen that the cutters 20, 21 and 22 are each independently adjustable in elevation along the standard 29 and may be held at adjusted elevation by a set screw. It should also be noted that each kerf-cutter is adjustable in inclination on a horizontal axis. Each of the cutters is also independently detachable from its respective cutter-carrying arm.

The three kerf-cutters may be adjusted into a position so as to be in spaced-apart parallel planes parallel to the path of movement of the machines. The three kerf-cutters after being adjusted into fixed relation to each other by means of the independent adjusting devices, may be adjusted as a whole in inclination on the axis 26. For this purpose a bracket arm 64 is secured to the vertical standard 29, as shown in Figs. 1 and 2, and is adapted to receive a set screw 65 which occupies a vertical position so as to engage the upper surface of the base plate 19. The arm 64 extends at an angle toward the inner side of the base plate 19 so as to be in position to tilt the vertical standard 29 on the axis 26 when the set screw 65 is moved up or down. When the set screw 65 is moved up the weight of the cutting mechanism will be sufficient to tilt the standard 29 toward the inenr side of the base plate 19, and when the set screw 65 is moved in the opposite direction the cutting mechanism will be lifted and the standard 29 tilted toward the outer side of the base plate 19. In order to hold the standard 29 at adjusted inclination on the axis 26 an auxiliary arm 66 is extended from the opposite side of the standard 29 so as to be on the opposite side of the axis 26. A set screw 67 extends through the arm 66 in position to engage the base plate 19, as shown in Figs. 1, 2 and 4. It will be seen that when the arm 64 is tilted up or down the auxiliary arm 66 will likewise be titlted, but after the adjustment desired has been made the set screw 67 may be tightened so as to firmly hold the standard 29 at the adjusted inclination relative to the base plate 19 and therefore the three spaced-apart horizontal kerf-cutters will be held at adjusted inclination relative to the base plate 19.

The three horizontal kerf-cutters are similar in construction and therefore description of one will also apply to the others. The preferred construction of the horizontal kerf-cutters is shown in Figs. 7 to 10, inclusive. Secured to the periphery of the disc cutter-frame 45 as by means of rivets 68 are annular plates 69 and 70 which lie flush with the spaced-apart faces of the cutter-frame 45 and afford an annular runway for the roller bearing mechanism 71. This roller bearing mechanism comprises spaced-apart cylinders 72 which rotate at 73 between rings 74. The ring cutter-frame 20′ is extended into the annular groove formed by the ring plates 69 and 70.

As shown in Figs. 7 to 10, inclusive, one cutter bit 49 is mounted on each of the gear teeth 75 of the ring cutter-frame 20′. A rectilinear opening extends through one of the lateral faces of the ring cutter-frame 20′ to the outer end of the gear tooth 75. Each of these openings is screw-threaded, as shown at 76 in Fig. 10, to receive the lower screw-threaded portion 77 of the cutter bit. The rear end of each of the cutter bits is also provided with a slot 78 for receiving a screw driver so that the extent to which the cutter projects from the gear tooth may be adjusted. After being adjusted it may be secured in adjusted position by means of a set screw 79.

Some of the cutter bits extend into the gear teeth from one side of the cutter ring 20′ and some of the cutter bits extend through the gear teeth from the opposite side of the cutter ring 20′. For instance, the cutter bit 49 shown in Fig. 9 on the section line 10—10 extends into an opening 76′ from one side of the cutter-frame 20′, whereas the cutter 49 just to the left extends into the gear tooth 75 from the opposite side of the cutter ring 20′. This is for the purpose of permitting the cutters to be arranged at varying inclinations relative to each other as shown by the dotted line positions 80 in Fig. 10, so that a kerf will be cut of sufficient width to provide ample clearance for feeding of the kerf-cutter during the cutting operation.

Separate independent driving mechanism is provided for each of the respective cutters 20, 21 and 22. Each of these cutters comprises a large gear into the teeth of which the cutters extend and from which they project, as shown in the various views of the drawings. As shown in Fig. 2, a driving pinion 81 is pivoted at 82 in position to mesh with the gear teeth 75 of the ring cutter 20′. There is ample clearance, however, for the gear teeth 75 of the ring cutter 20′ to mesh with the gear teeth 83 of the driving pinion 81 without interfering with the cutters 49. If desired the pinion 81 may be provided with curved recesses 84, as shown in Fig. 9, so as to provide ample clearance for cutters of any size which may be desired.

The driving pinion 81 is pivoted at 82 to the cutter-carrying arm 35 and an electric motor 85 may be connected to the pinion 81 in the manner illustrated in Fig. 1. By referring to Fig. 1 it will be seen that the motor 85 is connected to a pinion in the gear casing 86 which meshes with a larger gear in the gear casing 87, which larger gear is connected to drive the pinion 81 which

meshes with the gear teeth of the cutter 20 in the manner illustrated in Figs. 2 and 9. It should be particularly noted that the driving pinion 81, the motor 85 and the interconnecting gearing are all mounted on the cutter-carrying arm 35 so as to move bodily therewith. Therefore, whenever the cutter-carrying arm 35 is adjusted on the axis 34 the pinion 81 will remain in mesh with the gear teeth 75. Also when the cutter 20 is adjusted in elevation along the standard 29 the mechanism for driving the cutter will be moved bodily up and down with the latter.

In a similar manner the intermediate kerf-cutter 21 is driven by an electric motor 88 connected to a driving pinion 89 and mounted to be supported on the cutter-carrying arm 58. The floor kerf-cutter 22 is driven by an electric motor 90 which is connected to a driving pinion 91 and mounted for support on the cutter-carrying arm 60. The driving pinions 89 and 91 mesh with the gear teeth of the cutters 21 and 22, respectively, in a manner similar to the connection between the pinion 81 and the gear teeth of the cutter 20, as illustrated in Figs. 2 and 9.

The mechanism for supporting and operating the vertical kerf-cutter 23 is shown in Figs. 1, 2, 5, 6, 11, 12 and 13. The cutter 23 comprises a disc cutter-support 92 which is secured to the horizontal plate 93 as by means of the screws 94. This plate 93 is pivotally connected at 95 to a bracket 96 for adjustment in inclination on a horizontal axis extending longitudinally of the base plate 19. The bracket 96 may be adjusted in elevation along the standard 97 by means of a screw-threaded rod 261 extending through the bracket 96 and operated by a motor 260 mounted on the standard 97. When the bracket 96 has been adjusted in elevation it may be secured in position by means of the set screw 98, as shown in Fig. 5.

