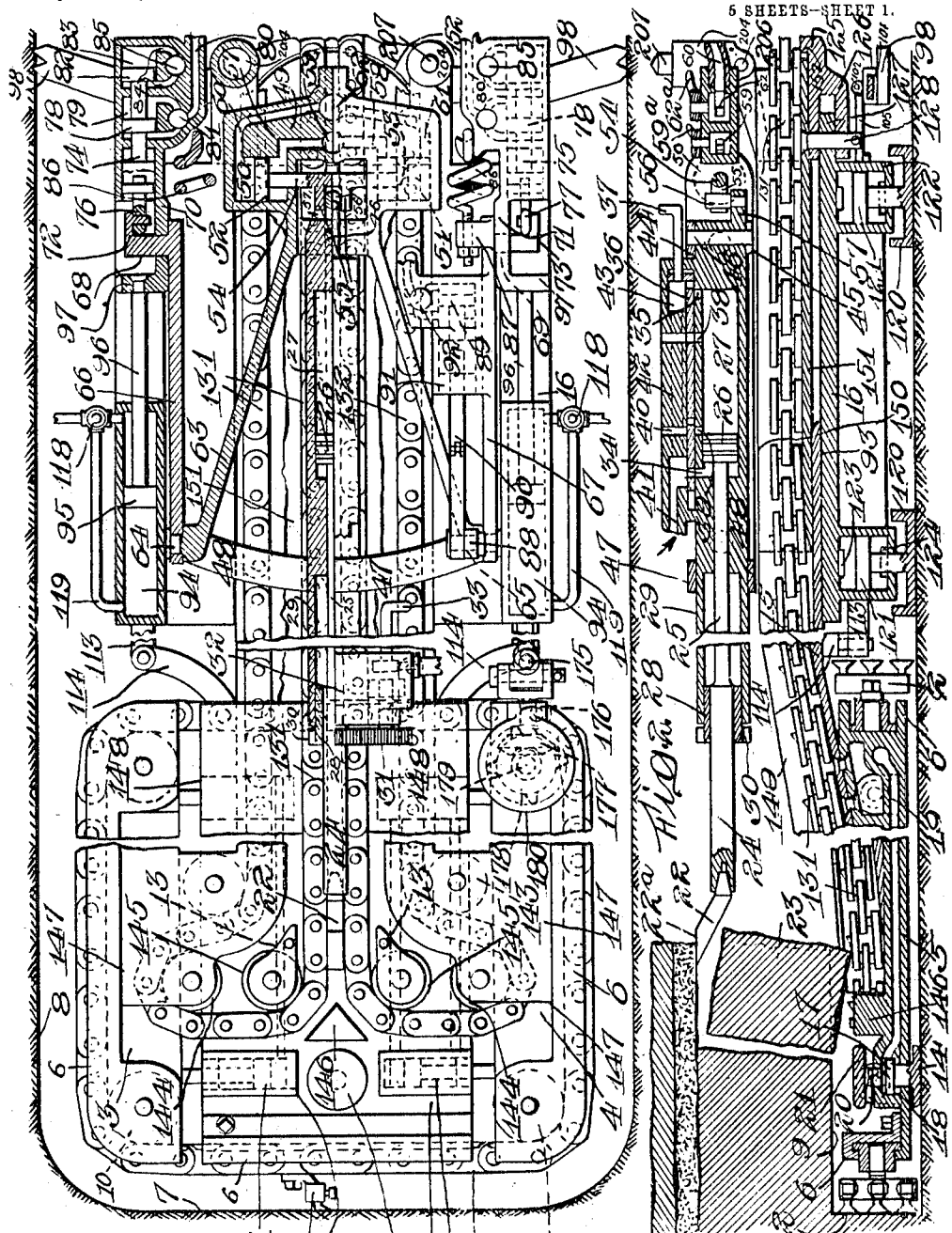
E. C. MORGAN.

MINING AND LOADING MACHINE.

APPLICATION FILED DEC. 22, 1905. RENEWED AUG. 17, 1914.

1,116,359. Patented Nov. 3, 1914.

5 SHEETS—SHEET 1.



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Fig. 1.

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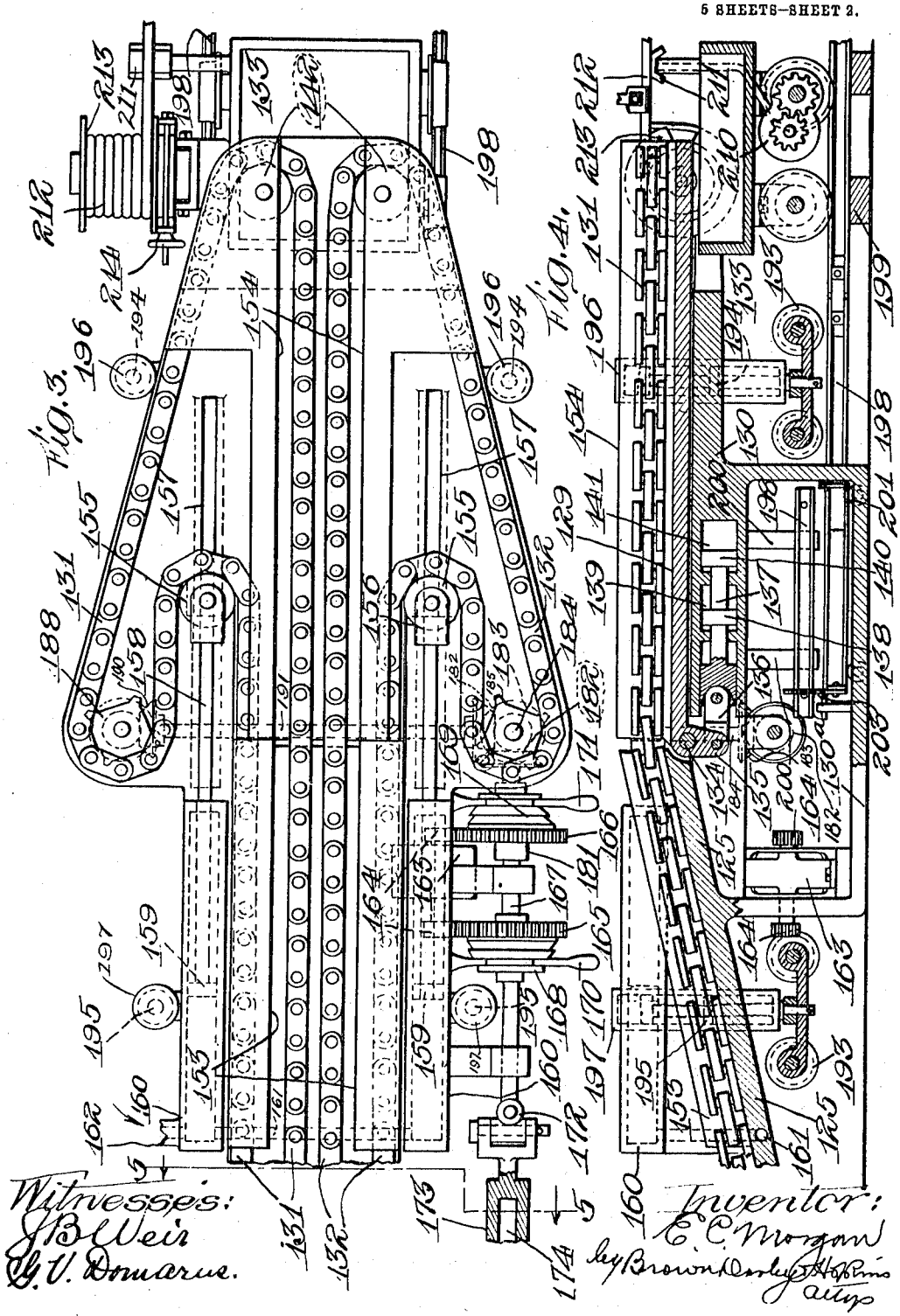
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5 SHEETS—SHEET 3.

