June 26, 1928. 1,675,180

N. D. LEVIN

MINING MACHINE

Original Filed Sept. 28, 1916 6 Sheets-Sheet 1

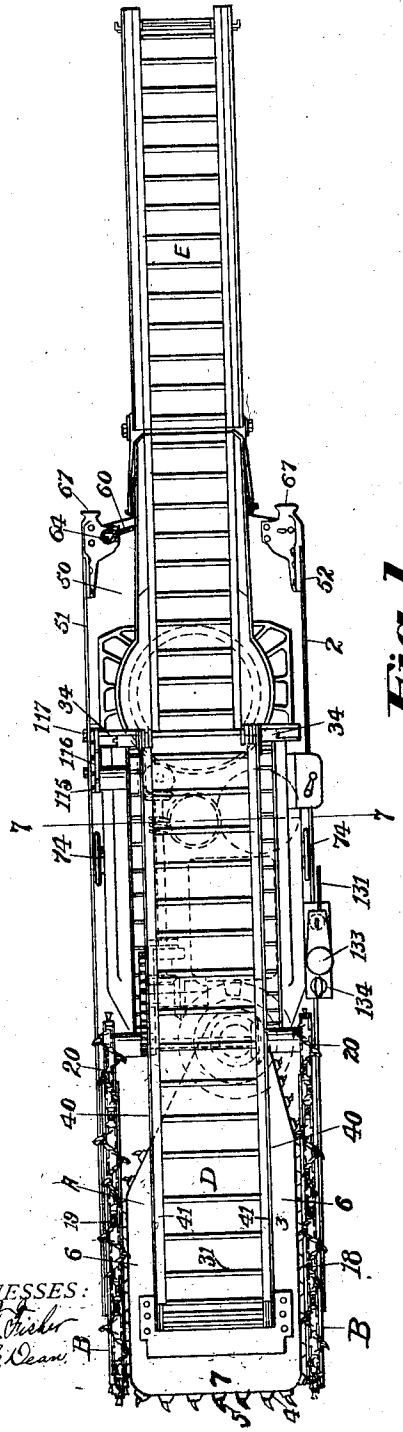


Fig. 1.

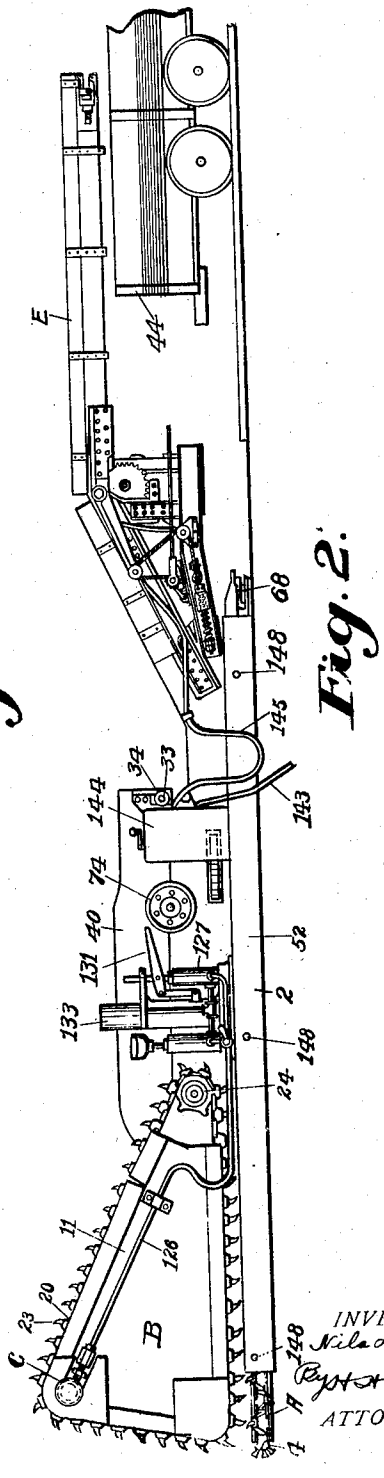


Fig. 2.

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MINING MACHINE

Original Filed Sept. 28, 1916 6 Sheets-Sheet 2

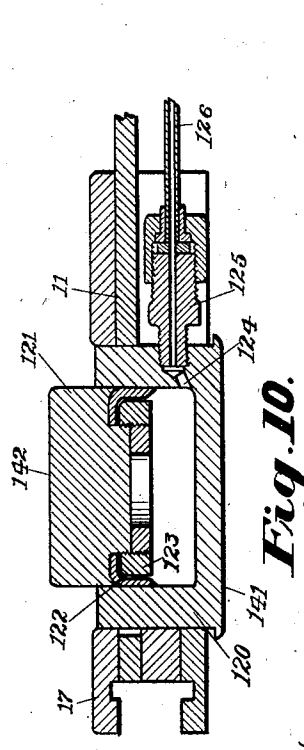


Fig. 10.

Fig. 3.