Secured to the plate 93 is a segmental gear 99 with which meshes a worm 100 journaled in bearings in the brackets 101 which are fixed to the bracket 96. By applying a socket wrench to the squared shaft 102 the worm 100 may be rotated to move the gear 99 and thus swing the plate 93 up or down to adjust the upright plane of operation of the kerf-cutter 23.

The upright standard 97 is pivotally connected at 103 to the bracket 104 which is bolted at 105 to the base plate 19. An arm 106 extends from the standard 97 toward the inner side of the base plate 19, as shown in Figs. 2 and 5. A set screw 107 extends vertically through the arm 106 so as to engage the upper surface of the base plate 19. An auxiliary arm 108 extends from the standard 97 toward the outer end of the base plate 19, as shown in Fig. 2, and is adapted to receive the set screw 109, as shown in Figs. 1 and 2. By loosening the set screw 109 and operating the set screw 107 the standard 97 together with the upright kerf-cutter 23 mounted thereon may be adjusted in inclination and after adjustment has been secured it may be set in fixed relation to the base plate 19 by means of the set screw 109.

By referring to Fig. 2 it will be seen that the bracket 96 has a dovetail connection with the standard 97 similar to the dovetail connection at 30 for the horizontal kerf-cutters. Such interlocking connections permit adjustment in elevation of the kerf-cutting mechanism and properly hold them from tilting downwardly. When downward tilting adjustment is desired it may be secured by the worm gear adjusting mechanism. (See 99, 100, Fig. 5.)

In order to drive the upright kerf-cutter 23 an electric motor 110 is mounted on the plate 93, as shown in Figs. 2 and 13. The shaft of this motor is connected to a pinion 111 which meshes with a gear 112 mounted on the transverse shaft 113 which extends through the plate 93 to the side thereof which is adapted to extend into the mine wall. The gearing 111, 112, as well as the motor 110, are completely covered by suitable casings 114, as shown in Figs. 2 and 13.

On the shaft 113 at the end thereof opposite the gear 112 is a driving pinion 115 which meshes with an annular gear 116, as shown in Figs. 11 and 13. The annular gear 116 is formed in an annular recess in one of the faces of the ring support 117 which is mounted to rotate on ball bearings 118 about the disc 92 which is secured rigidly to the plate 93 by means of the screws 94. The ball bearing runway may be formed by the annular plates 119 and 120 secured to the opposite faces of the disc 92 as by means of the rivets 121, as shown in Fig. 13. The annular plate 120 may be larger in width so as to also cover the annular space which is provided for travel of the pinion 115 relatively to the annular gear 116, the latter therefore being enclosed.

On the periphery of the rotatable ring 117 by means of interlocking connections is mounted a cutter ring 122. In Fig. 11 the cutter ring 122 is shown in interlocking engagement with the rotatable carrier 117 while in Fig. 12 the ring 122 is shown in position for detachment from the carrier 117. The cutter ring 122 is provided with a series of spaced-apart inward projections 123 which are provided with lateral cams 124 tapered as shown in Fig. 12 in position to enter correspondingly tapered recesses 125 of the radial extensions 126. As before stated, Fig. 11 shows the ring cutter 122 in interlocking engagement with the carrier 117, the cams 124 fitting into the recesses

125 of the radial extensions 126 in such a manner that during the cutting operation the wedging effect is increased, thus holding the ring 122 securely in interlocking engagement with the carrier 117. In Fig. 12 the radial extensions 123 and 126 are arranged alternately, thus permitting the ring 122 to be moved laterally from the carrier 117 so that another ring cutter of larger or smaller diameter may be placed on the carrier 117 with the cutters 127 in adjusted positions after having been re-sharpened.

By referring to Figs. 1, 5 and 6 it will be seen that the cutter 23 may be of such a diameter as to nearly sever the block of coal 128 in its entirety so that the weight of the coal will break it from the unmined mass at the points 129 and 130. The thickness of the coal left at the points 131 and 132 in Fig. 6 may be regulated by varying the diameter of the cutter 23. The diameter of the latter may be adjusted by providing rings 122 of the desired diameters.

In order to feed the mining machine shown in Figs. 1 and 2 during the driving of the horizontal kerf-cutters 20, 21 and 22 and the vertical kerf cutter 23 by means of the respective independently operated electric motors 85, 88, 90 and 110, I have provided rope-winding mechanism 133 on the forward end of the base frame 19. This rope-winding mechanism may comprise a frame 134 secured to the base plate 19. On this frame 134 is mounted an electric motor 135 for driving the rope drum 136 on which is wound a rope 137, the free end of which is connected to a roof jack 138 which is adapted to be secured between the floor and roof of the mine chamber, as shown in Fig. 1. By means of the rope-winding mechanism comprising the rope with its free end connected to an anchorage in the mine the whole machine may be fed forward rectilinearly in a long wall mining operation.

In Figs. 3 to 6, inclusive, I have shown diagrammatically the nature of the coal where it contains dirty bands 139, 140, 141 and 142. When coal containing such dirty bands is blasted the foreign material mixes with the broken down coal and it is difficult to eliminate such foreign material. It is therefore preferred to retain the coal in comparatively large blocks so that when removed from the mine the elimination of the foreign material in the dirty bands will be greatly facilitated.

While the motor 88 shown in Fig. 4 drives the cutter 21 through the train of gearing 143, 144 in the casing 145, as shown in Fig. 4, the platform 93 supports the block of coal above the same while the vertical kerf-cutter 23 is being fed forward, but when the column of coal extends rearwardly beyond the rear edge of the platform 93 it tends to break away from the unmined mass before it is ready to be delivered to the loading apparatus hereinafter described. In order to hold the upper column of coal 147 (Fig. 5) while the lower column of coal 148 is being removed, a supporting plate 149 may be provided. The plate 149 is pivotally connected to the plate 93 to swing horizontally on an upright axis 151. The worm gear segment 150 is secured to the swinging plate 149, as shown in Fig. 6. A worm 152 is mounted between bracket arms 153 which are secured to the plate 93. When a socket wrench is applied to the squared shaft 154 the plate 149 may be swung into the kerf, as shown in Figs. 1 and 6, to in effect extend the rear supporting surface of the plate 93. The plate 149 may be provided with an upright projection 155 to assist in holding the upper column of coal in place. When desired the supporting plate may be swung out of the kerf when the long rearwardly projecting column of coal is to be relied on to effect breaking down of its own weight.

