Dec. 31, 1946. N. D. LEVIN 2,413,508

MINING LOADING MACHINE

Original Filed Oct. 22, 1937 4 Sheets-Sheet 1

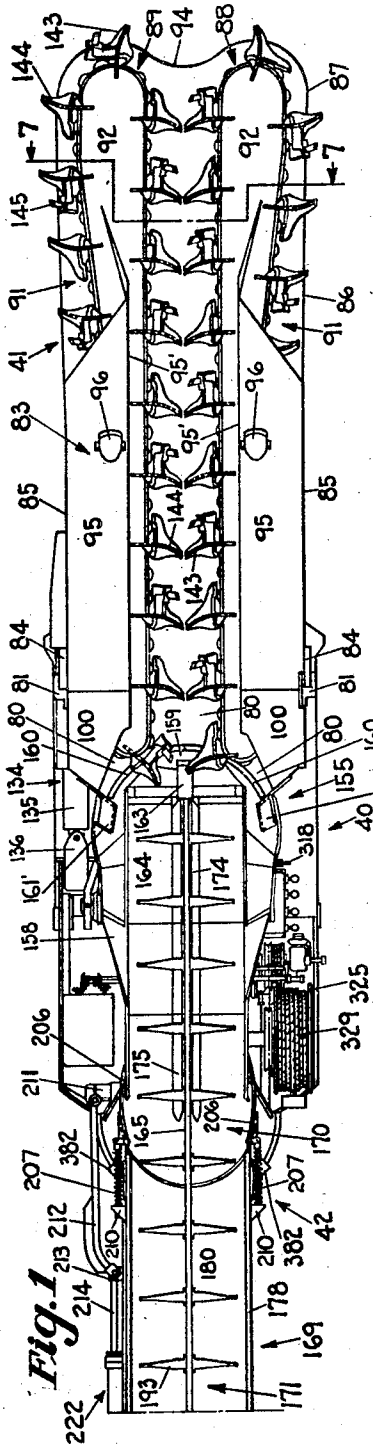


Fig. 1

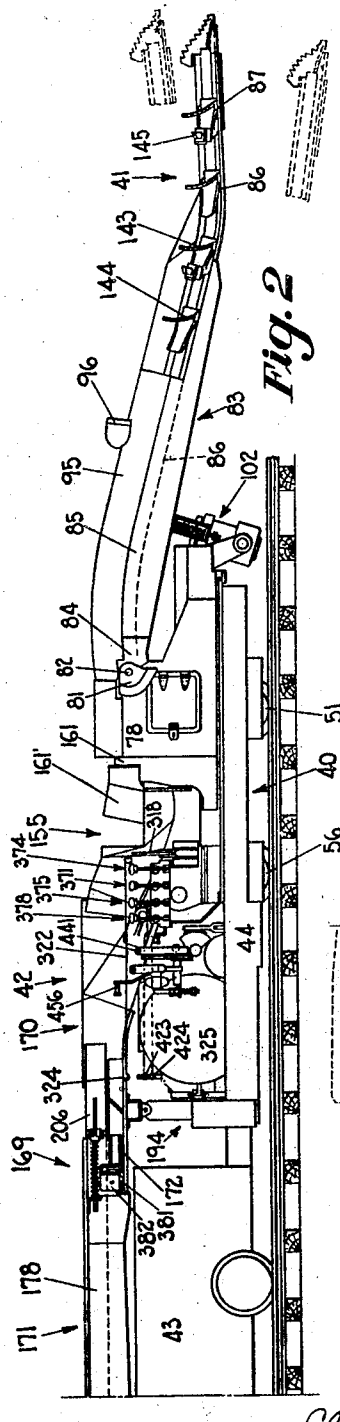


Fig. 2

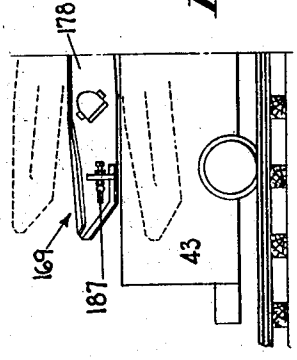


Fig. 3

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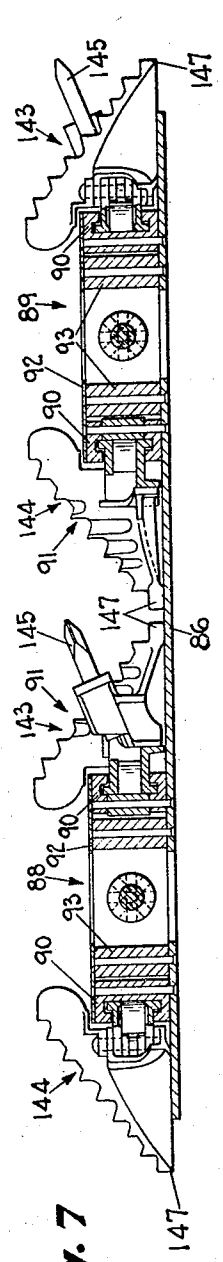


Fig. 7

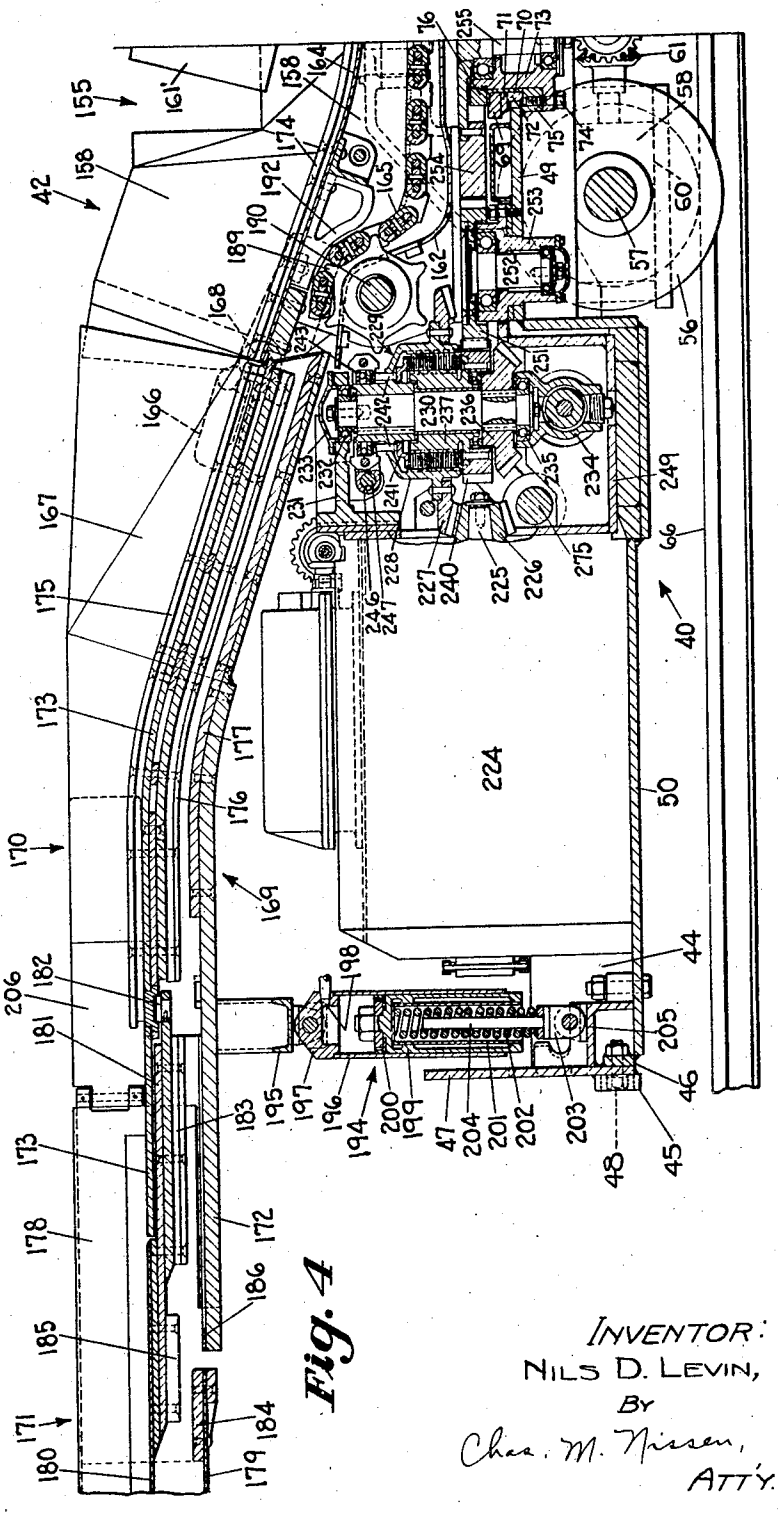


Fig. 4

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Original Filed Oct. 22, 1937 4 Sheets-Sheet 3