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N. D. LEVIN

MINING MACHINE

Original Filed Sept. 28, 1916 6 Sheets-Sheet 3

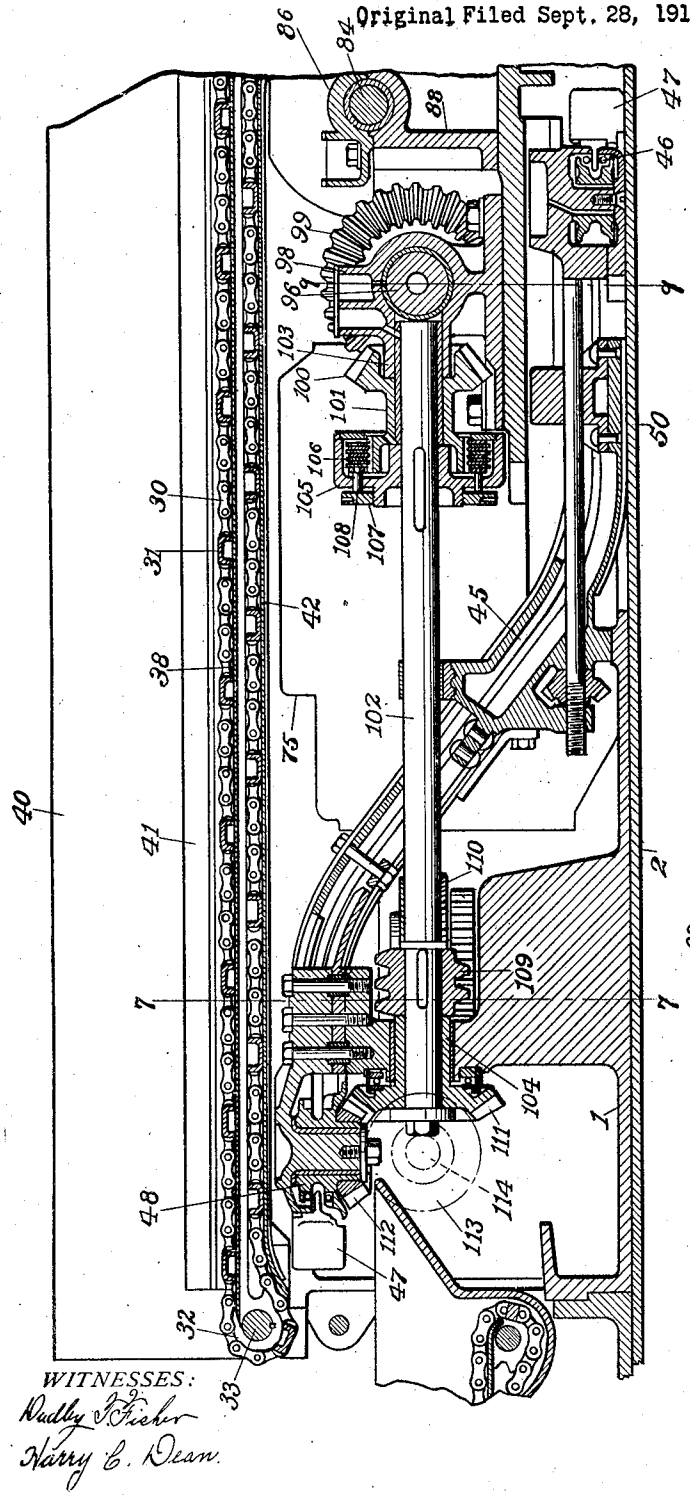


Fig. 4.

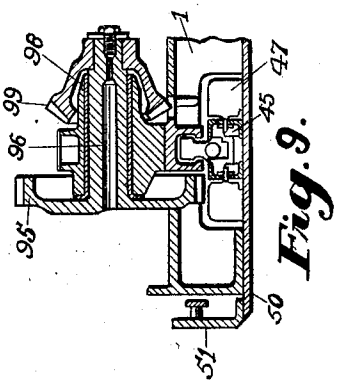


Fig. 9.

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June 26, 1928. 1,675,180

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MINING MACHINE

Original Filed Sept. 28, 1916 6 Sheets-Sheet 4

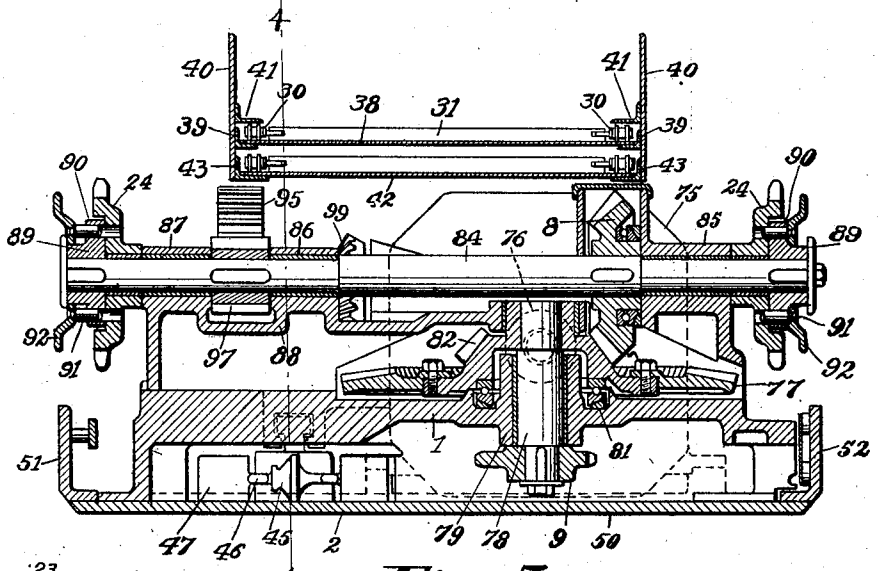


Fig. 5.