FIG. 5.

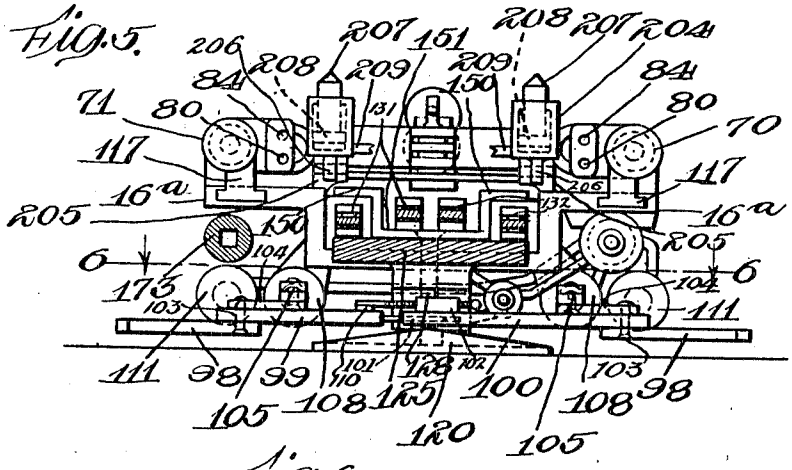


FIG. 6.

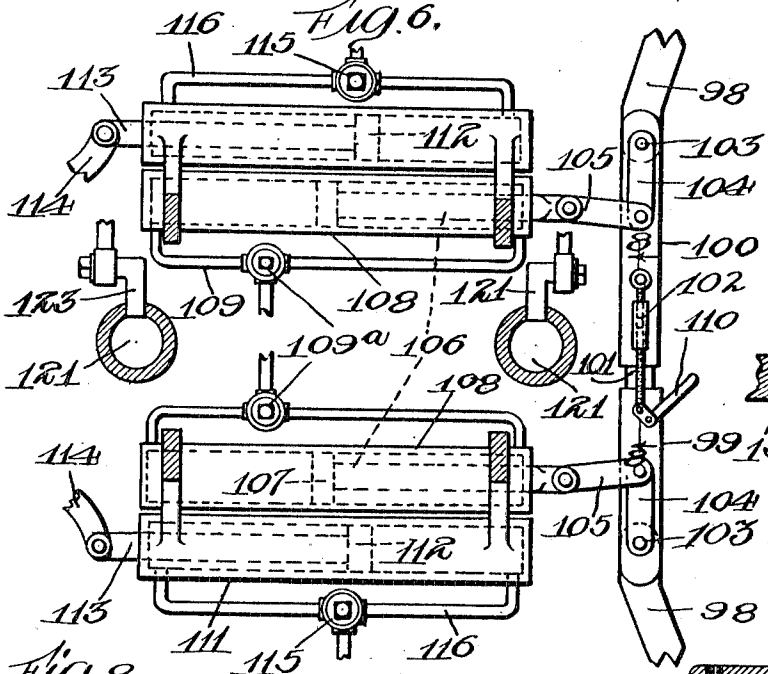


FIG. 7.

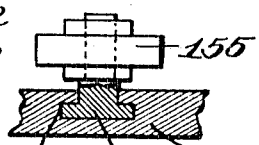


FIG. 8.

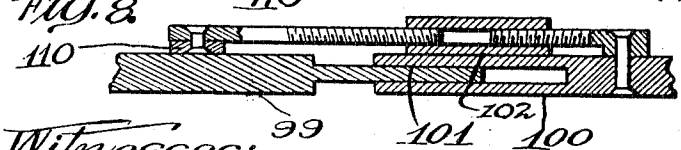


FIG. 19.



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5 SHEETS—SHEET 4.

Fig. 9.

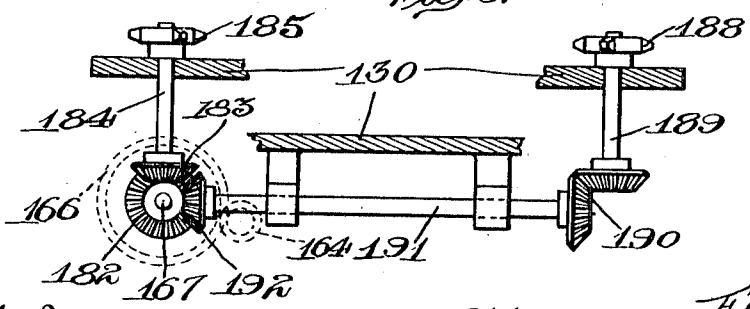


Fig. 11.

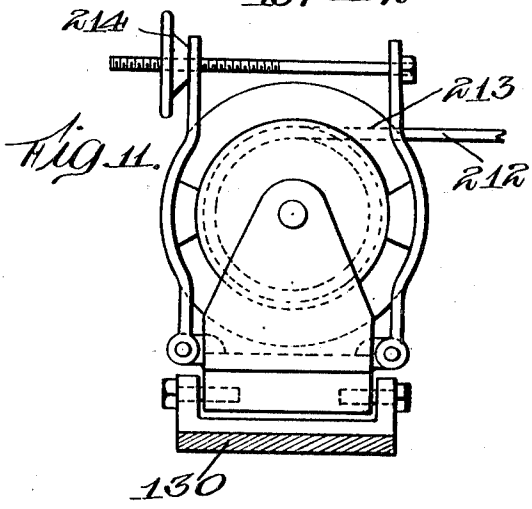


Fig. 12.

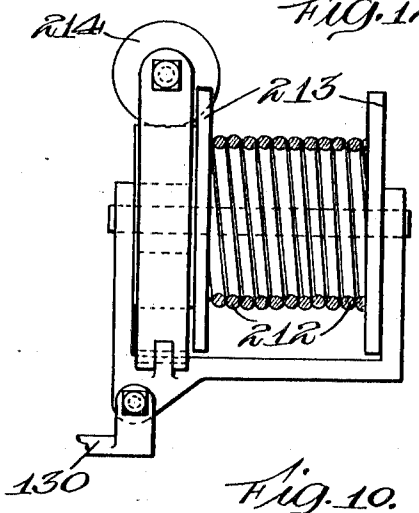
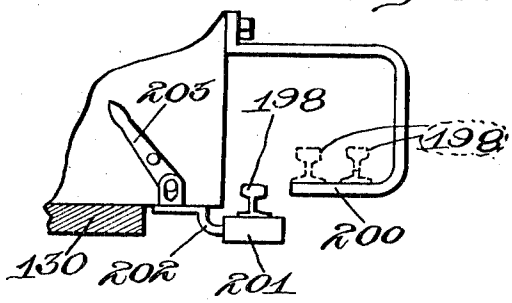


Fig. 10.



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5 SHEETS—SHEET 5.