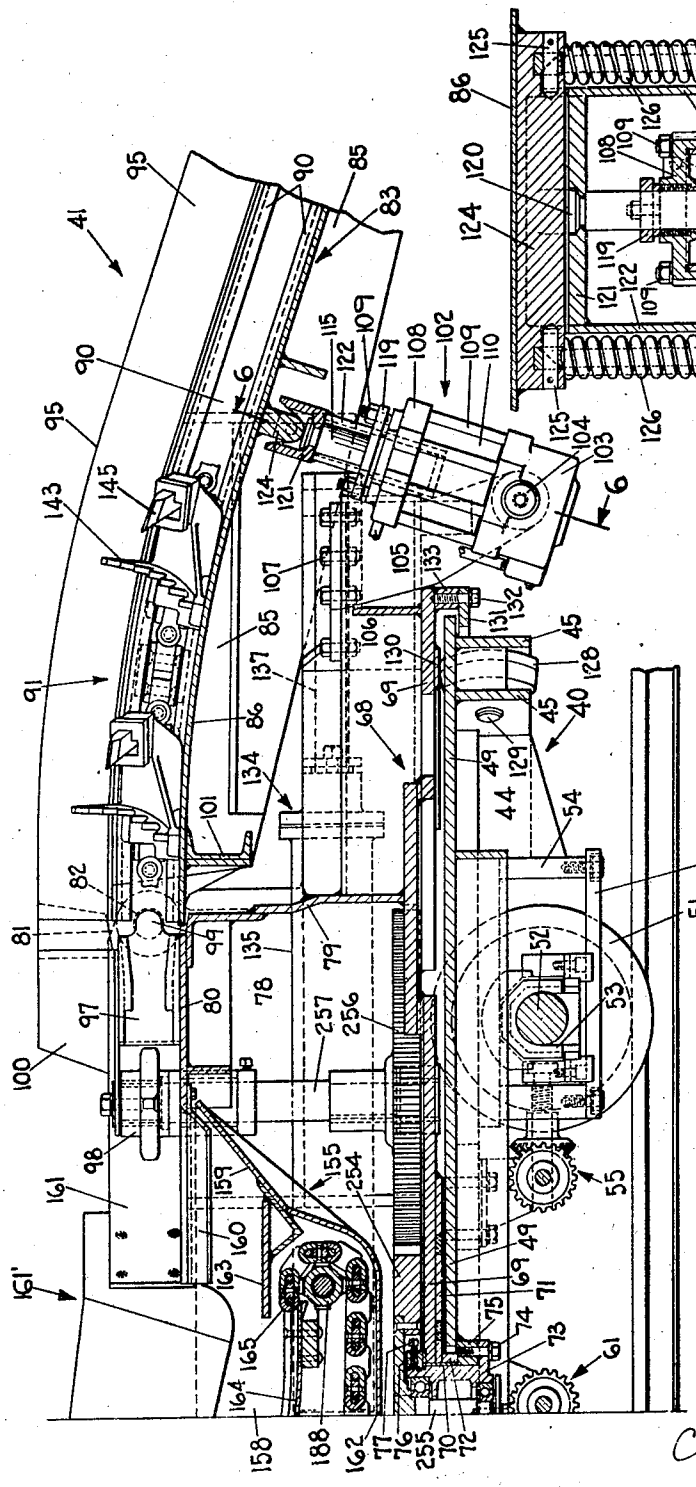


Fig. 5

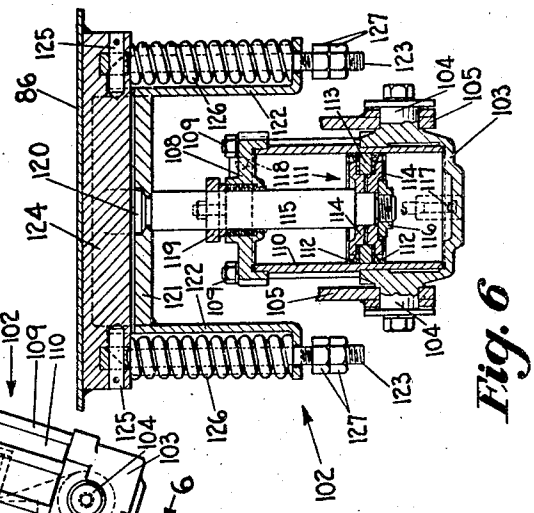


Fig. 6

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MINING LOADING MACHINE

Original Filed Oct. 22, 1937 4 Sheets-Sheet 4

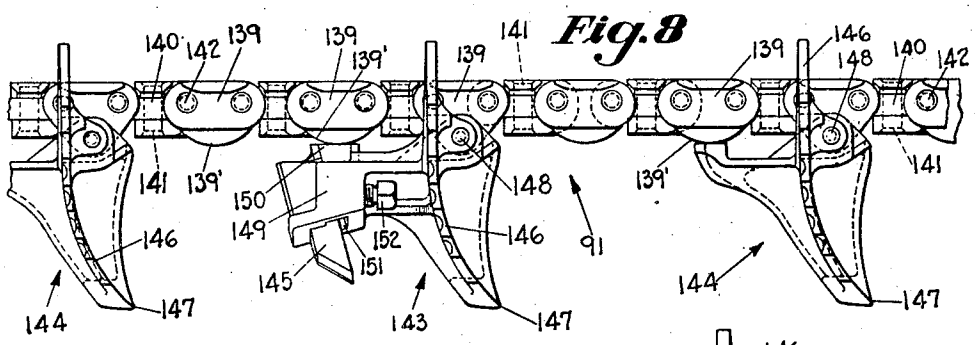


Fig. 8

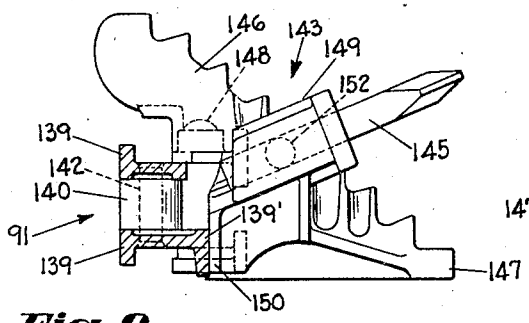


Fig. 9

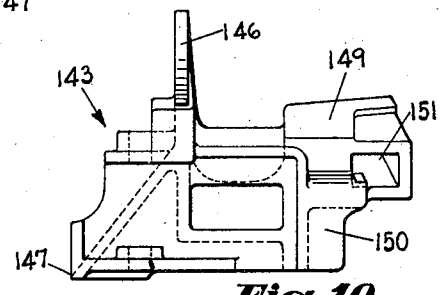


Fig. 10

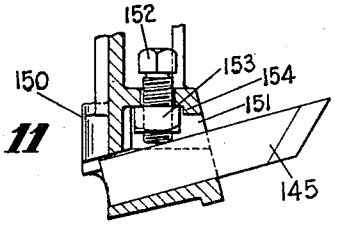


Fig. 11

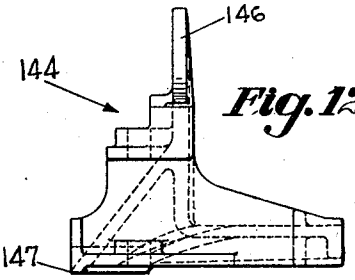


Fig. 12

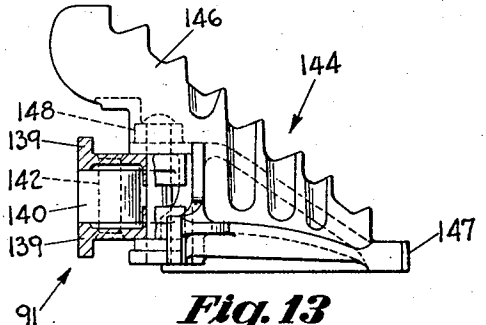


Fig. 13

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Patented Dec. 31, 1946 2,413,508

UNITED STATES PATENT OFFICE

2,413,508

MINING LOADING MACHINE

Nils D. Levin, Columbus, Ohio, assignor, by mesne assignments, to The Jeffrey Manufacturing Company, a corporation of Ohio

Original application October 22, 1937, Serial No. 170,426. Divided and this application October 22, 1943, Serial No. 507,315

11 Claims. (Cl. 198—11)

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This invention relates to a mining loading machine and more particularly to a frontal attack type of machine adapted to break down coal particularly when in a semi-compact state after being shot and to load it into a mine car in a continuous operation.

An object of the invention therefore is to produce a machine of the above mentioned type.

A further object of the invention is to provide a machine which is fundamentally and primarily a loading machine but which is so constructed as to be able to dig into loose or semi-compact coal.

A further object of the invention is to provide an improved machine of the above mentioned type in which there is gathering mechanism including gathering chains which carry bits adapted to dig under a mass of coal and tear the coal loose so that the coal above the bits will fall forwardly of itself and be conveyed rearwardly of the machine.