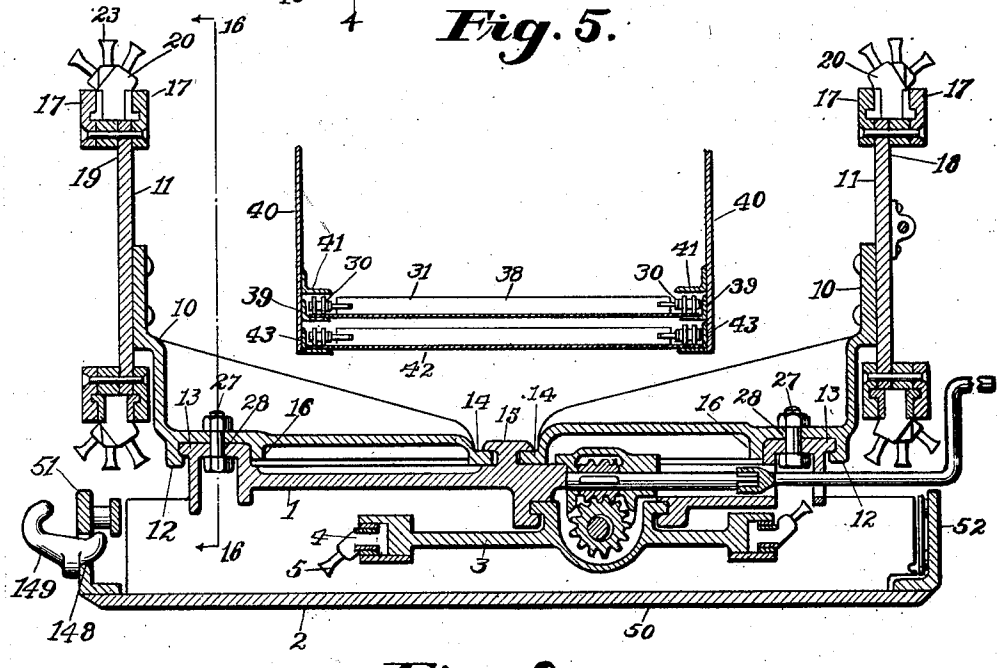


Fig. 6.

WITNESSES:
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June 26, 1928. 1,675,180

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MINING MACHINE

Original Filed Sept. 28, 1916 6 Sheets-Sheet 5

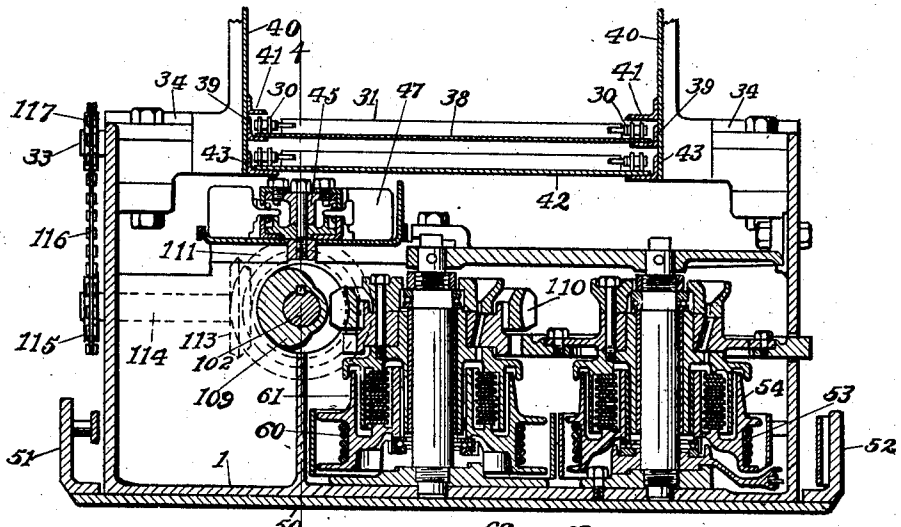
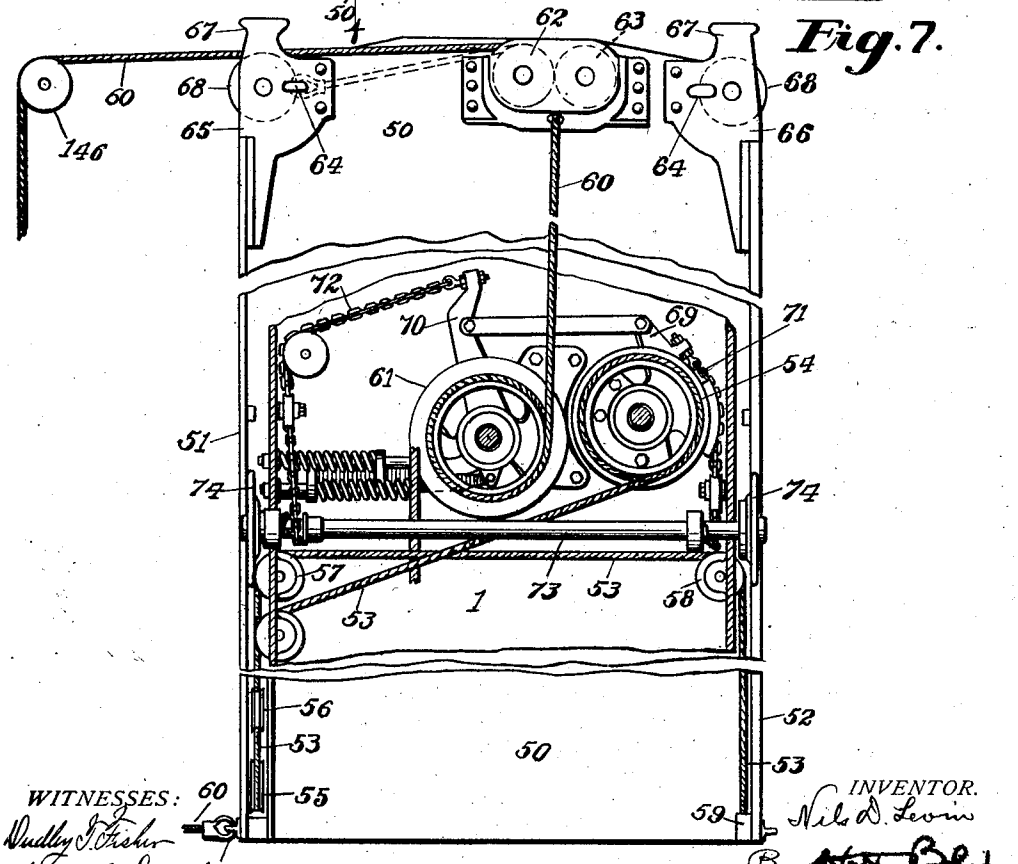