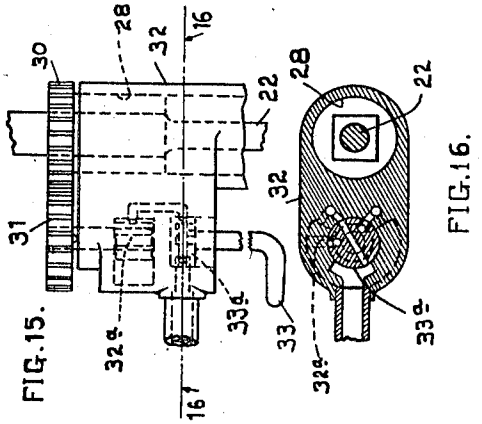


FIG. 15.

FIG. 16.

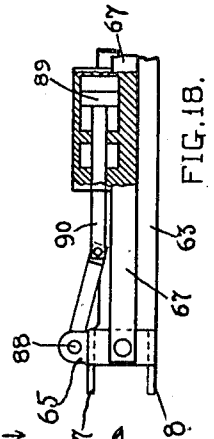


FIG. 18.

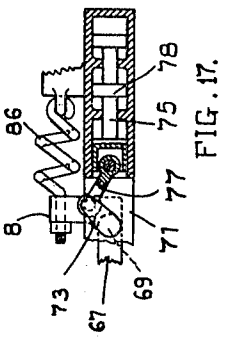


FIG. 17.

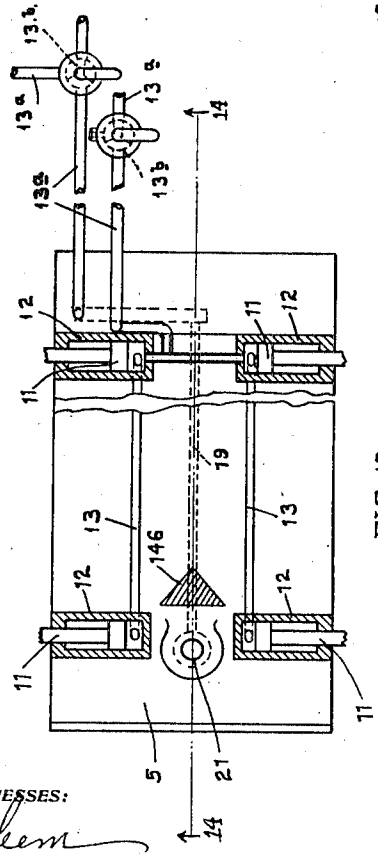


FIG. 13.

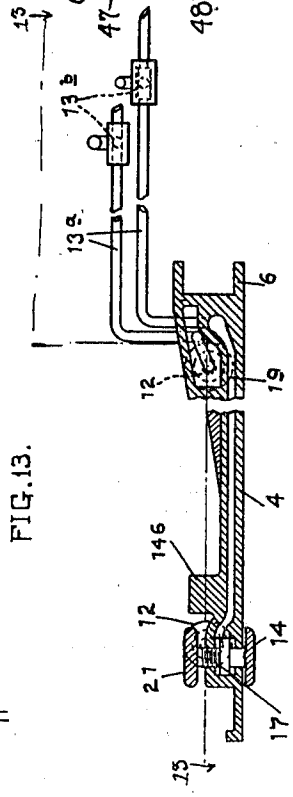


FIG. 14.

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UNITED STATES PATENT OFFICE.

EDMUND C. MORGAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO AMERICAN MORGAN COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF SOUTH DAKOTA.

MINING AND LOADING MACHINE.

1,116,359. Specification of Letters Patent. Patented Nov. 3, 1914.

Application filed December 22, 1905, Serial No. 293,004. Renewed August 17, 1914. Serial No. 857,265.

To all whom it may concern:

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

This invention relates to mining and loading machines and more particularly to machines for mining and loading coal, and has for its primary object to provide an improved machine of this general character which will be efficient in cutting and breaking down the substance to be mined, and automatically conducting the same to the rear and loading it into suitable cars or means for taking it away.

The invention contemplates the use in a single organism or machine of means for accomplishing these three general results, namely, the cutting, the breaking, and the carrying away of the particles of the material mined, and which means comprise or contain a horizontally traveling series of kerf cutters, which are adapted to form a horizontal channel ordinarily called a kerf in the wall of the mine at the desired elevation; a percussive tool or pick or similar implement arranged above the kerf cutting means and adapted to engage the wall for dislodging a section thereof and throwing it down upon a traveling conveyer, which conducts the dislodged wall particles to the rear, where they are discharged into a car or other means for conducting them out of the mine. The percussive tool or pick has a reciprocatory movement, whereby it is enabled to disintegrate the wall above the cut or kerf, and it is also capable of longitudinal adjustment in order that it may follow up the kerf cutting means as well as a vertical adjustment to a horizontal position in order that it may engage the wall at the desired elevation, and in addition to this, it has a horizontal oscillatory motion in order that it may engage the wall contiguous to the side walls of the tunnel or entry. The pick also has a projection extending at an angle to the line of its reciprocatory motion, and is capable of rotary adjustment, whereby it may engage the wall at various other points incapable of being quickly reached by either of the adjustments before described. The kerf cutting means is adjustable bodily with reference to the main frame of the machine so that it may advance independently of the main frame for following up the cut, and the conveyer for conducting the particles to the rear is mounted partially upon the support of the kerf cutting means and partially upon the main frame and is extensible with means for taking up the slack thereof, so that the kerf cutting means may go and come with reference to the main frame without interfering with the proper operation of the conveyer. These being the salient features of the invention, the details of the particular exemplification of the invention shown in the accompanying drawings will now be described, the invention consisting of the features of novelty whereby the said objects and certain other objects which will hereinafter appear, are attained, all as pointed out in the specification, and particularly set forth in the claims.

In the said drawings—Figure 1 is a plan view partially in plan section of one end of a mining and loading machine embodying this invention. Fig. 2 is a vertical longitudinal sectional view thereof taken at the center of the machine. Fig. 3 is a plan view of the remaining half or portion of the machine. Fig. 4 is a vertical longitudinal section thereof taken in the same plane as Fig. 2. Fig. 5 is a vertical cross-section thereof on the line 5—5, Fig. 3. Fig. 6 is a detail plan section on the line 6—6, Fig. 6. Fig. 7 is a detail vertical section of a slide and its guide for one of the conveyer belt tightener pulleys hereinafter described. Fig. 8 is an enlarged detail section on the line 8—8, Fig. 6. Fig. 9 is a detail view of the gearing for driving the conveyer. Fig. 10 is a detail view of a portion of the track-laying mechanism, and Fig. 11 is a detail view of the electric cable reel and its brake hereinafter described. Fig. 12 is a side elevation of Fig. 11, with the cable shown in section. Fig. 13 is an enlarged detail view partly in section taken on line 13—13 of Fig. 14 and showing the passages for conducting fluid to the adjusting pistons for the frame sections and the manner of controlling the supply of fluid. Fig. 14 is a sectional view on line 14—14 of Fig. 13. Fig. 15 is an enlarged detail view of the motor for rotating the tool. Fig. 16 is a sectional view on line 16—16 of Fig. 15. Fig. 17 is a view partly in

section showing the manner of lifting the tool. Fig. 18 is a view partly in section of another portion of the mechanism for raising the tool. Fig. 19 is a detail sectional view of a portion of the cutting chain showing the manner of detachably connecting the links together.