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 is a plan view of the loading machine comprising my invention with the swinging boom of the discharge conveyor cut short;

Figs. 2 and 3 placed end to end comprise a side elevational view of the device of Fig. 1;

Fig. 4 is a vertical longitudinal sectional view of the loader comprising my invention showing particularly the rear end portion thereof;

Fig. 5 comprises an extension of Fig. 4 and shows the operating mechanism for the forward end of the device, the extreme forward end of the gathering conveyor being cut off;

Fig. 6 is a sectional view taken along the line 6—6 of Fig. 5 looking in the direction of the arrows;

Fig. 7 is a transverse sectional view taken along the line 7—7 of Fig. 1 looking in the direction of the arrows;

Fig. 8 is a plan view of a portion of the continuous chain and connected flights of the gathering conveyor;

Fig. 9 is a rear elevational view of the conveyor flight showing the conveyor chain in section;

Fig. 10 is a side elevational view of the flight showing particularly the side attached to and adjacent the conveyor chain;

Fig. 11 is a detail sectional view showing the mounting of removable bits or picks carried by the flight;

Fig. 12 is a side view of a form of conveyor flight which does not carry a bit or pick, showing the side adjacent and attached to the chain; and

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Fig. 13 is a rear view of the flight of Fig. 12.

This application is a division of my co-pending application Serial No. 170,426, filed October 22, 1937, for an improvement in a Loading machine.

As illustrated generally in Figs. 1, 2 and 3 of the drawings, the loading machine comprising my invention is primarily a frontal attack machine but provision is made whereby a gathering conveyor cannot become wedged into the material being loaded in that the attack is not confined to a frontal attack but also includes a lateral attack at both sides of the forward end of the gathering conveyor.

The said loading machine comprises a track mounted truck 40 upon which is mounted a gathering conveyor 41 and a discharge conveyor 42, the former being adapted to dig into and gather loose or semi-compact coal and to convey it to the latter by which it is discharged into track mounted coal cars, one of which is illustrated at 43 (Figs. 2 and 3).

As will be hereinafter described in complete detail, power means is provided to tram the loading machine along the mine tracks at a relatively fast speed, and to operate it along said tracks at a feeding or operating speed while at the same time operating the gathering and discharge conveyors to gather and load coal into coal cars 43.

As best seen by reference to Figs. 2, 4 and 5, the truck 40 comprises a main frame formed by longitudinally extending side members 44 rigidly attached together at their forward ends by an arcuate front cross-piece formed by spaced members 45, preferably welded to the side members 44 and rigidly attached at their rear ends, as by welding, to an arcuate cross-piece 46 (Fig. 4) having removably attached thereto an arcuate bumper plate 47 held in place by nuts and bolts 48.

Adjacent its forward end, the main frame comprises a bed plate 49 (Fig. 5) rigidly attached to the tops of the side members 44 and front cross-pieces 45, as by welding. The gathering conveyor 41 and the drive means therefor are supported from this bed plate 49, as will be hereinafter explained in complete detail.

Adjacent its rear end, the main frame is provided with a bed plate 50 (Fig. 4) which is rigidly attached to the bottoms of the side members 44 and the rear cross-piece 46. The bed plate 50 supports the single drive motor 224 which drives all of the apparatus on the loading machine, as

hereinafter described in full detail, and supports most of the gear mechanism for controlling said loading machine.

As best seen in Figs. 4 and 5 of the drawings, the truck 40 is mounted upon a pair of forward track engaging flanged wheels 51, 51 keyed on axle 52 which is journaled in adjustable bearing boxes 53, 53 slidably supported upon guideways 54, 54. Gearing mechanism 55 is provided for adjusting the bearing boxes 53, 53 in unison longitudinally along the guideways 54, 54 from a convenient position adjacent the side of the truck 40. The truck 40 is also provided with rearward track engaging flanged wheels 56, 56 mounted upon axle 57 journaled in bearing boxes 58, 58 slidable longitudinally in guideways 60, 60. Gearing mechanism 61 readily accessible from the side of the truck 40 is provided for adjusting the bearing boxes 58, 58 longitudinally in unison along the guideways 60.

The axles 52 and 57 are provided with sprockets which are connected together by a continuous chain to insure their movement in unison. Axle 57 also carries a drive sprocket by which it is driven, as described in full detail in the above mentioned patent application. It is thus evident that driving power will be applied to all of the track engaging wheels 51, 51 and 56, 56.

The construction of the gathering conveyor 41 is best seen by reference to Figs. 1, 2, 4, 5 and 7 of the drawings and comprises a turntable 68 formed by a bottom plate 69 provided at its rear end with a circular opening adapted to receive a journal bearing 70 (see Figs. 4 and 5) which is reinforced by a plate 71 and a ring 72, all rigidly attached together, as by welding. The journal bearing 70 is journaled to a casting 73 which is removably attached to the front bed plate 49 by virtue of screws 74 which thread into a ring 75 welded to the bottom of said front bed plate 49, as clearly seen in Figs. 4 and 5 of the drawings. It is thus evident that the turntable 68 is journaled to the truck 40 about an upright axis provided by the casting 73 thereby providing for lateral swinging movement of the gathering conveyor 41.

It will be evident that the thrusts received by the gathering conveyor 41 will be translated to the truck 40 through the casting 73 and thus this casting and the journal bearing 70 associated therewith is made of very rugged construction.

As clearly illustrated in Figs. 4 and 5 of the drawings, the bottom plate 69 is removably attached to the casting 73 by a threaded ring 76 threaded to the top of said casting 73 and held locked by a set screw 77.

The turntable 68 also includes upright side plates 78 and an intermediate front plate 79 which cooperate to support a top plate 80, which plates cooperate to provide a gearing housing and support, as hereinafter explained in full detail.

As best seen in Figs. 1 and 2 of the drawings, side plates 78 of the turntable 68 carry side brackets 81, 81 provided with pivot pins 82 upon which is pivoted the gathering boom 83 of the gathering conveyor 41 by means of brackets 84, 84 having apertures to receive the pins 82, which brackets 84, 84 are welded rigid with side members 85, 85 of said gathering boom 83. It will be evident that the boom 83 is swingable with respect to the turntable 68 about a horizontal axis provided by the pivot pins 82. The gathering boom 83 comprises a bottom plate 86 welded to a cross channel 101 which said bottom plate 86 is welded rigid with the side members 85, 85 and, at its rear end, is substantially parallel with, and forms an extension of the top plate 80 of tuntable 68.

As clearly illustrated in Fig. 2 of the drawings, the bottom plate 86 is provided with a flat working portion 87 adjacent its forward end which lies in a plane forming an angle with the plane of the major portion of said bottom plate 86, said two plates being connected by a smooth curve. In other words, the bottom plate 86 is smoothly curved to form a working portion 87 at its forward end which is substantially horizontal thereof when at the mine floor, slightly sloping upwardly and rearwardly when the boom 83 is in its lowered position with the working portion 87 sliding over the floor of the mine. This construction is particularly desirable to the end that the bottom plate 86 may work under all of the coal during the attack on the shot-down or semi-compact mass of coal.

As best illustrated in Figs. 1 and 7 of the drawings, the bottom plate 86 carries a pair of laterally spaced gathering chain guides 88 and 89 forming a conveyor way between them and each formed by an outer grooved track member 90 grooved at its outer surface to receive the side bars and retaining gibs of the gathering conveyor chains designated generally 91, 91. That is, the track members 90 are provided with grooves and retaining flanges to keep the gathering conveyor chains 91, 91 in proper position. Cover plates 92, 92 extend between the opposite sides of each track member 90 to prevent any material accumulating therebetween. Reinforcing bars 93, 93 are provided inside each of the track members 90 and all of said members comprising bottom plate 86, track members 90, 90, cover plates 92 and reinforcing bars 93 are rigidly attached together by appropriate rivets.

As clearly illustrated in Fig. 1 of the drawings, the track members 90 extend substantially the full length of the gathering conveyor 41 and thus the gathering conveyor chains operate substantially throughout the entire length of said gathering conveyor. As a consequence, there is only one rehandling of the gathered material from the time it is first gathered by the gathering conveyor to the time it is discharged into the mine cars and this is during the time it is discharged from the gathering conveyor to the discharge conveyor.

It is furthermore to be noted by particular reference to Fig. 1, that the inner portions of the track members 90 are substantially parallel through the entire length. As a consequence, there is no progressive squeezing action on the coal being loaded which can produce undesirable stresses and strains.

As was previously pointed out, the width of the bottom plate 86 is substantially constant through the entire length but at the front end attacking portion thereof it is curved rearwardly as seen at 94, to provide for a maximum amount of coal contact of the flights of the gathering conveyor chains during operation.

It is also to be particularly noted that during the rearward portion of the travel of the conveyor chains 91 in their progress toward the front end of the gathering conveyor, the flights are spaced inwardly of the sides of the bottom plate 86 and are within the confines of the side members 85 which are provided with appropriate cover plates 95, 95 (Fig. 1) attached to inner side wall cover plates 95', 95' (see Fig. 5). However, adjacent the forward end of the gathering conveyor 41 the cover plates 95, 95 and the side members 85 are cut away and the outside track members 90 di-

verge progressively as the front end is approached. As a consequence, the flights of the gathering conveyor chains 91 progressively move laterally beyond the edges of the bottom plate 86 adjacent the flat working portion 87 thereof. These flights also, in moving around the front curved ends of the guide members 90, extend beyond the front extremity of the curved portion 94 of the bottom plate 86 to dig into, break down and gather the coal either in shot-down condition or in a semi-compact mass. This operation is described in more complete detail hereinafter.