The loading apparatus shown in the drawings is particularly adapted for use with the mining mechanism shown, but it should be understood that it may have a general application. In fact, as shown in the accompanying drawings, the loading apparatus may be detached at 156 from the mining mechanism and used separately therefrom.

The loading apparatus comprises a supplemental base plate 157 which is adapted to rest on and slide over the mine floor, together with the base plate 19. The rear end of the base plate 19 is provided with a transverse flange 158 which is adapted to be bolted to a similar transverse flange 159 on the forward end of the base plate 157. In Figs. 1 and 6 a series of bolts 160 are shown for detachably connecting the supplemental base plate 157 to the mining machine base plate 19.

Secured to the rear portion of the base plate 157 at 161 is a bracket 162 to which is pivoted at 163 a supporting plate 164 which is adapted to rest on the mine floor between the base plate 157 and the inner end of the horizontal floor kerf, as shown in Fig. 6. By means of worm gearing 165 the plate 164 may be adjusted in elevation and when desired this plate 164 may be thus lifted to pry loose the column of coal 148 from the unmined mass or to break a portion from the rear end of the lower column 148.

Pivotally mounted in a slot 166 in the plate 164 is a pulley 167, as shown in Figs. 2 and 6. Rope-winding mechanism 168 is mounted on the base plate 157 and comprises a rope 169 which extends around the pulley 167 and is connected at its end to the forward end of the belt or apron 170 which is adapted to rest on and slide over the mine floor. The winding mechanism 168 may

comprise an electric motor 171 and suitable gearing connected to the winding drum 172.

By placing Figs. 1 and 14 end to end and by placing Figs. 2 and 15 end to end it will be seen that the sliding belt or apron 170 extends from the belt-winding mechanism illustrated at the right-hand portions of Figs. 14 and 15. The belt 170 is made of flexible material, such as sheet steel, so that it may be wound on the drum 173. This winding drum 173 is mounted on a shaft 174 in suitable journal bearings mounted on the base frame 175. The latter may be anchored in position by the roof jack 176 which is preferably pivotally connected at 177 to the base frame 175 so as to occupy an inclined position when in use, as shown in Fig. 14, and to be folded into a small or compact space when the belt-winding mechanism is being transported.

At one end of the shaft 174 is secured a gear 178 which meshes with a pinion 179 connected to an electric motor 180.

While the lower column of coal is being permitted to extend rearwardly and the mining mechanism is being fed along the mine wall, portions thereof may be broken away either by their own weight or by means of the prying mechanism shown at 164 in Fig. 6. The blocks of coal thus broken from the lower column are received on the belt 170 while the plate 149 holds the upper column in elevated position. When the rope drum 168 is released and the motor 180 operated to wind the drum 173 the belt 170 with the blocks of coal thereon, as shown in Figs. 2 and 15, may be moved toward the anchored belt-winding mechanism.

In order to deflect the blocks of coal from the belt when such blocks reach the position shown at the right-hand end of Fig. 15, an upright deflecting plate 181 is provided, as shown in Figs. 14 and 15. This plate is pivoted at 182 to the frame 175 and is provided with an opening 183 for receiving a hook or latch 184 which is pivoted at 185 to the frame 175, as shown in Fig. 15. When the hook 184 is in the position shown in Fig. 15 the plate 181 will be held in the anchored position illustrated so as to deflect the block of coal 186 laterally from the belt 170 onto such other conveying mechanism as may be provided and as is illustrated in Fig. 18.

After the belt 170 has been wound on the drum 173 to such an extent that all of the coal on the belt has been moved rearwardly and deflected by the plate 181 off the belt, the latter may again be moved forwardly for another load. In order to effect this operation the motor 171 is operated to wind the drum 172 and exert a pull on the rope 169.

While the belt is being pulled forwardly for another load it may be desirable to retard the movement of the drum 173 so that the belt will not unwind too quickly. A pulley 187 is therefore mounted on the shaft 174 in position to be engaged by a spring-pressed brake-shoe 188. When the motor 180 is operated, however, to rotate the drum 173 to wind the belt thereon the brake-shoe 188 may be released from the pulley 187 by means of the lever 189, and this lever may be held in released position by the latch 190.

It should also be noted that while the belt 170 is being moved in the direction for delivering a load thereon the mining operation may continue and the lower column be held in elevated position by the plate 164 shown in Fig. 6. Therefore, when the belt 170 is returned for another load it may be freely moved by the rope 169 along the kerf under the column of coal 148. It should also be noted that when desired and after the coal has been loaded from the lower column the supporting plate 149 may be shifted laterally out from under the column of coal 147 so as to allow the latter to fall of its own weight and be directed to the belt 170 to be received by the latter and moved toward loading position.

An adjustable extensible vertical wall may be provided by an additional upright flexible belt 191 pivoted at 192 to the rear inner end of the base plate 157. This vertical belt 191 is extended rearwardly, as shown in Figs. 14 and 15, into position to be wound on the drum 193 which is mounted on a vertical shaft 194 journaled in bearings supported on the frame 175. An electric motor 195 is carried by a bracket 196 and is provided with a pinion 197 which meshes with the gear 198 for driving the shaft 194 and therefore operating the drum 193 to wind thereon the belt 191 and thus hold the latter taut during the loading operations.

While the frame 175 is anchored by the roof jack 176 the mining machine is continually being fed forward rectilinearly and therefore the vertical belt 191 because of its attachment at 192 to the frame 157 is also being continually being drawn forward. This belt 191 must therefore be gradually unwound from the drum 193 during the operation of the mining machine. A pulley 199 is mounted on the vertical shaft 194, as shown in Fig. 14, and is provided with a spring-pressed brake-shoe 200 so as to retard the unreeling of the vertical belt 191. When desired, however, the brake-shoe 200 may be released by means of a lever 201 shown in Fig. 15 and held in released position by the latch or hook 202.

By releasing the brake-shoes 188 and 200 and locking the drum 172 against rotation the frame 175 and the parts mounted thereon may be moved forward to new posi-

tions after releasing the roof jack 176 and starting the operation of the winding drums 173 and 193. If desired, however, a winding drum 203 may be mounted on the base frame 157 for operation by an electric motor 204. This winding mechanism 203 would then comprise a rope 205, the free end of which would be adapted to be connected to the frame 175 so as to drag the same over the mine floor and place it in position nearer the frame 157. During the operation of the winding mechanism 203 to move the frame 175 to a new position the roof jack 176 would be in released position and both the belt drums 173 and 193 operated to take up the slack which would occur in the belts 170 and 191 during such adjusting operation.