1 is a flexible member or chain belt, the links of which are provided at suitable intervals with cutters of any desired form. An example of one of these cutters is shown at 2 in Figs. 1 and 2, and it will be understood that the same may be secured to the chain wherever desired by any suitable means. This chain or flexible cutter-carrying member is arranged to travel in a horizontal plane and preferably continuously or always in the same direction, and it is mounted and guided upon a suitable platform or support preferably comprising three members or sections 3, 4, 5, all of which have horizontal guide flanges 6, between which the links of the chain travel, while cutters project therefrom and engage the wall or walls 7, 8, of the mine for forming a longitudinal kerf or cut such as illustrated at 9 in Fig. 2. The support for the kerf-cutting means is, of course, portable, and is preferably adapted to slide upon the floor or bottom of the tunnel or entry, and in order that it may be withdrawn and adapted to cut entries of different widths the sections 3, 4, of the supporting platform are laterally adjustable with relation to the sections 5, and have mounted therein anti-friction rollers 10, or other suitable means for receiving the friction and wear of the chain at the bends. two of which are mounted on the frame 3 and one on the frame 4. A drive pulley corresponding to the second roller on the section 3 is provided on the section 4, as will be presently described. These sections may be thus adjusted at the will of the operator by any suitable means, such as pistons 11. located in pneumatic cylinders 12 supplied with compressed air or other operating fluid from any suitable source through passages 13 and connections 13^a, controlled by suitable controlling means 13^b (see Fig. 13). As the pivots of the cutter chain wear the chain will permit the sections of the frame to be adjusted to some extent, but should it be necessary to adjust the frame sections to any great extent, a link may be removed from the chain to permit such adjustment. The platform or support 3, 4, 5, of the kerf-cutting means may be held aloof a sufficient distance from the floor of the entry to enable it to slide easily by a shoe 14 arranged at one end and the center thereof, the other end being supported by an arm or projection 15 upon main frame 16, as will be presently described. This shoe, if desired, may be capable of adjustment, or, more properly speaking, the kerf cutting means may be capable of adjustment with relation to the shoe. As a means for accomplishing this, the shoe is shown as being provided with a piston 17, arranged in a small hydraulic or pneumatic cylinder 18, capable of being supplied with fluid under pressure through a passage 19 from any suitable source. The same object may be accomplished also by a screw 20 screw-threaded in section 5 above the piston 17, and having a hand-wheel 21, whereby it may be turned down for elevating the cutter supporting platform with relation to the shoe, or for locking the platform at the elevation to which it is forced by fluid under pressure in the cylinder 18.

In the present exemplification of this invention, breaking down means for the material is shown as a pick machine comprising a pick 22 operated percussively and arranged over the kerf cutting means so as to be adapted to engage the face of the mine well above the kerf as shown in Fig. 2. When reciprocated longitudinally, the pick acts to disintegrate the wall above the kerf and break down the same in sections or lumps but as illustrated at 23 in Fig. 2, the pick machine is mounted upon the end of a stock 24, which is formed on or operatively connected with a piston rod 25, provided with a piston 26, arranged in a cylinder 27, mounted upon or secured to the main frame 16 in any suitable way, but preferably by the adjusting means which will be presently described. The pick 22 is preferably turned at an oblique angle to the line of reciprocatory motion of the stock 24, and the stock 24 is capable of being rotated so that the point of the pick 22 may be caused to engage the face of the vein or wall of the mine at various points above the kerf 9, and consequently may be utilized for not only breaking down a section, as 23, of the wall, but for also breaking such section into a number of smaller particles after it is dislodged, as well as for following down the line of the side wall where it conjoins with the end wall for breaking out or cutting off the section where it conjoins with such side wall. For thus rotating the stock 24, there is preferably employed a sleeve 28, journaled in a suitable support 29 at the end of cylinder 27, and having a squared or angular interior complementary in form to the squared or angular exterior of the stock 24, which is capable of sliding back and forth in the sleeve 28 while rotating with the sleeve, the piston rod 25 being, of course, round as usual. On the outer end of the sleeve 28 is secured a pinion 30, and this is connected by any suitable train of gears 31 (see Fig. 1), or other appropriate means, with mechanism for imparting rotary motion to said pinion. As in some instances the rotation of the pick 22 may require more power than

could be readily supplied by the hand of the operator, it is preferable to employ a small motor for the purpose, and as an example of such means a small oscillatory engine 32 is employed having a piston 32^a (shown more clearly in Figs. 15 and 16). This, as shown in Fig. 1, is mounted upon the side of the supporting arm 29, and is provided with a valve lever 33 arranged in a position accessible to the hand of the operator, and which lever controls a valve 33^a and serves to admit fluid to the motor 32 for causing rotary motion of the desired degree to the pick 22. The reciprocatory motion of the pick 22 for causing it to strike against the wall of the mine is imparted thereto by fluid pressure, preferably air admitted to the cylinder 27 at the will of the operator through one or the other of two ports 34, 35, in said cylinder, which are controlled by any suitable valve 36, having an operating handle 37, the fluid being exhausted from one end of the cylinder through exhaust port 38, while the fluid is admitted to the port 34, and from the other end of the cylinder through exhaust port 39 while the fluid is admitted through the inlet port 35, the valve 36 being of course provided with corresponding exhaust ports to register with the ports 38, 39, and with atmospheric ports 40 in the valve housing, as usual in devices of this character. Fluid may be admitted to the ports 34, 35, through a supply connection 41 and by-pass 42 from said connection to a chamber 43 in the valve housing. from which the port 35 leads.

The rear end of the cylinder 27 is supported between upper and lower cross-bars 44, 45, on a vertical pivot 46, while the projecting arm 29 on the cylinder is arranged between top and bottom cross-bars 47, 48. The cross-bars 44, 45, are formed on or secured to a frame or casting 49, in which are produced two cylinders 50, 51, provided with pistons 52, 53, connected together by a piston-rod 54 common to both of them, and provided with two lateral arms 55, between which is situated a lug 56, rising from horizontal projection 57 on the end of cylinder 27, so that when fluid is admitted to one of the cylinders 50, 51, the cylinder 27 and the pick carried thereby will be moved in a horizontal plane around the pivot 46 to one side of the tunnel or entry, and when fluid is admitted to the other of these two cylinders 50, 51, the pick will be correspondingly moved to the opposite side of the tunnel, thus enabling the operator to produce a clean cut along the line of the side walls. In order that the pick 22 of the pick machine may be adapted for this use its end is preferably beveled as shown at 22^a, whereby it may be turned into that position which will be most advantageous for the particular use to which it is to be put. Fluid may be admitted to these cylinders 50, 51, for thus horizontally oscillating the pick through passages 57, 58, respectively controlled by a cock or valve 59, which may be of the usual type, provided not only with ports for connecting it with the source of fluid pressure supply, but for exhausting the fluid from one of the cylinders when supplying the fluid to the other one. In order that the pick may be locked or firmly held in the position to which it is thus adjusted by pressure of the fluid under the control of valve 59, hydraulic pressure may be admitted to the outer end of either of the cylinders 50, 51, through passages 60, 61, respectively controlled by a cock or valve 62 similar to the valve 59. These valves 59, 62, may be controlled manually by levers or handles 59^a, 62^a, respectively, and which handles are located in convenient positions for ready access by the operator. The element or casting 49, in which the cylinders 50, 51, are formed and on which the cross-bars 44, 45, are secured, is also formed on or secured to a pair of diverging arms 63, which are pivoted at their divergent ends by means of pivots 64, 65, to two arms or links 66, 67, respectively, and also in turn are pivoted by means of pivots 68, 69, to brackets or frame members 70, 71, supported on the main frame 16. The pivots 68, 69, are rigid with their arms 66, 67, respectively, and are provided with upwardly extending cranks 72, 73 (see Figs. 1 and 17), respectively, to which are respectively secured piston-rods 74, 75, by means of short links or other suitable connections 76, 77. These piston rods 74, 75, are provided with pistons or other suitable means whereby they may be moved in either direction at will for causing the links or arms 66, 67, to oscillate on their pivots 68, 69, and thereby lift the forward ends of the arms 63 and correspondingly lift the pick 22, which, as before explained, will be supported by the cross-bars 47, 48, at any adjustment within the range or length of these cross-bars. As an example of a means for thus operating the piston rods 74, 75 at will, a piston 78 is provided on each end situated in cylinder 79 capable of being supplied with fluid under pressure through passages 80, which passages may be controlled by any suitable cocks or valves 81, capable of admitting pressure to either side of the piston for causing motion in the desired direction and for exhausting it from the opposite side. When the arms 66 are raised to the desired elevation they may be locked at the proper adjustment by any suitable means, but preferably by hydraulic or other suitable fluid admitted to one side or the other of pistons 82, also secured to the rods 74, and situated in suitable cylinders 83, capable of being supplied with fluid under pressure through passages 84, which