As clearly illustrated in Fig. 1 of the drawings, I also preferably provide a pair of electric lights 96, 96 on the gathering conveyor 41 to illuminate the material being worked.

Since the gathering boom 83 of the gathering conveyor 41 is pivoted about a horizontal axis 82 with respect to the turntable 68 of said gathering conveyor 41, it is, of course, evident that the track members 90 must be broken at this pivot point. As illustrated in Fig. 5 of the drawings, an extension for the track members 90 is provided at 97 to guide the conveyor chain 91 in its movement over the turntable 68. The extensions 97, of which there will be one for each of the two gathering conveyor chains, provide guide paths on each side thereof leading both to and from drive sprockets 98 for which there will be one for each of the chains 91, 91. The extensions 97 will, of course, terminate the guide track for the chains 91, 91 adjacent the drive sprockets 98, 98.

Each of said extensions 97, 97 is provided with a rounded nose 99 (Fig. 5) adapted to extend into a pocket in the frame of the boom 83 and slightly spaced therefrom. This, of course, permits limited movement of the boom 83 about the horizontal axis provided by the pins 82, 82. It is also to be noted that protecting cover plates 100 are provided adjacent and above the top plate 89 of the turntable 68, which cover plates 100 overlap the cover plates 95 (Fig. 5).

To provide for the vertical swinging movement of the boom 83 about the axis of pivot pins 82 I provide a double acting type of hydraulic piston motor mechanism best seen in Figs. 5 and 6 of the drawings and designated generally by the character 102. Said piston motor mechanism 102 comprises a bottom head casting 103 provided with trunnions 104 by which it is pivotally mounted upon a bracket formed by spaced plates 105, 105 rigidly but removably attached to frame members 106, 106 of the turntable 68 by nuts and bolts 107, 107.

Clamped rigidly between the head casting 103 and a piston rod receiving cylindrical head 108 by a plurality of elongated clamp bolts 109, provided with appropriate nuts, is a cylinder 110. Within the cylinder 110 is a piston 111 formed by a pair of opposed sealing rings 112, 112 preferably made of leather or a composition to effect a perfect seal and carried upon a ring 113 and clamped between clamp plates 114 clamped rigidly to a piston rod 115 by a keyed nut 116. The head casting 103 is provided with an inlet port 117 and the cylinder head 108 is provided with an inlet port 118. The piston rod 115 extends through an appropriate opening in the cylinder head 108 provided with an appropriate packing gland or stuffing box 119. It will be evident that fluid under pressure may be admitted either above or below the piston 111 to move it either upwardly or downwardly.

As described in complete detail in the above mentioned parent application, the piston 111 may also be sealed and locked in any adjusted position. The upper end of the piston rod 115 is provided with an upset head 120 received fixedly but loosely in a channeled cross member 121 provided at its opposite ends with downwardly extending L-shaped hanger plates 122, 122 forming a yoke. The connection between the head 120 and the cross member 121 permits relative movement between them while insuring their attachment together.

The hanger plates 122, 122 have their horizontal portions provided with apertures through which extend rods 123, 123 pivotally attached at their tops by pins 125, 125 to a transversely extending bar 124 welded rigidly with the bottom plate 86 of the boom 83. Between the horizontal portions of said hanger plates 122, 122, I provide compression coil springs 126, 126. The bottom ends of the rods 123, 123 are threaded and receive adjusting and lock nuts 127, 127.

It will be evident, particularly by reference to Fig. 6 of the drawings, that the boom 83 is supported upon coil springs 126, 126. When the loading machine, with the gathering conveyor 41 elevated, travels along the track about the same weight is carried on the axles 52 and 57. When at the face, the front end of the gathering conveyor 41 is lowered until it rests on the mine floor. This takes a great amount of weight off the front axle and, except for springs 126, 126, would throw the machine out of balance to such an extent that the front wheels 51, 51 might raise off the track and derail the machine. Also, sometimes the front end of the gathering conveyor 41 climbs up a roll in the mine bottom. The springs 126, 126 insure sufficient load on front wheels 51, 51 to keep them on the track rails under all normal conditions and prevent derailment.

By reference particularly to Fig. 5 of the drawings, it will be seen that adjacent the forward end of the truck 40 and extending upwardly through the front bed plate 49 thereof, is a plurality of rollers 128 mounted upon stub shafts 129 carried by the spaced plates of the front crosspiece 45. These rollers 128 bear against an arcuate bearing plate 130 carried on the bottom plate 69 of the turntable 68 and thus provide an antifriction support for the front end of the turntable 68 of said truck 40. In other words, the turntable 68 will be supported upon the truck 40 by the journal bearing 70 and by the rollers 128 and bearing plate 130. To insure upward movement of the truck 40 in case the forward end of the gathering conveyor 41 is operated to return the front wheels 51 of the truck to the mine rails, I provide an arcuate lifting plate 131 (Fig. 5) which extends under the forward edge of the front bed plate 49 and is rigidly attached to the bottom plate 69 of the turntable 68 by screws 132 threaded in an arcuate spacer 133.

To provide for the swinging of the gathering conveyor 41 about the axis of casting 73 I provide a very simple and compact arrangement in the form of a hydraulic piston motor 134, best seen in Figs. 1 and 5 of the drawings, comprising a cylinder 135, pivotally attached at its rear end to a bracket 136 formed rigid with the main frame of the truck 40, and a piston carrying a rod 137 pivotally attached to a bracket formed rigid with the turntable 68 of the gathering conveyor 41. The piston motor 134 is of the double acting type. That is, it may be moved under power in reverse directions and with the system comprising my invention, may be locked in any adjusted position. It is to be noted that this

hydraulic piston motor is entirely within the confines of the loading machine truck 40 and thus does not increase the width of said machine. It is furthermore to be noted that it is highly protected and therefore cannot be easily damaged.

Attention is now directed particularly to Figs. 1, 2, 5 and 8 to 13, inclusive, and to the construction of the gathering conveyor chains 91 and the gathering flights which they carry. Each of said gathering chains 91 comprises a plurality of main links 139 formed by spaced retaining gib carrying side bars interconnected with a plurality of connecting links 140 formed in two parts which are pivotally connected about horizontal axes formed by pins 141. The main links and connecting links are pivotally attached together by pins 142. The pins 141 and 142 make a snug fit with the connecting parts whereby the chain will be relatively rigid except for movement about rectangularly disposed horizontal and upright axes provided by said pins 141 and 142. That is, each chain 91 will be free to pivot about a horizontal axis so that the chain can travel over the irregular surface of the bottom plate 86, and also free to pivot about a vertical axis so the chain can travel around the continuous generally orbital path provided by the track members 90. For any other movement the chain will be relatively rigid which is particularly desired in carrying out the rather heavy work required of the gathering chains 91.

As illustrated in Fig. 8 of the drawings, I pivotally attach to every sixth main link 139 a gathering flight 143 of the construction illustrated in detail in Figs. 9, 10 and 11 interspersed with alternate gathering flights 144 of the type illustrated in detail in Figs. 12 and 13 of the drawings. The essential difference between the gathering flights 143 and 144 lies in the fact that the former carry removable bits or picks 145 which are particularly effective to dig into and break down a semi-compact mass of material while the gathering flights 144 are devoid of such bits or picks.

Each of the gathering flights 143 comprises a body having an upstanding serrated rib or comb 146 which forms a scraping face and extends generally at right angles to the path of travel of the chain 91 with the free outer end concavely curved forward and terminating in a bottom point 147 which extends beyond the forward edge of plate 86 as it passes around it and rides rearwardly on said plate 86 during its return movement. The rib 146 progresses in height from a minimum adjacent the point 147 to a maximum adjacent the opposite side thereof where it terminates at a position on the opposite side of the chain 91. That is, the serrated rib 146 extends laterally from both side runs of the chain 91 to a position above said chain 91. As a consequence, there is a positive movement of material by the flights 143 over a very extensive area including the area above the chain 91. Each flight 143 is pivotally attached to a main link 139 by a pin 148 to permit pivotal movement with respect thereto. Extending rearwardly from the main body of the flight 143 is an arm 149 provided with an abutment 150 adapted to abut against a cam 139' on the following main link 139 and provided with a bit receiving socket 151 adapted to receive the bit or pick 145 which extends upwardly and outwardly in trailing relation to rib 146.

In view of the fact that the entire gathering flight 143, as well as the gathering flight 144, are made of a casting of extremely hard material, it is not possible to form threads in said flight and thus I provide a set screw 152 to hold the bit 145 in place, having in cooperation therewith a removable threaded nut 153. As a consequence, a receiving aperture for the set screw 152 is cast during the formation of the gathering flight 143.

To prevent rotation of the nut 153 a holding ledge 154 is provided adjacent one of the flat faces of the nut. As previously stated, the construction of the gathering flight 144 is substantially the same as that of the flight 143 except the socket 151 and the bit or pick 145 is eliminated. A detailed description of the gathering flights 144 appears unnecessary.