By detaching the rear base plate 157 from the forward base plate 19 the loading apparatus may be used separately from the mining mechanism. For instance, if the vertical kerf is so related to the horizontal kerf as to leave much more coal at the points illustrated at 131 and 132 in Fig. 6, the columns of coal will remain intact and attached to the mine wall until the loading apparatus is ready for operation. The plate 164 of Fig. 6 being connected to the base plate 157, as shown in Figs. 2 and 6, the breaking down mechanism may be operated in connection with the loading apparatus. The upper columns could be dislodged by manual prying devices inserted in the uppermost kerf.

When the loading apparatus is used separately from the mining mechanism the winding mechanism illustrated at 206 in Fig. 2 may be used. This rope-winding mechanism comprises an electric motor 207 for driving the drum on which is wound a rope 208 which is provided with a hook 209 for connection to an anchorage, such as that illustrated at 138 in Fig. 1.

It should be particularly noted that by reason of the belt-winding mechanism the belt or apron 170 may be extended along the mine floor to considerable lengths and yet the apparatus when transported need occupy only a comparatively small amount of space. In other words, by means of the belt-winding mechanism an elongated belt conveyer may be laid out to varying lengths and to varying distances at any time desired, but when the apparatus is to be transported into or out of the mine or to new locations in the mine, the apparatus is very compact.

It should be understood that since the belt 170 is shown broken apart at 210 and the belt 191 is shown broken apart at 211, the belt may be extended to considerable distances. In some instances when the belt is returned for another load it may tend to return some coal which has not been unloaded therefrom. In order to prevent the coal from returning with the belt 170 the apparatus shown in Figs. 16 and 17 may be provided to automatically act as abutments to prevent return of the coal but to permit free return of the belt 170 toward the mining mechanism.

The mechanism shown in Figs. 16 and 17 comprises a base plate 212 which is adapted to rest on and slide over the mine floor. Pivoted to one side of the plate 212 at 213 is a yoke 214 which is provided with spaced-apart journal bearings for the rock shaft 215. Mounted on the rock shaft 215 is a transversely extending pawl or clutch 216 which is adapted to engage the upper surface of the belt 170 and grip the same automatically when the belt 170 is moved toward the right, as viewed in Fig. 16. When the belt 170 is moved toward the left with a block of coal 217 thereon the belt may be moved freely toward the left, but the coal will engage the transverse face 218 of the abutment frame 214.

At the upper central portion of the abutment frame 214 is pivoted at 220 an inclined roof jack comprising a tube 221 for receiving the screw-threaded rod 222. The screw-threaded rod 222 is provided with a longitudinal groove 223 for receiving the inner end 224 of the screw 225. When the wheel 226 is rotated the nut operated thereby engages the screw threads on the rod 222 to lift or lower the shoe 227 which is pivoted at 228 to the upper end of the rod 222. A spring 229 is connected to the yoke 214 at 230 in position to urge the roof jack toward a vertical position in order to hold the shoe 227 against the roof 231 of the mine chamber.

The automatic roof jack mechanism shown in Figs. 16 and 17 may be located near the unloading position of the belt 170 in readiness to be connected to the belt so that when the latter is pulled forward into position for another load the abutment mechanism will act to hold the coal which is on the belt near the loading position of the apparatus. For instance, if three blocks are left on the belt when the latter is to be pulled forward for another load the roof jack mechanism shown in Figs. 16 and 17 may be connected to the belt between the coal on the belt and the free end of the belt. This may readily be done because the yoke 214 is pivoted at 213 to the base plate 212 and is detachably connected at 232 to the bracket 233 which extends from the right-hand end of the base plate 212, as viewed in Fig. 17. By releasing the cotter-pin 234 shown in Fig. 16 and withdrawing the pin 235, the yoke 214 may be tilted on its pivot 213 by swinging the whole roof jack laterally. During such position of the roof jack the belt with the coal thereon may be freely moved toward loading position, but when the belt is to be re-

turned for another load the abutment 228 may be swung into position ahead of the blocks of coal on the belt and the pin 235 inserted into the position shown in Fig. 16. Then when the belt 170 moves toward the left the block of coal 217 will be held near loading position and not returned with the belt. Any tendency of the belt 170 to move the roof jack toward the left, as viewed in Fig. 16, will be resisted by the shoe 227 more firmly gripping the roof 231. When the belt drum 173 is operated to move the belt 170 toward the right, as viewed in Fig. 16, the belt 170 will grip the cam 216 and cause the entire roof jack to be moved toward the right and this operation will act to cause the abutment face 218 to engage the coal on the belt near loading position and move the same forcibly against the deflecting plate 181. In fact the device shown in Figs. 16 and 17 may be placed back of the coal near the free end of the belt after the coal has been placed on the belt so that the clutch 216 may be relied on to grip the belt so that the roof jack will act automatically as means for engaging the coal to positively move the latter toward loading position and prevent the belt from slipping under the coal. In such event the roof jack mechanism may be returned to its initial position near the mining apparatus by disconnecting such roof jack mechanism from the belt and placing it on the upper surface thereof for transportation to the mining mechanism.

In Fig. 18 is illustrated my improved system of mining coal with the use of the apparatus shown in Figs. 1 to 17, inclusive. After driving the spaced-apart entries 236 and 237 and providing space back of the coal vein 238, mining operations may be carried on by the retreating method permitting the space 239 which has been mined out to subside or cave in. In order to properly sustain the roof adjacent the paths of operation of the mining and loading machines a series of roof props may be provided, as shown at 240, 241 and 242.

Mining machines of the type shown in Fig. 2 are located at 243 and 244. Anchorages 245 and 246 may be provided for the ends of the ropes 137, 137′ which are connected to the rope-winding devices 136, 136′. The machines 243 and 244 may start in the entries 236 and 237, respectively, and be fed toward each other, as shown in Fig. 18. Meanwhile the loading apparatus comprising the belt 170 may be provided to move the blocks of coal toward the entries 236 and 237 and then deflected by the diagonal vertical deflectors 181, 181′ onto the supplemental conveyers 247 and 248 for delivery of the coal to mine cars 249 and 250 which are on the mine tracks 251 and 252, respectively.