Fig. 7.



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Fig. 8.

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MINING MACHINE

Original Filed Sept. 28, 1916 6 Sheets-Sheet 6

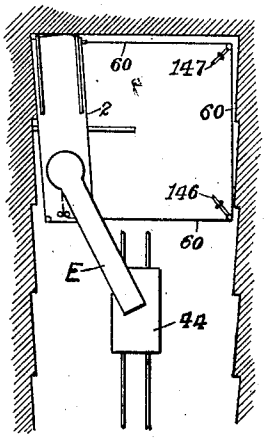


Fig. 11.

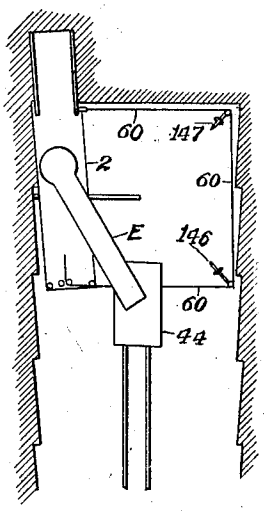


Fig. 12.

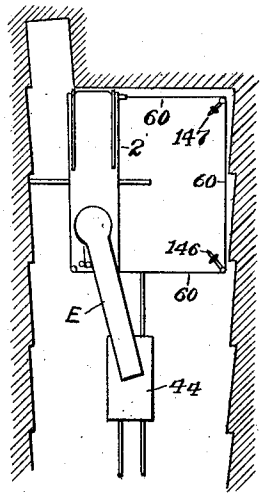


Fig. 13.

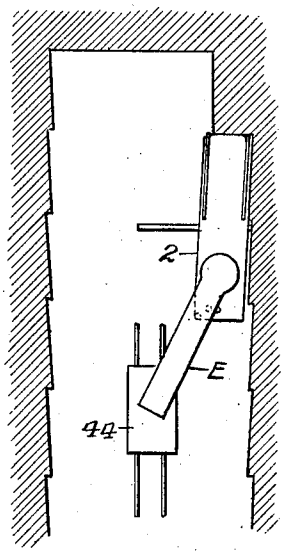


Fig. 14.

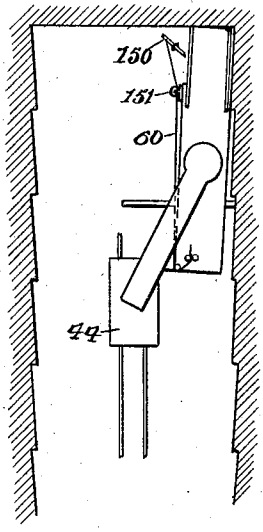


Fig. 15.

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INVENTOR.
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Patented June 26, 1928. 1,675,180

UNITED STATES PATENT OFFICE.

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MINING MACHINE.

Application filed September 28, 1916, Serial No. 122,706. Renewed November 17, 1927.

This invention relates to certain new and useful improvements, in mining machines of the types adapted for under cutting coal, breaking it down and loading it into conveniently placed cars for transport from the mine.

I am aware that it has been heretofore proposed to provide, in a cutting and loading machine, simultaneously movable horizontal under-cutting devices and parallel vertical shearing devices; to provide breaking down devices; to provide a car loading conveyor which is pivoted to the main frame for movement about a vertical axis; and to provide ropes or cables together with winding drums for moving the machine as a whole. None of the foregoing features are broadly claimed as a part of this invention.