are controlled by cocks or valves 85, similar to the valves 81. The weight imposed upon the arms 66, 67, may be counterbalanced, if desired, by suitable springs 86, secured at one end to the casting in which the cylinders 79, 83, are formed, and at the other end to lugs 87, carried by arms 66, 67. In thus raising the pick machine by the aid of the arms 66, it is obvious that the same will be lifted to an inclined position, but in order that it may be elevated into a horizontal position as well as at any desired degree of inclination, at least one of the pivots 64, 65, which support the forward end of the pick machine cylinder, is provided with a crank-arm and one of the arms 66, 67 with means for controlling said crank-arm, whereby the cylinder and the pick may be straightened up to a horizontal position, or to any desired degree of inclination. In order to accomplish this, the cross-bars 47, 48, may be rigidly secured to pivots 64, 65, while the arms 63 are pivotally connected therewith, and the pivot 65 is formed with an upwardly extending crank arm 88, to which is pivotally connected a piston 89 by means of a suitable connection or rod 90, the piston being situated in a cylinder 91, formed on or secured to the arm or link 67, and provided with a controlling valve 92, whereby fluid may be admitted to or exhausted from either side of the piston 89 at the will of the operator.

The main frame 16 is supported upon the floor of the tunnel and is held against retrograde movement during the advancing action of the kerf cutters by any suitable anchoring means, such, for example, as that shown in detail in Figs. 5 and 6, consisting of anchors 98 pivoted to rods or arms 99, 100, respectively, and arranged to engage the side walls of the tunnel. The rods 99, 100, have telescopic connection with each other, as shown at 101, so that the anchors 98 may be relatively adjusted for accommodating the machine to tunnels of different widths. This adjustment of the two arms 99, 100, may be conveniently effected by means of an ordinary turn-buckle connection 102, secured thereto. The anchors 98 are secured respectively to two short upright shafts 103, journaled in the arms 99, 100, and to the upper ends of which shafts are respectively secured two levers 104, which are connected by links 105 with piston rods 106, provided with pistons 107 in cylinders 108. These cylinders are provided with connections 109 for the introduction and escape of any suitable fluid under pressure, and the cylinders are rigidly secured to the main frame 16 in any suitable way, so that when fluid is introduced to the cylinders at one end the anchors 98 will be thrown outwardly into firm engagement with the side walls of the tunnel for holding the frame 16 against retrograde movement, and when fluid is introduced in the opposite end of the cylinders the pressure of the anchors against the walls will be relieved and the main frame will be free to advance or recede as necessary. The supply and exhaust of the cylinders 108 may be controlled at the will of the operator by any suitable valves 109ª. By this means it will be apparent that the anchors 98 may also be controlled by the operator in such a manner as to cause the machine to be shifted laterally.

As has already been stated, the valves 109ª are provided in the pipes 109 for controlling the admission and exhaust of the fluid into and from the chambers 108 on the respective sides of the pistons 107, and these valves may be adjusted or manipulated either simultaneously or independently with respect to each other. Assuming that the machine as it enters the mine to be in a position so that one of the sides thereof will be close to the adjacent wall of the mine, it will be apparent that the machine may be shifted laterally so as to properly position it while in the mine by the manipulation of one of the valves 109ª. When one of these valves 109ª is opened to permit the fluid to flow into the cylinder 108 on the side thereof to force it in a direction to cause one of the anchors 98 to engage the adjacent wall, a continued movement of the piston in the same direction will cause the anchor to exert a force upon the mine wall after it has engaged the wall and while it is still being moved by the piston. As there is nothing on the other side of the machine to retard its lateral movement, it will be manifest that the machine frame will be thus shifted. After this lateral adjustment of the frame, the other of the valves 109ª may be opened or adjusted to permit the fluid to enter the other of the cylinders 108 to throw the other anchor 98 into engagement with the adjacent wall and the machine will thereby be locked against retrograde movement. It is also apparent that after the anchors 98 have come into firm engagement with the side walls of the tunnel, further application of pressure to the pistons 107 in the cylinders 108 will cause a bodily travel of the entire main frame 16 and of the parts of the machine supported thereon or connected therewith, with the exception, of course, of the anchors 98, which remain in engagement with the side walls. By this means the machine as a whole may be caused to advance toward or to recede from the end wall 7 of the tunnel or entry. When the pistons 107 reach the limit of their movement in either direction, the pressure of the anchors 98 may be quickly released by means of a lever 110 pivoted to the arm 99 and also to one end of the turn-buckle 102, and serving when moved in one direction to force the anchors

98 outwardly, and when moved in the other direction to draw them together, this lever 110 in conjunction with the turn-buckle being capable of pressing the anchors 98 against the side walls with sufficient pressure to afford adequate abutment or anchorage for the pistons 107 when thus moving the machine in either direction.