By referring to Figs. 8, 9 and 13, it will be seen that the lower leading edge of each of the flights 143 and 144 is curved when viewed in plan although such leading edge occupies a single plane when viewed in elevation because such edge of each of the flights 143 and 144 is a scraping edge adapted to slide along the bottom of the conveyor trough that is located between the adjacent lengths of the conveyor chains, as shown in Figs. 1 and 7. The upper serrated rib 146 is also curved as viewed in plan so that it will meet the outer end of the lower curved scraping edge at 147. It will thus be seen by referring to Fig. 8 that the gathering surface between the lower leading scraping edge and the upper serrated rib 146 is an approximately concave surface so that the flight has a wedge formation transversely thereof or parallel to the chain and also a wedge formation longitudinally of the flight to facilitate frontal attacks by moving the whole machine along the mine track.

The upward and lateral extensions of the serrated ribs not only increase the size of the V-shaped kerfs produced at the base of the standing shattered mass of coal but also serve as extensions of the gathering faces of the flights. The cover plates 95, 95 have inner side walls 95', 95', as shown in Fig. 1, these inner side walls being vertical and parallel and spaced from the edges of the trough along which the conveyor flights scrape, as shown in Fig. 7. The upper ends of the serrated ribs extend over the adjacent lengths of the conveyor chains to positions closely adjacent the inner side walls 95', 95' and therefore these extensions serve to scrape material along the top plates which cover the chains, as shown in Fig. 7. It will thus be seen that when the flights move along in closely adjacent pairs 143, 144, as shown in Fig. 1, the scraping and flight actions for transferring material extend entirely across the space between the vertical parallel inner side walls 95', 95'. Such arrangement serves to materially increase the capacity of the pair of endless gathering conveyors.

As clearly seen by reference to Figs. 1 and 7 of the drawings, the opposite gathering conveyor chains 91 are so placed in operation that the bit carrying flights 143 of one conveyor chain 91 are directly opposite the free flights 144 of the other conveyor chain 91 during the movement of said conveyor chains 91 while conveying material from the front end of the gathering conveyor 41 to the rear end thereof. It has been found in practice that this is the best and most efficient arrangement of parts.

As clearly seen by reference to Fig. 7 of the drawings, there will be no binding of the conveyor chains 91 by coal particles because a pick or bit 145 on one chain 91 is never opposite a

bit or pick 145 on the opposite conveyor chain.

It will also be evident, particularly by reference to Fig. 7 of the drawings, that the inclining of the serrated ribs or combs of the flights 143 and 144 will prevent any binding due to the fact that large coal lumps will be moved upwardly and free themselves should any binding start to take place.

Attention is now directed particularly to the construction of the discharge conveyor 42 as illustrated in Figs. 1, 2, 3, 4 and 5. Said discharge conveyor 42 comprises three articulated parts including a stationary hopper 155 supported upon the front bed plate 49 of the truck 40 by spaced side brackets. The hopper 155 is removably attached to the side brackets by nuts and bolts. The hopper 155 comprises spaced side members 158 and a downwardly inclined rear chute 159 (Fig. 5) formed integral with said side plates 158. The chute 159 is adapted to receive coal as it discharges from the rear end of the gathering conveyor 41 over the top plate 80. A guiding arcuate apron 160 is carried by the top plate 80 in overlapping relation with the chute 159 to insure the proper reception of coal by said hopper 155 without any loss thereof. The chute 159 is of generally conical form thus permitting free rotation of the apron 160 with respect thereto.

It may also be pointed out that the side plates 78 of the turntable 68 have rearwardly extending deflector wings 161, 161 which extend over and partially into the arcuate chute 159 of the hopper 155 thus guiding the material discharged by the gathering conveyor 41 into the hopper 155 (Figs. 1 and 5). The hopper 155 is provided with a chain guiding bottom plate 162 (see Figs. 4 and 5) which is primarily adapted to guide the return flight of the conveyor chain associated with the discharge conveyor 42. A feed plate 163 is provided adjacent the forward end of the chute 159 in the hopper 155 and feeds the material onto a material supporting false bottom plate 164 of the hopper 155 over which bottom plate 164 the upper run of the flight carrying conveyor chain 165 of the discharge conveyor 42 travels to convey the coal rearwardly and discharge it onto the cars 43.

Pivotally attached to the hopper 155 by means of spaced side brackets 166, 166 (Fig. 4) carried by side members 167, 167 and journaled on pins 168, 168 is a discharge boom 169. It is evident that the boom 169 is pivoted about a horizontal axis formed by pins 168 for vertical swinging movement with respect to the hopper 155 and the truck 40. The discharge boom 169 is formed in two parts comprising the forward part 170 and the rearward part 171 which are pivotally attached about a vertical axis, the rearward part 171 being swingable horizontally about said vertical axis. The forward part 170 of the boom 169 comprises a bottom plate 172 which acts somewhat as a continuation of the bottom plate 162 of the hopper 155.

Positioned above the bottom plate 172 is a material supporting false bottom plate 173 which forms a continuation of the material supporting false bottom plate 164 of the hopper 155. Extending successively along the false bottom plates 164 and 173 is a pair of spaced guiding and retaining angle members 174 and 175, respectively. As clearly illustrated in Fig. 1 of the drawings, these angle members 174 and 175 cooperate with retaining gibs on the conveyor chain 165 to retain it in place while permitting longitudinal movement thereof, at the same time guiding it properly along the center of the troughway formed by the false bottom and side plates of the discharge conveyor 42.

Extending downwardly from the false bottom plate 173 and in alignment with the angle members 174, 174 I provide angle members 176 which form a guide and support for the return run of the chain 165 during its travel along the forward part 170 of discharge boom 169. Opposite the angle members 176 and carried on top of the bottom plate 172 is a wear strip 177 which also aids to support the return strand of the chain 165.

As clearly indicated by reference to Figs. 1 to 4 of the drawings, the rearward part 171 of the discharge boom 169 comprises spaced side plates 178, 178 between which extends a bottom plate 179 above which is positioned a material supporting false bottom plate 180 which is a continuation of the false bottom plate 173 and over which the conveyor chain 165 travels and conveys the material. The forward end of the rearward part 171 has attached to the false bottom plate 180 contacting plate means 181 which is pivotally attached by a pivot 182 to the rear end of the false bottom plate 173.

As clearly illustrated in Fig. 1 of the drawings, the rear end of the false bottom plate 173 and of the bottom plate 172 are formed on the arc of a circle, the center of which is along the axis of the pivot 182. Likewise, the forward end of the bottom plate 179 and the false bottom plate 180 are formed on the arcs of slightly larger circles than those of plates 172 and 173, respectively, whereby a continuous surface is provided in each case for any swinging position of the rearward part 171 of the discharge boom 169.

It is also to be noted by reference to Fig. 4 of the drawings, that angle members 183 are provided on the bottom of the plate member 181 to form a guide for the return strand of the chain 165 leading up to the pivot point provided by pivot 182.

Adjacent the break between the bottom plates 172 and 179 I provide a lower wear plate 184 on plate 179 and laterally spaced guide plates 185 on member 181. These plates 184 and 185 serve to guide and direct the return strand of the chain 165 so that their gibs enter the guideways of the angle members 183.

Adjacent the rearward arcuate end of the bottom plate 172 I provide an arcuate bearing plate 186 upon which rolls a pair of rollers 381 (see Fig. 2) carried at opposite sides of the front end of the rearward part 171 of discharge boom 169, by brackets 382, which, with the pivot 182, support the rear part 171 of the discharge boom 169. Adjacent its rearmost end the rearward part 171 will be provided with a centrally positioned discharge sprocket mounted upon an adjustable shaft 187 (see Fig. 3) upon which sprocket the conveyor chain 165 will ride. At the forward end of the discharge conveyor 42 (see Fig. 5) I provide within the hopper 155 a centrally disposed guide sprocket 188 for said chain 165.

To effect a driving of the chain 165 I provide a drive sprocket 189 (see Fig. 4) mounted on a shaft 190 by a hollow sleeve which shaft 190 is journaled in the rear end of the side members 158 of the hopper 155. To maintain the chain 165 in meshing relation with the drive sprocket 189 I provide a curved wear shoe 192 mounted on the false bottom plate 164.

As clearly illustrated in Fig. 1 of the drawings, the chain 165 carries a plurality of spaced flights 193 which, during the upper run of the chain

165 are adapted to scrape over the false bottom plates 164, 173 and 180 successively thereby to convey material rearwardly from the hopper 155 and discharge it into the cars 43.