The automatic abutment mechanism shown in Figs. 16 and 17 is illustrated diagrammatically at 253 in Fig. 18, to act as means for engaging coal to positively move the latter toward the lateral entry when the belt is moved away from the mining machine. The horizontal belts of the loading apparatus may be reciprocated repeatedly until all of the coal across the mine vein 238 has been loaded onto the supplemental conveyers 247 and 248 and thence into the mine cars. One mining machine may be operated farther than the other so as to complete the mining operation across the working face of the mine vein. It is preferred to use two mining machines for supplying the coal to mine cars in two spaced-apart entries, but it should be understood that the extensible conveyer also permits one mining machine to be used entirely across the working face between the two entries while the mined coal is being delivered to the mine car in only one entry. While these mining operations are taking place substantially half across the working face or entirely across the working face the vertical belt 191 is also extended so as to continually afford a vertical wall for the horizontal belt 170 during the loading operation of the latter. After a mining and loading operation has been effected entirely across the working face of the vein 238 the mining machines be relocated in the entries 236 and 237 and both the mining mechanism and the loading mechanism shifted forwardly along the entries 236 and 237 to new starting positions. The entries 236 and 237 need not be very wide for this purpose because the belts 170 and 191 may be reeled up and occupy a comparatively small space at the rear end of the mining machines. The total length of the mining mechanism and the loading mechanism at the initial positions in the entries is therefore comparatively short notwithstanding the fact that the conveyer may be extended as desired to considerable lengths.

As the mining operations proceed across the working face repeatedly new rows of roof-sustaining props are installed to sustain the roof near the mining operations while the rear row, such as that indicated at 240, may be removed so as to permit the roof of the worked-out portion to gradually subside.

On account of the kerf cutters being comparatively narrow in thickness and mounted for operation on ball bearings, and on account of the depths of the horizonal kerfs being no greater than that illustrated in Fig. 2 the total amount of power necessary to operate the mining machine may be comparatively small. The motors for operating the kerf-cutters are mounted independent of each other to occupy comparatively small individual spaces. The motor for feeding the

apparatus is also separate and independent of the motors for driving the kerf-cutters and can occupy a small space, as shown in Fig. 2. The depths of the horizontal kerfs may be regulated in accordance with the hardness of the coal and therefore the feeding may be proceeded with rapidly. The mechanism for operating the loading apparatus may be driven at the same time that the feeding of the mining machine takes place. It will thus be seen that the columns of coal cut from the working face may be varied in size and such columns cut rapidly and at the same time that the loading apparatus is operated. By proceeding rapily with the mining operations illustrated in Fig. 18 and simultaneously carrying on the loading operations the coal may be removed rapidly from the working face before the roof subsides sufficiently to put much strain on the roof props. The rapidity of the mining and loading operations is increased by having the operations carried on in opposite directions, as indicated in Fig. 18. The tendency for the roof to subside is quite gradual and therefore when the mining and loading operations are carried on rapidly the roof-propping mechanism becomes more reliable and can more easily be removed from the rear rows and placed in new positions in the front rows, or the three rows illustrated may each more easily be moved forward to new positions nearer the working face.

It should also be noted that when the mining mechanism is at a lower elevation than the reel for operating the belt toward loading position the tendency for the blocks of coal to slip off the belt will be increased and in such instances the automatic abutment mechanism shown in Figs. 16 and 17 to act to positively move the blocks of coal up the incline and even when the belt is returned toward the left, as viewed in Fig. 16, the coal cannot slide back down the incline because of the roof jack mechanism. In other words, although some of the coal may still be left on an incline the belt 170 may nevertheless be returned toward the mining mechanism while the coal is kept from sliding back by resting against the face 218 while the shoe 227 grips the roof of the mine chamber.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended and I wish therefore not to be restricted to the precise construction herein disclosed.

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

1. In a mining and loading machine, the combination with dislodging mechanism, of a flexible extensible conveyer, belt adapted to be rolled up and means for operating said flexible extensible conveyer belt to receive the dislodged coal and convey it toward loading position.

2. In a mining and loading machine, the combination with mining mechanism for dislodging coal from an upright mine wall, of extensible conveyer mechanism comprising a horizontal flexible belt adapted to be rolled up, and means for reciprocating said belt to receive a load of coal from said mining mechanism and move such coal toward loading position.

3. In a mining and loading machine, the combination with mining mechanism, of loading apparatus comprising a flexible belt adapted to be rolled up, and means for operating said belt to receive mined material from said mining mechanism and moving such material toward loading position.

4. In a mining and loading machine, the combination with mining mechanism, of loading apparatus comprising a flexible belt carrier adapted to be rolled up, and means for moving said flexible belt carrier toward said mining mechanism in position to receive a load and move said carrier belt away from said mining mechanism to move the load toward loading position.

5. In a mining and loading machine, the combination with mining mechanism, of loading apparatus comprising a flexible belt adapted to be rolled up and when unrolled adapted to slide along the mine floor, reeling mechanism for rolling up said belt, and means for reciprocating said belt to receive a load of dislodged material from said mining mechanism and move such material toward loading position.

6. In a mining and loading machine, the combination with mining mechanism, of loading apparatus comprising an elongated flexible belt adapted to slide over the mine floor, means for reciprocating said belt to receive a load and move it toward loading position, and means adjustable along said belt in position to extend across the same to engage the load on the belt to positively move such load toward loading position.

7. In a mining and loading machine, the combination with mining mechanism, of loading apparatus comprising a horizontally reciprocating belt adapted to slide over the mine floor, and a load-engaging device for gripping the belt when the latter is moved in one direction but permitting free movement of said belt relatively thereto when said belt is moved in the opposite direction.

8. In loading apparatus, the combination with an extensible conveyer comprising a reel and a flexible belt adapted to be rolled up and when unrolled adapted to slide over the mine floor to varying distances, and means for reeling and unreeling said belt

into position to receive a load of material and move such material toward loading position.

9. In loading apparatus, the combination with an extensible conveyer comprising a raveling belt, of an abutment device spanning said belt but movable relatively thereto, and mechanism for causing said abutment device to automatically clamp said belt and move with the latter.

10. In loading apparatus, the combination with a conveyer belt, of a cross-piece spanning said belt, a clutch for causing said cross-piece to move with the belt in one direction but permitting the belt to be moved freely in the opposite direction relatively to said cross-piece, and roof jack mechanism connected to said cross-piece to cause the latter to be anchored when the belt is moved in such opposite direction and the load is resting against such cross-piece.

11. In an automatic abutment for conveyers, the combination with a frame, of clutch mechanism for gripping the belt of a conveyer when such belt is moved in one direction but permitting free movement of said belt relatively to said frame when said belt is moved in the opposite direction, and an abutment face for engaging material on said belt when said clutch mechanism is gripping said belt.