The cylinders 108 and their described associated mechanism are utilized primarily for advancing the machine as a whole, and in addition to this advancing mechanism it is preferable to employ, as before intimated, means for advancing the kerf cutter supported upon the platform members 3, 4, 5, independently of the main frame 16 for keeping the kerf cutters up to their work in the kerf, and it is only after the kerf cutter has reached the limit of this independent advancing movement and is again withdrawn to its position of close relation to the main frame 16, that the machine advancing cylinders 108 are brought into operation while the machine is advancing into the tunnel or entry. In order that the platform or support 3, 4, 5, for the kerf cutters may be given this independent advancing movement for holding the cutters up to their work in the kerf, or for withdrawing the cutters preparatory to bringing up the main machine, two cylinders 111 mounted rigidly upon the main frame 16, are employed and are provided with pistons 112, respectively secured to piston rods 113, pivoted to the arms 114 projecting from the sides of the extension 15, these cylinders 111 being connected to any suitable source of fluid under pressure, and provided with controlling valves 115, connected by suitable pipes or passages 116 with opposite ends of the cylinders 111. During this independent travel of the kerf cutter supporting frame or platform, the arm or extension 15 is supported upon the main frame 16 by a slide 93, which forms a continuation of the extension 15, but is arranged in a horizontal position so as to move with ease upon the surface of the frame 16. The pick machine also has a forward and back adjustment or travel independently of the movement of the main frame 16, and independently of the movement of the kerf cutter supporting frame or platform 3, 4, 5, so that as the kerf cutter advances into the kerf the pick machine may be accordingly adjusted in a rearward direction, and as the pick breaks down the mine wall it may be accordingly adjusted in the opposite direction to keep the pick up to its work. This longitudinal adjustment of the pick as contradistinguished from its longitudinal or reciprocating movement, is produced by a pair of power cylinders 94, mounted rigidly upon the main frame 16 at the sides thereof, as shown in Fig. 1, and provided with pistons 95, connected by rods 96 to brackets or lugs 97, which are formed on or secured to the castings or members 70, 71, carrying cranks or pivots 68, 69, of the arms 66, 67. These lugs 97, as well as the castings 70, 71, in which the cylinders 79 and 83 are formed, are mounted upon slides 117, running in suitable guideways in elevated flanges 16^a of the main frame (see Fig. 5). Consequently when pressure is admitted to the cylinders 94 at one end, (which may be accomplished by any suitable valves 118 and pipes or connections 119,) the slides 117 will be pushed in one direction, carrying with them arms 66, 67 and the pick machine cylinder and all parts secured thereto, while leaving the pick and its operating cylinder to be oscillated from right to left or raised or lowered by the means already described. Pressure admitted to the opposite ends of the cylinders 94 will, of course, produce a movement of the slides 117 in a corresponding direction.

Instead of mounting the main frame 16 directly upon the floor of the tunnel, it is preferable to provide it with shoes 120, two of these being shown, arranged in line with the longitudinal axis of the machine and at or near the ends of the main frame. These shoes are provided with pistons 121, situated in cylinders 122, arranged on the bottom of the main frame, and provided with ports 123 at both ends capable of being utilized alternately as inlet and exhaust ports for any suitable fluid under pressure, whereby the main frame may be adjusted or lifted bodily when necessary or desirable to better adapt the machine for the work in hand.

The primary purpose of the frame 16 is to support and carry the pick machine for giving the pick the described adjustments and operating motion, and in conjunction with such frame 16 there is employed an extension or continuation 125, which is preferably flexibly connected thereto, so that the frame 16 will be capable of a limited lateral movement independently of the extension 125, (see Fig. 4) this flexible character of the frame being desirable owing to the great length of the machine and to the difficulty that might be encountered in moving the machine around curves or deflecting it from a strictly straight course. In order to thus make the extension 125 flexible with relation to the frame 16 the forward end thereof is provided with a coupling member 126, which embraces a tongue 127 of the frame 16, and through which coupling and tongue passes a pivot pin 128. From the coupling 126 the frame extension 125 is extended in an upward inclined direction for the purpose of elevating the rear and discharge end of the conveyer, which will be presently described, and which runs

from the kerf cutter platform to an elevated platform or support 129, with the forward end of which latter the rear end of the frame extension 125 is connected in any suitable way, but it is preferable to form the frame extension 125 integral with a base frame 130, which during the mining and loading operation of the machine rests directly upon the floor of the tunnel, as shown in Fig. 4, and serves as a support for the platform 129.

The conveyer just referred to for carrying away the sections or particles 23 of the mine wall thrown down by the pick 22, preferably consists of two endless belts or chains 131, 132, traveling in the same plane which are parallel with the surfaces of the kerf cutter platform, the inclined extensions 15 and 125, and the platform 129. These chains or belts are driven in unison with their inner or contiguous runs traveling in the same direction and in a direction away from the kerf cutter, and their forward ends are situated under so as to be coöperatively related to the pick or other breaking down tool 22, in such a manner that as the particles of the mine wall are thrown down the inner runs of the chain will conduct them away and finally cast them off at the end of the machine whence they may be removed. In practice it is preferable to have the platform 129 at such an elevation from the floor of the mine that a car 133 may be run under it for receiving the discharge from the conveyer, and in order that the platform 129 may be adjusted to various elevations for accommodating cars of different heights, it is pivoted at 134 to the base frame 130, and contiguous to the pivot it is provided with an arm or crank 135, connected by a link 136 to a piston rod 137, provided with a piston 138 situated in a cylinder 139, whereby the admission of pressure, which may be drawn from any suitable source, to one side of the piston will elevate the platform 129. In order that the platform may be locked in its elevated position the piston rod 137 may be provided with an additional piston 140 situated in a cylinder 141, having suitable hydraulic connections, whereby water or any other known incompressible fluid may be imprisoned in the cylinder for holding the platform from descending, and of course any other suitable locking mechanism might be employed. The conveyer belts are guided and held in the described manner by any suitable means, such as anti-friction rollers 145, which hold the inner runs of the chains at the requisite distance apart, being situated upon the main or central member 5 of such platform, while the rollers 143, 144, are situated upon the adjustable members 3, 4, and this end of the conveyer is so positioned upon the platform of the kerf cutter that as the particles of the wall are broken down they will fall thereon and will be automatically caught and conducted to the rear. In order that the chains or conveyer may not become choked or clogged by particles lodging between the converging runs of the chains where they are rounded upon rollers 145, a wedge shaped guard 146 may be situated at that point upon the member 5 of the platform.

It is, of course, desirable and important that the outer runs of the chains which travel toward the kerf cutter be covered or shielded from the particles of coal or other material in order that they may not counteract the conveying action of the inner runs which are always exposed, and to this end these outer runs where they pass over the kerf cutter platform are covered by suitable plates or shields 147, mounted upon the adjustable members 3, 4, of the platform and plates or shields 148 mounted upon the main member 5. Where the outer runs of the chains pass over the extension 15 they are covered by shields 149, which may be formed on or secured to said extension 15 and the slide 93 and moved therewith as the kerf cutter is advanced or retracted with reference to the frame 16. The outer runs of the chains where they pass over the remaining portion of the frame 16 are covered by shields 150, better shown in Fig. 5, which are formed on the edges of a supporting plate 151, which carries the inner runs of the chains over the frame 16, and under which supporting plate slide 93 moves. The plate 151 is secured in place by the pivot pin 128, and the end of this plate contiguous to the extension 125 is rounded and countersunk or mortised into said extension, the contiguous surface of the extension being similarly rounded, as shown at 152 in Fig. 1, so that the main frame 16 may have a slight lateral or oscillatory motion with relation to the extension 125, while keeping the surfaces of the extension 125 and plate 151 substantially flushed. Where the outer runs of the chains pass over the extension 125 they are covered by suitable shields 153, and where they pass over the platform 129 they are covered by similar shields 154.

As the kerf cutter recedes with respect to the frame 16 the slack of the chains should, of course, be taken up, and in order to accomplish this any suitable belt tighteners may be employed. In this exemplification of the invention the chains are engaged by two pulleys 155, respectively mounted in slides 156, running in grooves 157 in the frame 130, and connected to piston rods 158, provided with pistons 159, arranged in pneumatic cylinders 160, which are shown as connected together by a passage or pipe

161, and provided with a supply passage 162, whereby pressure may be maintained behind the pistons for keeping the chains tight.