As clearly illustrated in Figs. 2 and 4 of the drawings, the means for swinging the discharge boom 169 about the horizontal axis provided by the pins 168, comprises a single acting hydraulic piston motor mechanism 194 comprising a bracket 195 rigidly attached to the bottom of the bottom plate 172 to which is pivotally attached a cylinder 196 having a head 197 provided with an appropriate inlet port 198 within which cylinder extends a cylindrical piston 199 provided at its top with a clamped leather or compound sealing ring 200 which makes a leak-proof sliding fit, within which cylindrical piston 199 is a guide cylinder 201 within which extends a coil spring 202 mounted upon a pivoted coupling member 203 having an upstanding guide rod 204 which extends into the coil spring 202 and into the guide cylinder 201, the coupling member 203 being pivotally attached to a bracket 205 formed integral with the rear bed plate 50 and the bumper plate 47 of the truck 40.

It is evident that the coil springs 202 will provide a flexible support for the discharge boom 169 for any position of adjustment thereof, thus relieving any strain caused by a large lump of coal on the boom striking the top of the mine roof or for any other similar cause. The guide rod 204 provides a guide and retaining means for the coil spring 202.

It will be evident that by admitting fluid under pressure to the port 198 or discharging it by said port, the piston 199 may be adjusted in the cylinder 196 to expand or contract the hydraulic piston motor mechanism 194 thus swinging the discharge boom 169 about the horizontal axis provided by the pins 168. By locking the fluid in the cylinder 196, as hereinafter described, the boom 169 may be locked in any elevated position.

Attention is now directed particularly to Figs. 1, 2 and 3 of the drawings, and to the construction of the means for swinging the rearward part 171 of the discharge boom 169 with respect to the forward part 170 thereof. It may be mentioned that to provide continuous side walls for the discharge conveyor 42 for any position of adjustment of the rearward part 171 with respect to the forward part 170, each of the side plates 178 carries a pivoted arcuate extension side plate 206, the free end of which is urged into contacting relation with the side plate 167 by a coil spring 207 coiled about an extensible rod pivoted at one end to a bracket rigid with the plate 206 and extending through a bracket 210 formed rigid with the side plate 178. As the rearward part 171 of the boom 169 swings about the axis of pin 182, the free end of the plate 206 will move forwardly and rearwardly in contacting relation with the side member 167 thus forming continuous sides for the discharge boom 42.

To cause swinging movement of the rearward part 171 of the boom 169, with respect to the forward part 170 thereof about the axis of pin 182 (Fig. 4), I provide a bracket 211 formed rigid with the bottom plate 172. Pivotally attached to bracket 211 is a rod 212 the rear end of which is pivoted to a sliding head 213 of a hydraulic piston motor 222. Said hydraulic piston motor 222 comprises a cylinder rigidly attached to a side plate of rearward part 171 of discharge boom 169 within which is a piston attached to a piston rod 214.

It is evident that upon operation of the hydraulic piston motor 222 the rearward part 171 of discharge boom 169 will swing about the axis of pin 182. The motor 222 may be locked in any desired position of adjustment to lock the rearward part 171 of discharge boom 169 in position. In actual practice this angle of swing is made approximately eighty degrees. It may also be mentioned that the angle of swing of the gathering conveyor 41 is also approximately eighty degrees.

This ability to swing the discharge boom by fluid pressure motor operated mechanism provides for the loading of cars on tracks adjacent the track which supports the loading machine and, in addition, provides for the loading of cars while the loading machine is on a curved track. It is also useful in traveling around curves while tramming the loading machine to an operating position.

Attention is now directed particularly to Figs. 4 and 5, and to the drive means for the various devices to be driven. At the outset it may be stated that only a single or common electric motor 224 is relied upon as the primary source of power to effect a driving of all of the devices of the loading machine. Said electric motor 224 is mounted upon the rear bed plate 50 of the truck 40 and compactly positioned below the discharge conveyor 42 which extends upwardly and rearwardly from the hopper 155. Due to this positioning of the electric motor 224 it is possible to provide a very large and powerful motor which is capable of effecting any and all of the drives required at any time while maintaining a machine of low height to permit its use in a relatively low head coal mine. Said electric motor 224 is provided with a forwardly extending armature shaft 225 (see Fig. 4) carrying a drive pinion 226 meshing with a bevel ring gear 227 which is rigidly attached to the housing 228 of a friction clutch mechanism 229. The housing 228 is keyed to a vertical shaft 230 which is mounted at its top in a bracket 231 rigidly attached to the main frame of the truck 40, there being an anti-friction ball bearing 232 interposed between the bracket 231 and the shaft 230 which is held in place by a removable cap 233. The bottom of the shaft 230 is supported in a bracket 234 formed rigid with the bottom plate 50, said support being through an anti-friction ball bearing 235. Keyed to the lower end of the shaft 230 and above the bearing 235, is a bevel gear 236. It may thus be noted that the gear 227 and the gear 236 being both keyed to the shaft 230, will be driven together at all times from the motor 224.

Journaled loosely on the central portion of the shaft 230 is a clutch member 237. Splined on the interior of the housing 228 and on the exterior of the clutch member 237, which members 228 and 237 comprise cooperating clutch members, is a plurality of overlapping stacked friction plates alternate ones of which are connected to the housing 228 and the clutch member 237, respectively. Adjacent its bottom the clutch member 237 is provided with an integral extended flange to which is keyed a gear 240. The flange, in addition to supporting the gear 240, also acts as one compression member for the friction clutch plates.

To effect a compression of the clutch plates and thus to effect an engagement of the clutch elements 228 and 237, I provide a compression ring 241 within the housing 228 having a flange which bears against said clutch plates. Downward

movement of the ring 241 to effect the aforementioned compression action is effected by a plurality of pins 242 which extend through apertures in the housing 228 and are carried by a ring 243 operable through an anti-friction ball bearing operable by a trunnion collar which is controlled by a shipper 246 keyed on a shaft 247 which shaft 247 is journaled at one end in an upwardly extending plate rigidly attached to a false bottom plate 249 which, in turn, is rigidly attached to the main frame of the truck 40.

It will be evident that rocking movement of the shaft 247 to urge the collar downward will cause an application of the friction clutch 229 to drive the gear 240 and when the shaft 247 is released the clutch 229 will automatically become disengaged due to lack of sufficient clamping pressure on the clutch plates.

It may be stated that the gear 240 which is controlled by the clutch 229 is individual to a gear train for driving the gathering conveyor chains 91. This gear train will now be described with particular reference to Figs. 4 and 5. The gear 240 meshes with idler gear 251 mounted upon an anti-friction supported shaft 252 journaled in a cup 253 rigidly and removably attached to front bed plate 49, which gear 251 in turn meshes with a large gear 254 carried by a shaft 255 on anti-friction bearings in the previously described casting 73.

It is to be particularly noted that since the vertical axis about which the gathering conveyor 41 swings is along the axis of the shaft 255, power can be transmitted to said gathering conveyor through the gear 254 while the gathering conveyor is in any desired position of adjustment. The large gear 254 meshes with one of a pair of inter-meshing large gears 256, 256 which are journaled in the bottom plate 69 and top plate 80 of the turntable 68 and which drive the previously mentioned sprockets 98, 98 through shafts 257, 257. It is thus seen that the two drive sprockets 98 are driven in reverse directions and at the same speed, thereby to drive the gathering chains 91, 91 at the same speed and in reverse directions, with the flights on one chain in fixed relation to the flights on the other chain.

The gear train which is operative to drive the truck 40 either forwardly or reversely and at either a fast tramming or transportation speed or at a low feeding or sumping speed is not completely disclosed herein as it forms no part of the invention herein claimed. It is disclosed in full detail in the parent application.

In the interest of clearness, many of the details of the loader which are disclosed in full in the parent application are not herein disclosed because they are not, per se, a part of the invention herein claimed. For example, the aforedescribed clutch operating shaft 247 is operated by a handle 456 (Fig. 2) adjacent an operator's station at one side of the machine, said handle being spring biased to clutch disengaging position.

In addition, there is a gear train between the beveled gear 236 (Fig. 4) and the truck axles 52 and 57 including a pair of alternately engageable clutches operable by a handle 441 (Fig. 2) to effect selectively reverse driving of the loader. This gear train also includes speed ratio varying gears so that the drive may be either at a tramming or at a working speed.

Still further, there is a gear train extending from said beveled gear 236 to transverse shaft 190 (Fig. 4) which drives chain 165 through sprocket 189 as above described. This gear train

includes a friction clutch operable by a lever 318 (Fig. 2) located adjacent the operator's station, from which extends a cable to a handle 324 adjacent a trip rider's station near the rear end of the loader, whereby both the loader operator and trip rider can control the operation of conveyor chain 165.

The loader is also provided with an electric feed cable 329 (Fig. 1) mounted on a power driven reel 325.

Also, the loader includes a hydraulic system having as a part thereof the four aforedescribed hydraulic piston motors 102, 134, 194 and 222. There is an individual control valve for each of these motors adjacent the operator's station. These four valves are seen at 371, 374, 375 and 378 in Fig. 2 of the drawings. The two valves 375 and 378 which control the swinging of part 171 of boom 169 are also operable from the trip rider's station by virtue of extensions to handles 423 and 424.