It is the especial object of this invention to provide, in a machine of the class described, improved breaking down devices whereby the coal, after being undercut and sheared, may be broken into relatively large fragments greatly reducing the proportion of fine coal or slack.

The preferred embodiment of my invention is set forth in the following specification and illustrated in the accompanying drawings. However, I desire it to be understood that various modifications as to details may be made within the scope of the appended claims without departing from the spirit of my invention.

Of the drawings:—

Fig. 1 is a plan view of a machine embodying my invention.

Fig. 2 is a side elevation of the machine illustrated in Fig. 1.

Fig. 3 is a side view partly in section and partly in elevation of the forward part of the machine.

Fig. 4 is a fragmentary longitudinal section view taken along the line 4—4 of Figs. 5 and 7.

Fig. 5 is a cross section taken along the line 5—5 of Fig. 3.

Fig. 6 is a cross section taken along the line 6—6 of Fig. 3.

Fig. 7 is a cross section taken along the line 7—7 of Figs. 1 and 4.

Fig. 8 is a diagrammatic plan view showing the feeding mechanism, the other parts being removed for the sake of clearness.

Fig. 9 is a fragmentary sectional view taken along the line 9—9 of Fig. 4.

Fig. 10 is a fragmentary sectional view taken along the line 10—10 of Fig. 3.

Figs. 11 to 15 are diagrammatic views illustrating the manner of using the machine.

Like numerals refer to similar parts in the several figures.

Stated very briefly the machine comprises five principal operative parts. These are the under-cutting mechanism indicated in Figs. 1 and 2 by A; the vertical shearing devices B—B; the breaking down mechanism C; the primary conveyor D, and the secondary loading conveyor E.

The several principal parts are co-operatively connected together and are mounted upon a main frame 1. This main frame is supported upon a pan or shoe 2 which rests directly upon the floor of a mine room or entry in which the machine is being operated. The frame 1 is bodily movable with respect to the pan 2 in a manner to be described.

Supported on the main frame casting 1 is a relatively movable cutter frame 3, which is generally triangular in outline, and is provided around its edges with a groove adapted to receive and guide an endless chain 4 to which are secured cutting bits 5. The chain grooves along the sides of the frame are formed in part by the plates 6 and at the front by the plates 7. At the front the chain 4 passes over a hardened wearing plate 8. At the rear the chain passes around and is engaged by the driving sprocket wheel 9 which is mounted on the main frame to receive power in a manner to be hereinafter described.

Positioned at opposite sides of the main frame 1 and secured thereto in a suitable manner are brackets 10 to which are attached the vertical cutter frame plates 11, but as the details of this attachment are immaterial to the present invention further description at this time is not thought to be required. As shown in Fig. 1 the plates 11 are substantially triangular in outline. Each plate has a substantially vertical forward edge and is provided along its edges with chain engaging flanges 17 to form the cutter frames 18 and 19 about which the cutter chains 20 are adapted to travel in the manner common to such cutter frames. At the lower forward corners of the cutter frames 18 and 19 are provided idler sprocket wheels

21 and at the upper forward corners hardened steel wearing strips 22 are provided to guide the cutter chain 20 around the corners of the plate 11. The cutter chains 20 are of the type commonly used in a mining machine of this class, and carry renewable cutter bits 23 which engage the coal to cut it. At the rear the chains 20 pass over the sprocket wheels 24 which are mounted on the main frame to receive power in a manner to be hereinafter described.

The main conveyor for the machine is of the endless chain and scraper type and extends over substantially the entire width and the entire length of the main frame. It comprises two endless chains 30 which are joined at intervals by cross bars 31 which act as scrapers. The chains pass around the sprocket wheels 32 on the transverse drive shaft 33 mounted in bearing brackets 34 on the main frame 1. At the front of the machine the chains 30 pass around the sprockets 35 on a transverse shaft 36 journaled in bearings in the cutter frame 3. The upper strand of the conveyor travels over the surface of the plate 38 which is connected by means of suitable angle bars 39 with side plates 40. Angle bars 41 are secured to the plates 40 above the upper strand of the conveyor and serve to protect the chains and hold them in position. The lower strand of the conveyor travels over the surface of a plate 42 which is secured to the plates 40 by means of angle bars 43. The conveyor trough formed by the vertical plates 40 and the horizontal and inclined plates 38 and 42 is a rigid self supporting structure. At its rear end the trough is attached to the bearings 34 of the shaft 33 and its forward end is mounted in the cutter frame 3, the parts being so arranged that the entire forward end of the conveyor can extend into the kerf formed by the cutters 5, but as it forms no part of the present invention further description at this time is not thought to be necessary.

When material is broken down from the coal face it falls upon this main conveyor and is carried rearwardly and discharged upon the swinging loading conveyor E by which it is deposited in cars 44 conveniently placed at the rear of the machine. This pivoted loading conveyor is similar to that described in my copending application No. 782,522 filed in the Patent Office on Aug. 1st, 1913, and needs not be particularly described at this time.