The power for driving the kerf cutter and the conveyer comprising the chains 131, 132, is preferably situated upon the stationary frame 130, and may be constituted by any suitable motor such as that shown at 163. The shaft of this motor is shown as provided with pinions 164, which are in mesh with gears 165, 166, respectively loosely mounted upon a shaft 167, and each provided with one member of two friction clutches 168, 169, having operating levers 170, 171, respectively, the two members of the friction clutch 168 being, of course, secured to the shaft 167 in the ordinary way. One end of the shaft 167 is operatively connected with the kerf cutting chain 1 by any suitable means capable of permitting the kerf cutter platform to go and come with relation to the frame 16. As an example of such a means there is shown a universal joint 172, which connects the shaft 167 directly with a sleeve 173, having a squared or angular interior in which fits one end of a shaft 174 of complementary form, while the other end of this shaft is connected by a universal joint 175 with a short shaft 176, carrying a beveled pinion 177, engaging a companion pinion 178 on an upright shaft 179, carrying a sprocket wheel 180, engaging the cutter chain 1 and imparting the requisite travel thereto, the universal joints 172 and 175 allowing for the angular relation of the shaft 167 to the shaft 176, while the sliding connection 173, 174 allows for the advancing and receding movement of the kerf cutting platform.

The gear 166 instead of being mounted directly upon the shaft 167, may be journaled upon a sleeve 181, which is rigidly secured to clutch member 169, controlled by the lever 171, so that when the clutch member 169 is thrown into engagement with the member carried by the gear 166, the sleeve 181 will be rotated. To the sleeve is secured a beveled pinion 182, which meshes with a companion pinion 183, upon a vertical shaft 184, on whose upper end is mounted a sprocket wheel 185, engaging a loop in the chain 132, whereby said chain is driven. The other chain 131 is driven by a sprocket 188 on a vertical shaft 189, connected by a pair of beveled pinions 190, with horizontal shaft 191, deriving its power from the beveled pinion 182, see Fig. 9. The object in thus providing two separate clutches for the kerf cutting means and the conveyer, is that at times it is desirable to operate the conveyer and the kerf cutter independently or one at a time, while at other times it may be desirable to operate them simultaneously.

The more weighty portion of the machine constituted in greater part by the stationary frame 130 and its connected parts, may be transported back and forth in the tunnel in any suitable way. For this purpose the special track-laying mechanism, more clearly shown in Fig. 4, may be employed. During the operation of the machine while the cutting and loading is being done, the frame 130, as before stated, rests upon the floor of the mine, but when it is desired to transport it it is elevated by means of hydraulic, pneumatic or other suitable jacks, and tracks are placed under the trucks 193, preferably carried by or secured to the frame member 130 and extension 125. If desired, these trucks may be secured directly to pistons 194, 195, in upright cylinders 196, 197, secured to the frame members 130, 125, respectively, and provided with suitable connections with a source of water under pressure, or other suitable fluid, for elevating the cylinders 196, 197, respectively, to the pistons and trucks 193, and correspondingly elevating the frame 130, 125, until blocks may be inserted under the base portion 130^a of the frame 130 for holding it elevated until the rails 198 may be laid in line with the trucks 193, which are subsequently raised for shifting the rails to be placed thereunder and then lowered upon the rails, the rails being supported, if desired, by cross-ties 199. As a convenience for carrying a supply of the rails 198, the frame 130 is provided with brackets 200 on both sides, so arranged that the rails thereon may be dropped off on to rollers 201 supported close to the floor of the mine on slides 202, capable of being pushed back and forth with respect to the brackets 200 by means of levers 203, whereby the rollers may be pulled out from under the rails, allowing the rails to settle upon the cross-ties 199.

In addition to the anchors 98 for holding the machine against retrograde movement in a direct line, the frame 16 may be provided with upwardly operating jacks, which are preferably in the form of hydraulic cylinders 204, secured to arms 205 on the flanges 16^a by means of pivots 206, and anchors 207, having pistons 208, working in the cylinders 204, the cylinders being supplied with any suitable pressure to connections 209.

It is, of course, evident that the car 133 may be mounted upon the same track or rails 198 employed for transporting the machine, and may be driven back and forth with respect to the machine, if desired, by a motor, 210, mounted directly upon the car, and having trolley connection 211 with the trolley wire or cable 212, mounted upon a reel 213, carried by the frame 130, and provided with suitable braking mechanism 214 for controlling its action. As has already been stated, the frame 16 is capable of a limited lateral adjustment about the pivot 128. This limited lateral adjustment will

cause the cylinders 122 (see particularly Fig. 2) to abut the edge of the coupling member 126 and when in this position, it will be apparent that when the frame is shifted laterally in the manner already described, that is, by the anchors 98, the forward part of the structure will also be shifted laterally to a greater extent than the limited lateral adjustment referred to so that the cutting mechanism will be given a correspondingly lateral adjustment. The structure may also be shifted by means of the frames 3. 4, and 5 which support the cutting mechanism 1. This may be effected in the following manner: Assuming again that the machine enters the mine in a position that one edge of the cutter frame is closer to one of the walls of the mine than the opposite edge of the frame, it will be apparent that inasmuch as the frames 3 and 4 are adjustable laterally with respect to the section 5, all that is necessary is to permit the fluid to flow into the cylinders 12 on the side of the machine which is in close proximity to the adjacent wall of the mine. When the fluid is admitted into these cylinders, the pistons 11 therein will be forced outwardly and will cause that section of the cutter frame which is controlled by these pistons to be forced into engagement with the wall of the mine and a continued movement of the pistons and the frame section in the same direction will bodily shift the machine laterally.

While I have herein presented claims covering the combination between kerf-cutting mechanism and a pick machine arranged to operate on the mine wall above and remote from the kerf, and also claims covering kerf-cutting means in combination with conveying means and breaking-down mechanism arranged above the conveying means, I have presented in my co-pending application Serial No. 848,331 filed July 1, 1914, as a division of my application Serial No. 611,603 filed Nov. 10, 1896, claims covering the combination with a breaking-down tool, of means for removing the material broken down, without the inclusion of kerf-cutting mechanism, and also claims directed to reciprocating breaking-down means mounted for vertical and horizontal adjustment together with power-operated mechanism therefor. In another co-pending application, Serial No. 210,174, I have presented claims to the reciprocating tool or pick machine *per se* based on subject-matter specifically different from that disclosed in the present application but having in common a pick machine comprising a pick, power-operated, and pivotally supported for universal movement over the mine wall operated on, by being adjustable horizontally and vertically to various radial positions.

I claim:

1. In a mining and loading machine, the combination of positive means for cutting a kerf in the wall of the mine, means cooperatively related to said cutting means for engaging the wall of the mine above said kerf and breaking down a section of such wall, and means normally arranged under and coöperatively related to said breaking-down means for conveying the dislodged wall particles away.

2. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, having a flexible traveling cutter-carrying element and guides therefor, means coöperatively related to and arranged normally above said cutting means for engaging the wall of the mine above said kerf and breaking down a section thereof, and means arranged under and coöperatively related to said breaking-down means for conveying the dislodged wall particles away.

3. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, having a flexible traveling cutter-carrying element and guides therefor, means coöperatively related to said cutting means for engaging the wall of the mine above said kerf and breaking down a section thereof, and means arranged under and coöperatively related to said breaking-down means, for conveying the dislodged wall particles away.

4. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, having a continuous, flexible, traveling, cutter-carrying element, and guides therefor, means coöperatively related to said cutting means for engaging the wall of the mine above said kerf and breaking down a section thereof, and means arranged under and coöperatively related to said breaking-down means, for conveying the dislodged wall particles away.