12. In a transverse abutment for apron conveyers, the combination of a cross-piece adapted to span the belt of an apron conveyer, and means for gripping the conveyer belt to hold said cross-piece in adjusted position on the belt, said gripping means being releasable to permit said cross-piece to be shifted along said belt to another adjusted position.

13. An apron conveyer comprising a cross-piece adapted to span a belt carrier, and a clutch adapted to automatically grip the belt and hold said cross-piece in adjusted position thereon when the belt is moved in load-carrying direction.

14. An apron conveyer comprising an upstanding cross-piece adapted to span the belt, and means for adjustably holding said cross-piece secured to said belt when the latter is moving in load-carrying direction.

15. A conveyer comprising a belt, a transverse frame adapted to span said belt, and a releasable clutch for securing said cross-piece firmly to said belt when the latter is moving in load-carrying direction and automatically releasing said clutch when the belt moves in the opposite direction.

16. In a conveyer, the combination with a frame adapted to rest on and slide over the floor, of a belt extending through said frame, a cross-piece mounted on said frame in position to span the upper surface of the belt and engage material on the belt, and clutch mechanism mounted on said frame to span said belt to hold said cross-piece secured thereto when said belt is moved in load-carrying direction but permitting free movement of said belt through said frame in the opposite direction.

17. In a conveyer, the combination with a belt, of a frame adapted to extend across the under side of said belt, a yoke pivoted to one end of said frame, a releasable connection between the other end of said frame and said yoke, an abutment cross-piece on said yoke, and a clutch pawl pivoted to said yoke to span the upper surface in position to co-act with said frame to grip the belt when the latter is moving in load-carrying direction, said belt being free to move over said frame in the opposite direction.

18. In a conveyer for mines, the combination with a carrier, of a cross-piece on said carrier in position to engage material on said carrier, and a roof jack movable freely with said cross-piece when said carrier is moved in load-carrying direction but automatically anchored between the floor and roof when material on said carrier tends to move in the opposite direction.

19. In a conveyer, the combination with an apron carrier, of means thereon for engaging material on the carrier to assist the latter in moving the material in load-carrying direction, and means for automatically anchoring said engaging means when material on said carrier moves in the opposite direction.

20. In a conveyer for mines, the combination with a belt carrier, of a cross-piece adapted to span the belt and positively engage material thereon when moved toward loading position, and a roof jack movable with said cross-piece when said material is being moved toward loading position but acting to be automatically anchored when such material moves in the opposite direction.

21. In loading apparatus, the combination with a frame, of winding mechanism thereon comprising a haulage rope, a traveling conveyer belt connected to said rope and adapted to be rolled up, and a reel for winding up said conveyer belt.

22. In loading apparatus, the combination with a portable frame, of a reel thereon, a flexible belt adapted to extend along the floor and be wound on said reel, and means for operating said reel to haul said belt with a load of material thereon.

23. In loading apparatus, the combination with a reel mounted to rotate on a horizontal axis, of a flexible belt adapted to be wound thereon and unwound therefrom to lie flat on the floor of a mine chamber, means for pulling said belt to unwind the same from said reel and drag said belt over the mine floor into position for receiving a load, and means for winding said reel

to move said belt over the mine floor with the load of material on such belt.

24. In loading apparatus, the combination with a portable frame, of anchoring mechanism therefor, winding apparatus comprising a winding drum on said frame, a flexible belt adapted to be wound on and unwound from said drum, and means connected to the free end of said belt to drag the same over the mine floor into position for receiving a load.

25. In loading apparatus, the combination with a frame, of winding mechanism thereon comprising a drum rotatable on a horizontal axis, a belt carrier adapted to be wound on said drum, and means for deflecting material from said belt while said winding mechanism operates to move said belt with such material.

26. In loading apparatus, the combination with a frame, of winding mechanism thereon, an apron carrier adapted to be wound on said winding mechanism, and a vertical plate adapted to extend across said apron carrier in position to deflect material therefrom.

27. In loading apparatus, the combination with a portable frame, of a drum mounted thereon to rotate on a horizontal axis, means comprising a motor on said frame for operating said drum, a flexible belt wound on said drum and adapted to be unwound therefrom and dragged over the mine floor into position to receive coal thereon, an upright deflector pivoted to said frame and adapted to be in folded position parallel to the axis of said drum when said belt is entirely wound on said drum, and mechanism comprising a hook connected to said deflector plate to hold the same extending diagonally across said belt when the latter is being wound on said belt and coal is being carried by said belt toward said drum.

28. In loading apparatus, the combination with winding mechanism comprising a drum rotatable on a horizontal axis, of a supporting frame, a belt wound on said drum and adapted to be pulled therefrom into position for receiving a load to be carried by said belt, a deflector plate pivotally mounted on said frame in position to swing across said belt, mechanism for holding said deflector plate in a diagonal position relative to said belt, and a roof jack for anchoring said frame against the pull on said belt while the latter is unwound from said drum.

29. In loading apparatus, the combination with winding mechanism comprising a drum rotatable on a horizontal axis, a belt wound on said drum and adapted to be pulled therefrom into position for receiving a load to be carried by said belt, and means for regulating the unwinding of said belt from said drum.

30. In loading apparatus, the combination with winding mechanism comprising a drum having a shaft mounted for rotation on a horizontal axis, a brake pulley on said shaft, a releasable spring-pressed brake-shoe applicable to said pulley, and a belt wound on said drum and adapted to be unwound therefrom and moved into position for receiving a load of material thereon, and a motor connected to said shaft to rotate the same to wind said belt thereon and move said material toward unloading position.

31. In loading apparatus, the combination of an extensible conveyer comprising a winding drum and a conveyer apron wound thereon, and an extensible upright wall for one side of said conveyer.

32. In loading apparatus, the combination of an extensible conveyer comprising a winding drum and a conveyer apron wound thereon, and an extensible upright wall for said conveyer and comprising another drum and a flexible belt wound thereon and adapted to be unwound therefrom to form such upright wall.

33. In loading apparatus, the combination with an extensible conveyer comprising a winding drum and a belt wound thereon, of an extensible wall for said belt also comprising a winding drum and a belt, and means for operating said drums independently of each other.

34. In loading apparatus, the combination with an elongated reciprocating conveyer belt, of an extensible rectilinear wall for one side of said conveyer belt, and means for reciprocating said conveyer belt rectilinearly independently of said extensible wall but parallel thereto.