The slack formed by the cutter bits 5 of the under cutter will be carried backward within the main frame 1 and will not be caught by the main conveyor. In order to pick up this slack and load it with the other coal a supplementary slack conveyor 45 is provided by which the cuttings are gathered and deposited in the loading conveyor with the coal from the main conveyor. The active element of this slack conveyor is an endless chain 46 having scraper flights 47 constructed according to a well established practice. At its rearward end the chain 46 passes around a driving sprocket wheel 48 mounted underneath the rear end of the main conveyor for rotation about a vertical axis.

2 is the plate or pan upon which the main frame of the machine slidably rests. This pan 2 comprises a bottom plate 50, and side plates which are formed by angle bars 51 and 52.

The main frame is moved to advance the cutting and breaking down mechanisms into the coal by means of the rope controlled devices which will be described. These are shown in Figs. 7 and 8. For feeding the machine forward a feed rope 53 is provided which is connected to be wound upon a drum 54 mounted on the main frame. From the drum 54 the rope extends over a sheave 55 mounted at the forward end of the pan 2. A guide sheave 56 is positioned adjacent the sheave 55. After passing around the sheave 55 the rope extends backward to a sheave 57 mounted on the main frame 1 and across to a similar mounted sheave 58. From the sheave 58 the rope extends forward to a point of attachment to the front end of the pan at 59. It will be clear that when the drum 54 is rotated the rope 53 will cause the main frame and attached parts to move forward with respect to the pan, the tractive force being devided between the two sides.

60 is a rope for pulling the main frame and attached parts backward with respect to the pan. This rope is connected to the winding drum 61, and from the drum extends backward between two guide pulleys 62 and 63. From these sheaves the rope can extend to the right or the left and can be secured to one or to the other of the hooks 64, as shown in Fig. 8. It will be clear that when the drum 61 is rotated the rope 60 will act directly to pull the main frame and attached parts backward.

The hooks 64 are secured to or formed as parts of castings 65 and 66 mounted at the rear corners of the pan 2. These castings 65 and 66 are provided with rearward extending lugs 67 adapted to be engaged by lifting jacks or crow bars for handling the machine and assisting in moving it about the mine. Mounted on the castings 65 and 66 are sheaves 68 over which the rope 60 can be passed when it is to be used for moving the machine as a whole laterally or otherwise in a manner to be hereinafter described.

The drums 54 and 61 are mounted for rotation about vertical axes and are controlled by the levers 69 and 70 connected by chains 71 and 72 with the cross shaft 73 mounted for rotation in apertures of the main frame 1 in such manner that by the rotation of

the shaft 73 in one direction power is applied to the drum 54 to wind the rope 53 and by its rotation in the opposite direction power is applied to the drum 61 to wind the rope 60.

As these devices form no part of the present invention further description at this time is not thought to be required.

A hand wheel 74 is attached to each end of the cross shaft 73 by which it may be rotated to control the operation of the winding drums 54 and 61. When the operator desires to feed the machine forward to cause the cutter and breaking down mechanisms to advance into the coal, he turns the shaft 73 by means of one or other of the hand wheels 74 in the direction to cause the chain 71 to be wound thus engaging the clutch which controls the feed drum 54. When the operative parts have moved forward as far as is desired the shaft is turned in the direction to unwind the chain 71 and release the clutch of the feed drum 54. When it is desired to retract the operative parts the shaft 73 will be rotated in the direction to wind the chain 72 thus engaging the clutch which controls the pull back drum 61, it being assumed that the pull back rope 60 is connected to one of the hooks 64.

Power for operating the entire machine is derived from the electric motor 75. This motor has a pinion 76 on its armature shaft and this pinion meshes with a master bevel gear 77 which is keyed on a vertical shaft 78, shown in Fig. 5. This shaft is journaled in a bearing 79 of the main frame and carries at its lower end the sprocket 9 for the under cutting chain 4. The weight of the gear and of the shaft is carried by a ball bearing 81.

Formed on the hub of the gear is a smaller bevel gear 82 which meshes with a similar bevel gear 83 on a transverse shaft 84. This shaft is mounted in bearings 85, 86 and 87 formed in a plate 88 secured to the main frame. Loosely mounted on the ends of the transverse shaft 84 are the sprocket wheels 24 for the shearing cutter chains 20. Keyed to the shaft 84 at points adjacent the sprocket wheels 24 are hubs 89 having flanges 90. These flanges are apertured at intervals and corresponding apertures are formed in the sprocket wheels. Clutch fingers 91 are mounted on plates 92 and these fingers can be moved through the apertures in the flanges 90, and into the apertures in the sprocket wheels 24 thus serving to connect the sprocket wheels to the shaft. Latch bars 93 are provided for holding the plates in or out of operative positions. These are mounted on pivot pins 94.

A spur gear 95 is mounted on a transverse shaft 96 and meshes with a pinion 97 on the shaft 84. The shaft 96 is mounted in a bearing 98 on the main frame. This construction is clearly shown in Figs. 4 and 9. Keyed to the shaft 96 is a bevel gear 99 which meshes with a similar bevel gear 100 on a longitudinally extending sleeve 101. This sleeve 101 is freely mounted on a longitudinal shaft 102 which is supported in bearings 103 and 104. The sleeve 101 is connected with the shaft 102 by means of a multiple disc friction clutch which comprises a driven member 105 secured to the shaft and discs 106 alternately secured to the sleeve and to the said driven member. The pressure between the discs can be adjusted by means of the nut 107 which is screwed on an extension of the driven member and which engages the discs by means of the pins 108.