In the operation of the loader comprising my invention, it may be trammed along a trackway in a mine to the place where the loading operation is to take place. During this tramming operation the drive wheels of the truck will be driven at their fast speed and the electric cable will be paid out freely. The gathering conveyor will be elevated with its front end above the tracks and both the gathering and the discharge conveyors may be controlled by the operator who rides on a small platform on the truck 40 adjacent the above described controls, to swing said gathering and discharge conveyors, as required by the travel of the loader along a curved track.

When the loading machine has reached the place where the coal is to be loaded, which coal has been previously cut and shot, with part thereof formed as loose coal and part formed as a semi-compact mass, the driving gears will be changed to drive it at a slow or sumping speed. The operator will then adjust the gathering conveyor 41 and the discharge conveyor 42, the former by lowering it in contacting relation with the mine tracks or, if the first operation is to take place adjacent the side of the mine tracks to lower it into contact with the mine floor with the discharge conveyor 41 positioned to discharge into a mine car 43.

With the conveyor mechanisms of the discharge and gathering conveyors set into operation, and with the front end of the gathering unit resting on the mine floor in advance of the mine track, the entire machine may be fed forwardly providing a frontal attack of the gathering conveyor 41 on the coal at the bottom of the mass of material to be loaded. The flights 143 and 144 will dig into the loose or semi-compact coal and feed it to the gathering conveyor 41.

One special feature of operation of my device lies in the fact that the gathering flights 143 and 144 of the gathering conveyor 41 attack the coal at the same time and in opposite directions to secure a balancing effect, thereby reducing to a minimum any tendency for the loader to jump off the tracks during the operation of the gathering mechanism.

A further very important feature of the operation of the flights 143 and 144 also lies in the wedging action which they have due to the inclined serrated rib or comb 146. Due to this construction the flights tend to wedge under the coal, particularly when in a semi-compact mass, thereby breaking it down and at the same time providing a minimum of degredation due to the lack of

a striking action comparable with a hammer blow.

It may also be mentioned that a low degredation is realized with my loader due to the fact that there is only a single rehandling of the coal by the loader, namely, at the hopper 155. This, of course, is realized by virtue of the fact that the gathering conveyor unit comprises continuous gathering mechanisms which operate through substantially the entire length thereof.

It is also to be noted that due to the fact that flights 143 and 144 extend laterally over the opposite edges of the flat working portion 87 of the bottom plate 86 there is no tendency for the gathering conveyor to become wedged in the pile of coal, particularly when it is in the form of a semi-compact mass. Furthermore, a swinging or side attack on the coal may be carried out due to this particular construction. This is particularly useful in a final clean-up for, in general, I prefer to operate the device as a frontal attack loading machine.

The power transmission mechanism connected between the motor 224 and the pair of endless conveyor chains on the gathering device 41, comprises the gear 240 on the vertical shaft 230 of Fig. 4. The gear 240 meshes with the gear 251 which in turn meshes with the gear 254, and the latter is in mesh with one of the gears 256. Since the gears 256 mesh with each other, the flights of the gathering conveyor are in such fixed relation to each other that they travel in pairs, in opposite directions, as illustrated in Fig. 1. The starting and stopping of the pair of endless chains of the gathering conveyor are controlled by the clutch 229 shown in Fig. 4. During normal operation of the gathering conveyor the flights move in pairs towards the discharge conveyor 42 and therefore the motor 224 should be continuously operated in the same direction.

The hopper 155 is capable of storing coal when the discharge conveyor 42 is discontinued while changing mine cars. That is to say, the hopper 155 enables the gathering mechanism to be kept continuously in operation even when mine cars are being changed. The rear end of the gathering mechanism is extended to a relatively high elevation to efficiently deliver the gathered coal to the hopper.

Should a lump of coal get caught between the rear end portion of the gathering conveyor and the roof of the mine chamber, the crowding and wedging action will be downward against the upwardly extending serrations of the flights 143, 144 (Fig. 7) and against the points of the cutter bits 145, thereby effecting a crushing of the unusually large lumps of coal so that delivery of the coal to the discharge conveyor need not be interrupted. If there is an overload on the gathering conveyor chain 91 due to contact between flights 143 or 144 and solid or irremovable coal the friction clutch 229 will slip, whereupon the proper clutch will be operated to cause the machine to move rearwardly thereby causing the conveyor flights 143 and 144 to release the contacted coal and relieve the overload.

Under the control of the lever 374 shown in Fig. 2 the operator may control the swinging of the gathering conveyor on its pivotal connection at 255 to the truck frame 40, and during such swinging movement of the gathering conveyor its frame 68 rests at its forward end on the rollers 126, as shown in Fig. 5. A single reciprocating hydraulic motor 134, pivotally connected at its ends to the truck frame and the gathering conveyor frame, is relied on to swing the forward end of the gathering conveyor to various angular positions relative to the mine track. The gathering conveyor may be locked in its angular adjusted position when the loading machine is to be sumped or withdrawn rectilinearly parallel to the mine track, but it should be understood that the reciprocating hydraulic motor 134 is sufficiently powerful to swing the forward portion of the gathering conveyor in either direction for lateral attack on a semi-compact mass of shot down coal, and at various elevations illustrated in full and dotted lines in Fig. 2.

After a mine vein has been undercut and shot down it may remain standing for several feet back from the face in a semi-compact mass termed a "standing shot." Some of this may be "tight" at various elevations but the frontal attack of the gathering unit may be relied on to effect dislodgment of such semi-compact mass onto the receiving end of the gathering unit. The outer ends of the flights reach out beyond the gathering head and move along the mine bottom, the rearwardly and upwardly extending serrations tending to form a V-shaped kerf at the base of the upstanding mass so that the picks following the flights can easily tear the coal loose to cause it to fall forward onto the gathering head plate. The coal thus loosened sometimes falls from the standing mass in large quantities necessitating retraction of the loader in readiness for another forward gathering movement to load the loosened coal. While in some instances by reason of the serrated flights and the picks mounted thereon, the coal may be dislodged from a mine vein without drilling and blasting, the main purpose of such flights and picks on a gathering conveyor is to attack semi-compact masses of coal to loosen the same while loading operations are being carried on.

I prefer to mount the bits or picking fingers or tools 145 on alternate flights so that two spaced serrated flights will move in advance of each picking tool. This can readily be seen by referring to Fig. 1. It will also be seen by referring to Figs. 7 and 9 that the picking tools extend diagonally upwardly considerably above the path of the serrations of the flights. Consequently the picking tools are able to penetrate the upper inclined wall of the V-shaped kerf sufficiently to tear loose the standing shattered coal and cause it to fall forward toward the gathering head plate.

The discharge conveyor comprises two sections 170 and 171 (Fig. 4), with the rear section 171 movable laterally on the upright pivot 182. Hydraulically operated mechanism comprising the hydraulic motor 222 is controlled by the valve lever 375 to effect power swinging of the rear section of the discharge conveyor. By means of the mechanisms 206, etc., the continuity of the sides 167, 167 and 178, 178 of the discharge conveyor 42 is maintained notwithstanding the fact that the discharge conveyor comprises a single endless chain 165 having links pivotally connected on vertical and horizontal axes, this chain being similar in construction to the chain 91, as shown in Fig. 8.

The cable reel 325 (Fig. 1) may be operated by power to wind up the cable 329 which contains the insulated wires connecting the motor 224 to the distant source of electric power supply.

It is preferred that a main loader operator should be in a position to operate all of the controlling levers and that another operator should be able by means of extended actuating connections, to control adjustments of the discharge conveyor independently of the operation of the

gathering conveyor. As the mine cars are brought up, loaded, and replaced by empty cars, a rear operator or trip rider may start and stop the discharge conveyor and adjust the elevation of the rear end thereof as well as its lateral position. The main operator will know when the discharge conveyor stops without looking backward and thus stop the gathering conveyor to prevent overflow from hopper **155**.

It should be understood that when the gathering conveyor unit is swung laterally the hopper **155** of the discharge conveyor apparatus remains stationary. The rearwardly extending wings **161'**, **161'** shown in Figs. 1 and 5 have their lower edges in overlapping relation to the upper semi-circular edge of the semi-funnel shaped chute **159**. Such wings **161'**, **161'** move bodily with the gathering conveyor unit. As the flights leave the rear edges of the plate **80** they move away from each other and any material thrown laterally will be deflected by the wings **161'**, **161'** into the hopper **155**. Furthermore, such wings extend upwardly from the lateral edges of the chute **159** to co-operate with the latter to deepen the hopper **155**.

Certain features herein disclosed are disclosed and claimed in my following application and patents: Application Ser. No. 699,784, Mining loading machine, filed Sept. 27, 1946; Patents Nos. 2,303,372, Loading machine, granted December 1, 1942; 2,353,051, Loading machine, granted July 4, 1944; 2,353,052, Loading machine, granted July 4, 1944; 2,362,647, Clutch operated mechanism, granted November 14, 1944; 2,366,536, Loading machine, granted January 2, 1945; 2,377,505, Clutch control, granted June 5, 1945; 2,400,835, Clutch, granted May 21, 1946.