35. In loading apparatus, the combination with two spaced-apart frames, of rope-winding mechanism on the forward frame comprising a rotatable drum, a rope wound thereon, an extensible conveyer comprising a rotatable drum on the rear frame, and a conveyer belt wound on said last-named drum and having its free end connected to the free end of said rope, and means for operating said conveyer by driving said last-named drum to wind said conveyer belt thereon while said rope is being paid out from said first-named rope drum, said conveyer belt being returned in the opposite direction by the operation of said rope-winding mechanism.

36. In loading apparatus, the combination with a forward frame, of haulage mechanism comprising a rope-winding drum mounted on said frame and having a rope wound thereon with its free end adapted to be connected to an anchorage in the mine, a rear frame separate from said forward frame, an extensible conveyer on said rear frame and comprising a traveling belt adapted to be rolled up, and additional haulage mechanism on said forward frame com-

prising a rope connected to the free end of said belt.

37. In loading apparatus, the combination with an extensible conveyer comprising a belt carrier adapted to be rolled up and when unrolled adapted to be moved horizontally over the mine floor, of haulage mechanism comprising a rope connected to the free end of said belt, and a rope guide adapted to occupy a position adjacent the mine floor.

38. In loading apparatus, the combination with an extensible conveyer comprising a belt carrier, of haulage mechanism comprising a rope connected to said belt, a rope guide, and a support for said rope guide in position to extend into an underkerf at the base of a mine wall to direct the belt to receive coal dislodged above such underkerf.

39. In mining and loading apparatus, the combination with long wall mining mechanism comprising a supporting frame, of an extensible conveyer comprising a belt, haulage mechanism on said frame and comprising a rope connected to said belt, and a rope guide plate on said frame in position to extend into a kerf at the base of the mine wall.

40. In mining apparatus, the combination with a supporting frame, of kerf-cutting mechanism extending laterally therefrom into position to cut a kerf at the base of a mine wall, means for operating said kerf-cutting mechanism including movement of said frame along the mine wall to effect feeding of said kerf-cutting mechanism, a plate pivoted directly to said frame on an axis parallel to the feeding path of travel of said kerf-cutting mechanism in position to extend into the kerf cut by said kerf-cutting mechanism, and means for tilting said plate on such axis.

41. In mining apparatus, the combination with a supporting frame, of a standard pivoted thereto, a plurality of bracket arms extending from said standard, adjusting screws between said bracket arms and said supporting frame for adjusting the inclination of said standard relative to said frame and holding said standard in its adjusted position, and kerf-cutting mechanism mounted on said standard to move bodily therewith when said standard is adjusted relatively to said frame.

42. In mining apparatus, the combination with a supporting frame, of an upright standard pivoted thereto, means for adjusting the inclination of said standard relative to said frame, a plurality of spaced-apart kerf-cutters mounted on said standard in position to cut superposed kerfs in an upright mine wall and each adjustable in elevation independently of the others, means individual to each kerf-cutter for adjusting the inclination thereof relative to said standard, means individual to each kerf-cutter for driving the same, and means for moving said frame together with said kerf-cutters to feed the same in a general horizontal direction along the mine wall.

43. In mining mechanism, the combination with a supporting frame, of a rotary cutter comprising a cutter frame. A plurality of bolts for detachably connecting said cutter frame to said supporting frame by fitting respectively into a plurality of parallel notches to permit removal of the rotary cutter from said supporting frame by movement of said cutter in the plane of itself when said bolts are released, said bolts being located at one side of said cutter frame distant from the center thereof, and means for operating said kerf-cutter to cut a narrow kerf of a depth approximately equal to the distance from said supporting frame at said notches to the outer boundary of said rotary cutter.

44. In a mining mechanism, the combination with a supporting frame, of a circular cutter frame, a ring cutter mounted on a periphery of said circular cutter frame and having gear teeth with cutters mounted therein, a pinion in mesh with said gear teeth for driving said ring cutter without interfering with the cutters mounted in said gear teeth, and a plurality of bolts at right angles to said cutter frame and near the inner edge thereof and adjacent the outer edge of said supporting frame to support the cutter for operation to a depth equal approximately to the distance from the outer end of said cutter frame supporting means to the outer boundary of said rotary cutter rung.

45. In a system of mining, the combination with a mining machine operable back of a vein of coal from a lateral entry, of an extensible conveyer, means for rolling and unrolling said conveyer to reciprocate the same to and from the mining machine during the operation thereof, and a conveyer in the entry in position to receive material from said extensible conveyer.

46. In loading apparatus, the combination with a belt winding drum, of a flexible belt windable thereon, a flexible draft device connected to the free end of said belt, an auxiliary winding drum adapted to wind said draft device, means to guide said draft device to cause said belt to be drawn out from said belt winding drum into position to receive a load, and means to actuate said belt winding drum to wind said belt and thereby move said load.

47. In loading apparatus, the combination with a belt winding drum, of a flexible belt connected to said drum and adapted to be wound thereon, an auxiliary drum, means to connect said auxiliary drum with said belt, means to actuate said auxiliary drum to

draw out said belt from said belt winding drum into position to receive a load, and means to actuate said belt winding drum to wind said belt and thereby move said load.

48. In loading apparatus, the combination with a supporting frame, of a reel on said frame, and a carrying belt connected to and wound on said reel and adapted to afford a conveyer extended from said supporting frame to varying distances.

49. In a mining and loading machine, the combination with mining mechanism adapted to dislodge coal from a mine vein, of extensible loading apparatus connected to said mining mechanism, and means for operating said loading apparatus while retraction of said mining mechanism to initial position is effected preparatory for another mining operation.

50. In a mining and loading machine, the combination with mining mechanism for cutting large columns of mineral from a mine vein, of loading apparatus having a predetermined loading position and comprising a conveyer connected to the mining machine so as to be automatically extended in length in accordance with the distance traveled by the mining machine from such loading position, and means for operating said mining mechanism to automatically deliver large blocks of material to said conveyer while the latter is extended from said loading position and remains connected to said mining mechanism.

51. In mining and loading apparatus, the combination with mining mechanism for cutting coal from a mine vein in column form, of mechanism for automatically receiving the coal as dislodged for delivery to a predetermined loading position, and means for simultaneously retracting the mining mechanism and said receiving mechanism while co-acting to transfer the dislodged coal toward said predetermined loading position.

52. In a mining and loading machine, the combination with extensible loading mechanism comprising a belt and a reel for receiving the belt, of mining mechanism connected to the free end of said belt in position to deliver dislodged material thereto, and means for operating the loading mechanism to bodily transfer to a predetermined position the coal dislodged.

53. In mining and loading apparatus, the combination with a long wall mining machine, of loading apparatus having its rear end in stationary position and extensibly connected to said mining machine, and means for operating said mining machine to deliver material to said loading apparatus while being extended and remaining in connection with said mining machine.