Keyed to the shaft 102 near its rear end is a worm 109 which engages with the worm wheel 110 for driving the rope drums 54 and 61. Also mounted on the shaft 102 is a bevel gear 111 which meshes with a bevel gear 112 attached to the sprocket wheel 48 of the slack conveyor. A second bevel gear 113 mounted on a transverse shaft 114, mounted on the main frame, meshes with the gear 111. Upon one end of the shaft 114 is a sprocket wheel 115 and a chain 116 passes over this sprocket wheel and over a similar sprocket wheel 117 on the drive shaft 33 of the main conveyor.

The breaking down mechanism consists of a hydraulic jack mounted in each of the shearing cutter frames to be carried into the kerf formed thereby and, at the will of the operator, to exert a pushing effort, transversely of the cutter frame, to disengage the block between the vertical kerfs from the main body of the coal. This hydraulic jack comprises a cylinder 120, mounted in an aperture of the plate 11, in which is slidable the plunger 121. The plunger 121 is provided with a packing washer 122 secured in place by the clamping ring 123 in the manner common in hydraulic plunger construction. The parts are so proportioned that when the plunger 121 is withdrawn into the cylinder 120 the overall length of the jack will be less than the width of the kerf to allow its free insertion into the kerf. When, however, the plunger 121 is pushed to its outer limit of travel the overall length of the jacket will be materially greater than the width of the kerf allowing a considerable yielding of the coal within the effective range of the jack. Formed in the body of the cylinder 120 is an aperture 124 into which is screw threaded a pipe coupling 125 by which the supply tube 126 is connected for admission of the fluid by which the jack is energized. The tube 126 is carried rearwardly along the face of the plate 11 and is connected with the cylinder 127 of a pressure pump positioned convenient to the hand of the operator. Formed in the tube 126 is a goose neck 128 to afford the flexibility necessary for the movement of the plate 11 to

adjust the tension of the cutter chain 20. The pump cylinder 127 is mounted upon a pump frame 129 attached to the main frame 1 of the machine and is provided with a plunger 130 operatively connected with a hand lever 131. A tube 132 connects with a fluid supply reservoir 133 mounted upon the pump frame 129, and suitable valves not shown in the drawing, control the flow of the fluid in the manner common in pump practice. Mounted upon the frame 129 is a suction pump 134 having a suction inlet 135 connected with the tube 126 by a two way cock 136, and a discharge outlet connection 137 connected to discharge into the supply tank 133. The suction pump 134 has a plunger 138 provided with a stirrup handle 139 convenient to the operator and is provided with the necessary pump valves to control the flow of fluid. When it is desired to actuate one of the hydraulic jacks to break the coal, the handle 140 of the cock 136 is turned to connect the pressure pump 127 with the cylinder 120 of the desired jack, and the hand lever 131 is moved to force the fluid from the reservoir 133 to the cylinder 120 to move the plunger 121 outwardly. The faces 141 and 142 of the jack come into forceful engagement with the coal at each side of the kerf to exert a pushing effort which breaks the coal between the parallel vertical kerfs from the main body of the coal. While breaking down jacks are provided on both shearing cutter frames the cock 136 is arranged to control the flow of fluid into either or both jacks. In practice pressure is applied to only one side of a block of coal the kerf at the opposite side affording a sufficient clearance for the movement necessary to dislodge said block from the main body of the coal. It has been found in practice that when such pressure is applied to the coal the natural cleavages of the coal open up and the fragments falling to the main conveyor are of sizes suitable for handling.

After the coal has been broken down the handle 140 of the cock 136 is turned to connect the tube 126 with the suction pump 134 which is of such capacity that a single upward stroke of its plunger 138 removes the fluid from the cylinder 120 to retract the plunger 121. The use of an auxiliary suction pump 134 to retract the plunger 121 is made necessary by the tendency of the packing washer 122 to leak air during the suction action when produced by the slow acting pressure pump 127.

143 is a flexible electric conductor leading from the controller 144 from which current is supplied to the motor 75. A branch conductor 145 supplies current to the motor which operates the swinging conveyor E.

The pull back rope 60 is used to move the machine bodily from place to place. When so used the rope is detached from the hook 64 and a sufficient amount is unwound to permit it to be attached to a jack or other stationary object or to be passed around the pulleys on jacks such as those indicated at 146 and 147.

At 148 as shown in Figs. 2 and 6 holes are provided for the attachment of hooks such as that indicated by 149. By means of such a hook the rope 60 can be attached to the front end of the machines or to other parts.

In operating the machine it is first placed in position near one rib, preferably the left, of a room as indicated in Fig. 11. Preferably the forward end of the machine is inclined outward away from the room axis. The main motor 75 is then started and by means of the power transmitting devices which have been described the under-cutting and shearing cutter chains are started. The main and slack conveyors are started. A pit car 44 is suitably placed on a track in the center of the room, and the swinging conveyor is laterally adjusted to bring the discharge end over the car and started.