5. In a mining and loading machine, the combination of means for cutting a kerf in the wall of a mine, a main frame with reference to which said kerf-cutting means is adjustable, a driving means on said frame, a flexible power-transmitting connection between said driving means and kerf-cutting means, means coöperatively related to and arranged normally above said kerf-cutting means for engaging the wall of the mine above said kerf and breaking down a section thereof, and means arranged under and cooperatively related to said breaking-down means, for conveying the dislodged wall particles away.

6. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, a slidable support for said kerf-cutting means, a main frame with

reference to which said support is adjustable, a driving means on the main frame, a flexible power-transmitting connection between the driving means and the kerf-cutting means, means arranged normally above and coöperatively related to said kerf-cutting means for engaging the wall of the mine above said kerf and breaking down a section thereof, and means arranged under and coöperatively related to said breaking-down means, for conveying the dislodged wall particles away.

7. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, a pick machine for engaging the mine wall above the kerf and breaking down a section thereof, and means arranged under and coöperatively related to said pick machine, for carrying the dislodged wall particles away.

8. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, means arranged normally above the first said means for engaging the wall above the kerf and breaking down a section thereof, and an extensible means arranged under and coöperatively related to the breaking-down means, for carrying the dislodged wall particles away.

9. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, means for engaging the wall above the kerf and breaking down a section thereof, and an extensible, continuous conveyer, arranged under and coöperatively related to said breaking-down means, for carrying away the dislodged wall particles.

10. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, means for engaging the wall above the kerf and breaking down a section thereof, a continuous conveyer, arranged under and coöperatively related to the breaking-down means, for carrying away the dislodged wall particles, said conveyer being extensible, and means for taking up the slack of the conveyer.

11. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, means normally above the first said means for engaging the wall above the kerf and breaking down a section thereof, and two traveling belts arranged under and coöperatively related to the breaking-down means, for carrying the dislodged wall particles away.

12. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, means normally above the first said means for engaging the wall above the kerf and breaking down a section thereof, two traveling belts arranged under and coöperatively related to the breaking-down means, for carrying away the dislodged wall particles, and means shielding the advancing folds of said belts from said wall particles.

13. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, a portable support therefor, a main frame with reference to which said support is vertically adjustable, means for engaging the wall of the mine above the kerf and breaking down a section thereof, an endless extensible conveyer running from the main frame onto said support and terminating under said breaking-down means, for carrying away the dislodged wall particles, means for advancing the kerf-cutter support with reference to said main frame, and means for taking up the slack in the conveyer as the cutter support recedes.

14. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, means operatively related to the first said means for engaging the wall above the kerf and breaking down a section thereof, an upwardly deflectable conveyer, arranged under and coöperatively related to said breaking-down means, for conveying the dislodged wall particles to the rear, and means for vertically adjusting the rear end of the conveyer.

15. A mining and loading machine having a single kerf producing means, in combination with a percussion tool arranged to engage the material to be mined above and remote from said kerf to break the same down in lumps, and so as not to enter the said kerf.

16. In a mining and loading machine the combination with means for producing a recess in the material to be mined, of a reciprocating tool arranged above such recess to engage and detach sections of such material and a conveyer adapted to be extended into such recess for receiving and conveying the sections of material detached by the tool.

17. In a mining and loading machine, the combination of means for cutting a kerf in the wall of a mine, and a reciprocating pick for engaging said wall above and remote from the kerf and breaking the same down in lumps, said pick being arranged so as not to enter the kerf.

18. In combination, a supporting frame, an undercutting mechanism mounted thereon, a motor for operating such mechanism, a pick machine mounted upon the frame above the undercutting mechanism, and a rearwardly extending conveyer on the frame beneath the pick machine.

19. In combination, a supporting frame, an undercutting mechanism, mounted thereon, a motor for operating such mechanism, a pick machine mounted upon the frame above

the undercutting mechanism, and means for feeding the frame forwardly.

20. In combination, a supporting frame, an undercutting mechanism mounted thereon, a motor for operating such mechanism, a pick machine mounted upon the frame above the undercutting mechanism, means for feeding the frame forwardly, and an independent motor for operating the same.

21. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, means normally disposed above the kerf-cutting means for engaging the wall above the kerf and breaking down a section thereof, and a conveyer having a portion projecting under the breaking-down means for conveying away the dislodged wall particles.

22. In a mining and loading machine, the combination of means for cutting a kerf in the wall of the mine, means normally disposed above the kerf-cutting means for engaging the wall above the kerf and breaking down a section thereof, and a conveyer having its forward end arranged under the breaking-down means and disposed in substantially the same plane as the kerf-cutting means, said end of the conveyer being of less thickness than the thickness of the said kerf-cutting means, whereby the forward end of said conveyer will enter directly into the kerf.

23. In combination, a supporting frame, an under-cutting mechanism mounted thereon, a motor for operating such mechanism, and a pick machine mounted for universal movement upon the frame above the undercutting mechanism.

24. In combination, a supporting frame, an under-cutting mechanism mounted thereon, a motor for operating such mechanism, a pick machine mounted upon the frame above the under-cutting mechanism, and means for adjusting the frame laterally.

25. In combination, a supporting frame, an under-cutting mechanism mounted thereon, a motor for operating such mechanism, a pick machine mounted upon the frame above the under-cutting mechanism, and means for adjusting the front end of the frame vertically.

26. The combination of a horizontal kerf cutting mechanism, a motor for operating the same, picking mechanism arranged above the kerf cutting mechanism and means for vertically adjusting the forward end of the kerf cutting mechanism.

27. In a mining and loading machine, the combination of means for cutting a kerf in the wall of a mine, a pick machine for engaging the wall above the kerf and breaking down a section thereof, means for anchoring the machine against retrograde movement, and means for controlling the said anchoring means to turn the machine.

28. In a mining and loading machine, the combination of means for cutting a kerf in a wall of a mine, a pick machine for engaging the wall above the kerf and breaking down a section thereof, anchors adapted to engage the wall of the mine for holding the mechanism against retrograde movement, and means for shifting the anchors with respect to each other to turn the machine.

29. In a mining and loading machine, the combination of means for cutting a kerf in a wall of a mine, means for engaging the wall above the kerf and breaking down a section thereof, pivotally supported anchors adapted to engage the wall of the mine and means for moving said anchors with respect to each other and about their pivots for turning the machine.

30. A mining and loading machine having a kerf producing means, in combination with a power operated percussion tool arranged to engage the material to be mined above and remote from said kerf to break down the material, said tool being also movable in an upright plane.

31. A mining and loading machine having a kerf producing means in combination with a power operated percussion tool arranged to engage the material to be mined above the kerf to break down the material, and means for adjusting said tool vertically.

32. A mining and loading machine having a kerf producing means in combination with a power operated percussion tool arranged to engage the material to be mined above the kerf to break down the material, and means for adjusting said tool vertically and at will.

33. A mining and loading machine having a kerf-producing means, in combination with a power-operated percussion tool arranged to engage the material to be mined above and remote from said kerf and operating to directly dislodge the material in lumps, and so as not to enter the kerf.

34. A mining and loading machine having a kerf producing means in combination with breaking down mechanism, operating directly upon the material above the kerf to dislodge the material in lumps, and means below said breaking down mechanism for receiving and conveying away the broken down material.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 18th day of December A. D. 1905.

EDMUND C. MORGAN.

Witnesses:

JESSE H. GOSS,

BEN W. WILSON.