54. In mining and loading apparatus, the combination with a mining machine adapted to have a predetermined path of travel along the working face of a mine vein and operable to dislodge mineral from such working face, of loading apparatus having a delivery location in an entry at right angles to said working face, means for operating said mining machine including the feed thereof along the working face, and connections between said loading mechanism and said mining machine to automatically extend the length of the loading mechanism in accordance with the distance traveled by said mining machine to keep the mining machine continually in position for delivering dislodged material to the loading apparatus for transfer to said delivery location in the right angle entry.

55. In mining and loading apparatus, the combination with a mining machine, of an extensible conveyor having a stationary delivery position and a receiving end at the mining machine extensible to various positions with the mining machine to vary the length of said conveyer from said stationary position, and means for extending and retracting said conveyer to effect the loading of material thereon from the delivery end of said conveyer at said stationary position.

56. In a mining and loading machine, the combination with mining mechanism, of an extensible belt conveyer connected thereto, and means for directing dislodged material from said mining mechanism to said belt conveyer.

57. In mining and loading apparatus, the combination with mining mechanism, of a belt paid out from a position at such mining mechanism for extension therefrom during the operation of the mining mechanism to receive the dislodged material and spread it out to temporarily retain the same in readiness for unloading, and means for operating the said belt to deliver or unload the dislodged material thereon.

58. In a mining and loading machine, the combination with a supporting frame, of mining mechanism thereon, and extensible loading apparatus comprising an extensible conveyer belt, and mechanism on said frame for receiving and paying out said belt.

59. In a mining and loading machine, the combination with a supporting frame, of mining mechanism mounted thereon, a conveyer belt connected to said frame in predetermined relation with said mining mechanism and adapted to receive material dislodged by said mining mechanism, and means affording extension of said belt from said frame to various distances while retaining the continuity of the belt in its extension from the mining mechanism to points at such varying distances.

60. In mining and loading apparatus, the combination with a mining machine, of loading apparatus extending along the working face and thence angularly into a lateral entry at right angles to the working face,

means for operating the mining machine including feed thereof along such working face, connections between said mining machine and said loading apparatus to effect automatic extension of the latter in accordance with the feed of the mining machine and while retaining connection between the mining machine and the loading apparatus and said lateral entry, and means for operating the loading apparatus to secure loading of dislodged material from and along the working face to said lateral entry from various positions of the mining machine distant from said lateral entry.

61. In mining and loading apparatus, the combination with a mining machine, of loading apparatus connected to said mining machine and extending along the working face to a stationary position in the lateral entry, means for operating the mining machine including feed thereof along the working face away from said lateral entry, and connections for effecting automatic extension of the loading apparatus to enable the latter to reach out varying distances from said lateral entry to the mining machine in its various positions along said working face thereby retaining the loading apparatus connected to the mining machine for delivery of dislodged material to said lateral entry from the various positions of the mining machine distant from said lateral entry.

62. In mining and loading apparatus, the combination with a mining machine, of loading apparatus comprising an extensible conveyer belt with one end connected to the mining machine and extending along the working face with its other end connected to a fixed position at a lateral entry, means affording extension of the said conveyer belt while it remains in connection with the mining machine and while the latter is operating along the working face to retain connection of the loading apparatus with the mining machine at various distances of the latter from said lateral entry, and means for operating said belt conveyer to transfer material from the various positions of said mining machine to said lateral entry.

63. Mining and loading apparatus comprising mining mechanism, a belt winding drum, a flexible belt windable thereon, a flexible draft device connected to the free end of said belt, an auxiliary winding drum adapted to wind said draft device, means to actuate said auxiliary drum, means to guide said draft device to cause said belt to be drawn out from said belt winding drum in position to receive a load, and means to actuate said belt winding drum.

64. Mining and loading apparatus comprising mining mechanism, a belt winding drum, a flexible belt connected to said drum and adapted to be wound thereon, an auxiliary drum, means to connect said auxiliary drum with said belt, means to actuate said auxiliary drum to draw out said belt from said belt winding drum in position to receive a load, and means to actuate said belt winding drum.

65. Mining and loading apparatus comprising mining mechanism, a belt winding drum, a frame for supporting the same, a flexible belt windable on said drum, a flexible draft device connected to the free end of said belt, an auxiliary winding drum mounted on said frame and adapted to wind said draft device, means to actuate said auxiliary drum, means to guide said draft device to cause said belt to be drawn out from said belt winding drum in position to receive a load, and means to actuate said belt winding drum.

66. Mining and loading apparatus comprising mining mechanism, a belt winding drum, a frame for supporting said drum, a flexible belt connected to said drum and adapted to be wound thereon, an auxiliary drum mounted on said frame, means to actuate said auxiliary drum to draw out said belt from said belt winding drum into position to receive a load, and means to actuate said belt winding drum to wind said belt.

67. In a mining and loading system, the combination with mining mechanism, of loading apparatus connected thereto and extending therefrom toward a loading position, means affording automatic lengthening out of said loading apparatus while the mining mechanism is operated along the mine wall and while said loading apparatus remains connected between the mining mechanism and said loading position, and means for operating said loading apparatus to take the dislodged material from said mining mechanism and transfer it toward said loading position.

68. In a mining and loading machine, the combination with mining mechanism adapted to dislodge material from a mine wall, of extensible loading apparatus connected to said mining mechanism, and means for operating said loading apparatus by reciprocating the same in its various extended positions to effect transfer of the dislodged material toward loading position and the restoring of the receiving portion of said loading apparatus in relation to said mining mechanism.

69. In a mining machine, the combination with supporting framework, of spaced-apart plane kerf-cutters projecting laterally from said framework in position to cut spaced-apart kerfs extending horizontally along a mine wall, means for operating said kerf-cutters including the feed thereof along parallel lines and along such wall to cut such spaced-apart kerfs, and means individual to said kerf-cutters for adjusting the inclination thereof transversely of their planes on

axes parallel to the path of feeding travel.

70. In a mining machine, the combination with a complete mining machine comprising a main frame, and an undercutting mechanism projecting laterally from the main frame, of an overcutting mechanism projecting laterally from the main frame, feeding mechanism adapted to move the machine bodily relative to the coal face, and means to adjust the angular relation of the undercutting mechanism and of the overcutting mechanism relative to the main frame and relative to each other.

In testimony whereof I have signed my name to this specification on this 24th day of July, A. D. 1922.

EDMUND C. MORGAN.