The operator by turning one of the hand wheels 74 throws in the clutch which drives the drum 54 for the feed rope 53, and the whole mechanism is caused to advance bodily with respect to the pan 2, the cutters 5 forming a horizontal kerf and the cutters 23 forming parallel vertical kerfs. At the same time the front end of the main conveyor is carried into the kerf formed by the cutters 5. When the cutters have been advanced a suitable distance the pump is operated to energize the jack C to break down the coal which falls upon the conveyor D and is carried rearwardly to the car 44. The cutting, breaking down and carrying away of the coal continued in the manner described until the mechanism reached the extreme limit of its forward movement, when the feeding mechanism is disconnected. The operator then throws the hand wheel 74 in the other direction and connects the drum 61 for winding the pull back rope 60, to retract the mechanism. The machine is then ready to be moved to a new position. To accomplish this the rope 60 is arranged, as shown in Figs. 11, 12 and 13 it being passed over pulleys secured to jacks 146 and 147 and secured at its outer end to the forward end of the pan 2. The drum 61 is then set in motion and the rope is wound, the result being that the machine is pulled laterally into the position shown in Fig. 13. It is then ready in position to again be operated in the manner before described. This series of operations can be repeated until the machine reaches the position shown in Figs. 14 and 15 in which it is inclined oppositely from the position in Fig. 11. This

outward inclining of the machine serves to keep the width of the room substantially constant as the machine advances.

When the last cut is finished the jacks 150 are set near the face of the coal on the free side of the machine. The rope 60 is then transferred to the other side of the machine and carried forward over a snatch block 151 attached to the forward corner of the pan. The drum 61 is then set in motion and the whole machine is moved bodily forward into position for another cut. The cuts of the next series are taken from right to left instead of from left to right. As soon as this series of cuts is completed the machine will be back in a position such as indicated in Fig. 11 and the whole cycle of operation can be repeated.

It will be understood that use may be made in handling the machine of jacks, skids, rails etc., such as may be necessary to meet local conditions. The use of such devices is well understood by mine engineers, and mine operators and a detailed description is unnecessary.

What I claim is:

1. In a machine of the class described, the combination of a kerf cutter adapted to form a kerf in a mine wall spaced from a free face of the coal, with means carried by the kerf cutter adapted to exert pressure towards said free face to dislodge the coal, and means to control the actuation of the pressure exerting means.

2. In a machine of the class described, the combination of a plurality of kerf cutters adapted to simultaneously form kerfs in a coal face, with means carried by the kerf cutters adapted to exert pressure transversely of either of the kerfs to dislodge the coal, and means to control the actuation of the pressure exerting means.

3. In a machine of the class described, the combination of a kerf cutter adapted to form a kerf in a mine wall spaced from a free face of the coal, with hydrostatically actuated means carried by the kerf cutter to exert pressure towards said free face to dislodge the coal, and means to control the actuation of the pressure exerting means.

4. In a machine of the class described, the combination of a plurality of kerf cutters adapted to simultaneously form kerfs in a coal face with hydrostatically actuated means carried by the kerf cutters to exert pressure transversely of the kerfs to dislodge the coal, and means to control the actuation of either of the pressure exerting means.

5. In a machine of the class described, the combination of a kerf cutter adapted to form a vertical kerf in a mine wall spaced from a free face of the coal, with means carried by the kerf cutter adapted to exert pressure towards said free face to dislodge the coal, and means to control the actuation of the pressure exerting means.

6. In a machine of the class described, the combination of kerf cutters adapted to simultaneously form horizontal and vertical kerfs in a mine wall spaced from a free face of the coal, with means carried by the vertical kerf cutter adapted to exert pressure towards said free face to dislodge the coal, and means to control the actuation of the pressure exerting means.

7. In a machine of the class described, the combination of kerf cutters adapted to simultaneously form horizontal and vertical kerfs in a coal face, with hydrostatically actuated breaking down means carried by the vetrical kerf cutter adapted to exert pressure transversely of the kerf to dislodge the coal, and means to control the actuation of the pressure exerting means.

8. In a machine of the class described, the combination of kerf cutters adapted to simultaneously form horizontal and vertical kerfs in a coal face, with hydrostatically actuated breaking down means carried by the vertical kerf cutter adapted to exert pressure transversely of the kerf to dislodge the coal, and a source of hydrostatic pressure within the control of the operator to actuate the pressure exerting means.

9. In a machine of the class described, the combination of means to form a vertical kerf in a mine wall spaced from a free face of the coal, with breaking down means adapted to enter the vertical kerf with said kerf forming means to exert pressure towards said free face to dislodge the coal, and means to control the actuation of the pressure exerting means.

10. In a machine of the class described, the combination of means to simultaneously form horizontal and vertical kerfs in a coal face with breaking down means mounted on the kerf-cutting means and arranged to travel therewith into a vertical kerf while it is being formed and to exert pressure transversely of the kerf to dislodge the coal, and manual means outside of the coal to control the actuation of the breaking down means.

11. In a machine of the class described the combination of means to simultaneously form horizontal and vertical kerfs in a coal face, with breaking down means carried by said cutting means into the vertical kerfs to exert pressure transversely of the kerf to dislodge the coal, and means to control the actuation of the breaking down means.

In testimony whereof I affix my signature.

NILS D. LEVIN.