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

Having thus described and shown an embodiment of my invention, what I desire to secure by Letters Patent of the United States is:

1. In a digging and loading machine, the combination with a frame, traction means for supporting and feeding said frame rectilinearly, conveyor mechanism mounted on said frame and having a laterally swingable discharge boom extending rearwardly of said frame for discharging coal into a receptacle, means for digging and gathering coal and delivering it to said conveyor, said means including a gathering boom having a bottom plate, a pair of laterally spaced chain guiding means mounted on said plate and spaced apart to provide a material conveying way between them of substantially uniform width, endless chains, one on each of said guiding means for conveying coal rearwardly along said way, a plate fixed to said frame against tilting movement and forming an extension of said bottom plate and over which said chains travel and convey said coal, delivering it from said fixed plate to said conveyor, drive shafts, one for each of said chains, mounted on fixed axes relative to said fixed plate and extending upwardly and each having a chain driving sprocket at its upper end, coal digging and gathering means carried by said chains including removable bits connected to said chains, means mounting said gathering boom for swinging movement relative to said frame about a horizontal axis adjacent said fixed plate, power operated means for swinging said gathering boom about said horizontal axis, and means for swinging said gathering boom laterally.

2. In a digging and loading machine, the combination with a frame, traction means for supporting and feeding said frame rectilinearly, conveyor mechanism mounted on said frame and having a laterally swingable discharge boom extending rearwardly of said frame for discharging coal into a receptacle, means for digging and gathering coal and delivering it to said conveyor, said means including a gathering boom having a bottom plate, a pair of laterally spaced chain guiding means mounted on said plate and spaced apart to provide a material conveying way between them of substantially uniform width, endless chains, one on each of said guiding means for conveying coal rearwardly along said way, a plate fixed to said frame against tilting movement and forming an extension of said bottom plate and over which said chains travel and convey said coal, delivering it from said fixed plate to said conveyor, drive shafts, one for each of said chains, mounted on fixed axes relative to said fixed plate and extending upwardly and each having a chain driving sprocket at its upper end, coal digging and gathering means carried by said chains including removable bits connected to said chains, means mounting said gathering boom for swinging movement relative to said frame about a horizontal axis adjacent said fixed plate, and power operated means for swinging said gathering boom about said horizontal axis.

3. In a digging and loading machine, the combination with a frame, traction means for supporting and feeding said frame rectilinearly, conveyor mechanism mounted on said frame, means for digging and gathering coal and delivering it to said conveyor, said means including a boom having a bottom plate, a pair of laterally spaced chain guiding means mounted on said plate and spaced apart to provide a material conveying way between them of substantially uniform width, endless chains, one on each of said guiding means for conveying coal rearwardly along said way, a plate fixed to said frame against tilting movement and forming an extension of said bottom plate and over which said chains travel and convey said coal, delivering it from said fixed plate to said conveyor, drive shafts, one for each of said chains, mounted on fixed axes relative to said fixed plate and extending upwardly adjacent said fixed plate and each having a chain driving sprocket at its upper end, coal digging and gathering means carried by said chains including removable bits connected to said chains, means mounting said boom for swinging movement relative to said frame about a horizontal axis adjacent said fixed plate, and power operated means for swinging said boom about said horizontal axis.

4. In a digging and loading machine, the combination with a frame, traction means for supporting and feeding said frame rectilinearly, conveyor mechanism mounted on said frame, means for digging and gathering coal and delivering it to said conveyor, said means including a boom having a bottom plate, a pair of laterally spaced chain guiding means mounted on said plate and spaced apart to provide a material conveying way between them of substantially uniform width, endless chains, one on each of said guiding means for conveying coal rearwardly along said way, drive shafts, one for each of said chains, mounted on axes fixed against tilting movement relative

to said frame and extending upwardly and each having a chain driving sprocket at its upper end, coal digging and gathering means carried by said chains including removable bits connected to said chains, and means mounting said boom for swinging movement relative to said frame about a horizontal axis.

5. A machine of the class described comprising a truck having a frame, traction means for feeding said truck frame rectilinearly, a discharge conveyor having a hopper and supported on said truck frame, said discharge conveyor including a portion extending upwardly and rearwardly from said hopper and a laterally swingable rear portion, a driving motor for said truck traction means and said conveyor mounted on said truck and positioned below said conveyor, a combination coal digging and gathering mechanism mounted on said truck and adapted to dig and gather coal and deliver it to said hopper, said mechanism including a rear plate fixed to said truck frame against tilting movement and a forward boom pivoted about a horizontal axis adjacent said fixed plate and having a bottom plate which is substantially a continuation of said fixed plate, said boom having a pair of spaced chain guides forming a conveyor way between them, endless chains on said guides, digging picks on said chains, said guides having a normal position of their front ends adjacent the mine floor when the machine is in operation and being formed with horizontal portions adjacent their forward ends to dig under standing coal when in operation, and means for driving said endless chains to dig into said coal and convey it rearwardly and discharge it into said hopper.

6. A machine of the class described comprising a truck having a frame, traction means for feeding said truck frame rectilinearly, a discharge conveyor having a hopper and supported on said truck frame, said discharge conveyor including a portion extending upwardly and rearwardly from said hopper and a laterally swingable rear portion, a driving motor for said truck traction means mounted on said truck and positioned below said conveyor, a combination coal digging and gathering mechanism mounted on said truck and adapted to dig and gather coal and deliver it to said hopper, said mechanism including a rear plate fixed to said truck frame against tilting movement and a forward boom pivoted about a horizontal axis adjacent said fixed plate and having a bottom plate which is substantially a continuation of said fixed plate, said boom having a pair of spaced chain guides forming a conveyor way between them, endless chains on said guides, digging picks on said chains, said guides having a normal position of their front ends adjacent the mine floor when the machine is in operation and being formed with horizontal portions adjacent their forward ends to dig under standing coal when in operation, and means for driving said endless chains to dig into said coal and convey it rearwardly and discharge it into said hopper.

7. In a machine of the class described, the combination with a main frame, of digging and gathering conveyor mechanism mounted on the front of said main frame, means providing for pivotal adjustment of the front of said conveyor mechanism about a horizontal axis while holding it against rectilinear movement relative to said main frame whereby its front end can be raised and lowered, a discharge conveyor mounted on said main frame, said digging and gathering conveyor mechanism including a pair of laterally spaced chain guides forming a material conveying way between them, endless digging and gathering chain means on said guides adapted to dig and gather coal and convey it rearwardly by a continuous uninterrupted movement from the time it is first dug and gathered until it is delivered to the receiving end of said discharge conveyor, said discharge conveyor comprising three articulated parts, one of which forms a receiving hopper rigidly attached to said main frame and positioned to receive coal discharged from said digging and gathering conveyor, a second part of which is pivotally mounted relative to said receiving part about a horizontal axis, and the third part of which is pivotally mounted relative to said second part about a vertical axis, a continuous conveyor mechanism running through all parts of said discharge conveyor to convey material therealong, and means for feeding said main frame rectilinearly together with said digging and gathering conveyor mechanism and said discharge conveyor to gather and load material.

8. In a machine of the class described, the combination with a main frame, of gathering conveyor mechanism mounted on the front of said main frame, means providing for pivotal adjustment of the front of said conveyor mechanism about a horizontal axis while holding it against rectilinear movement relative to said main frame whereby its front end can be raised and lowered, a discharge conveyor mounted on said main frame, said gathering conveyor mechanism including a pair of laterally spaced chain guides forming a material conveying way between them, endless gathering chain means on said guides adapted to gather coal and convey it rearwardly by a continuous uninterrupted movement from the time it is first gathered until it is delivered to the receiving end of said discharge conveyor, said discharge conveyor comprising three articulated parts, one of which forms a receiving hopper rigidly attached to said main frame and positioned to receive coal discharged from said gathering conveyor, a second part of which is pivotally mounted relative to said receiving part about a horizontal axis, and the third part of which is pivotally mounted relative to said second part about a vertical axis, a continuous conveyor mechanism running through all parts of said discharge conveyor to convey material therealong, and means for feeding said main frame rectilinearly together with said gathering conveyor mechanism and said discharge conveyor to gather and load material.

9. In a machine of the class described, the combination with a main frame, of gathering conveyor mechanism mounted on the front of said main frame, means providing for pivotal adjustment of the front of said conveyor mechanism about a horizontal axis while holding it against rectilinear movement relative to said main frame whereby its front end can be raised and lowered, a discharge conveyor mounted on said main frame, said gathering conveyor mechanism including a pair of laterally spaced chain guides forming a material conveying way between them, endless gathering chain means on said guides adapted to gather coal and convey it rearwardly by a continuous uninterrupted movement from the time it is first gathered until it is delivered to the receiving end of said discharge conveyor, said discharge conveyor comprising two pivoted parts the rearmost one of which is pivotally mounted for adjustment about a vertical

axis so the discharge end thereof may be shifted laterally of said main frame, power operated means for adjusting said conveyors about their pivots, a continuous conveyor mechanism running through all parts of said discharge conveyor to convey material therealong, and means for feeding said main frame rectilinearly together with said gathering conveyor mechanism and said discharge conveyor to gather and load material.

10. In a machine of the class described, the combination with a main frame, of gathering conveyor mechanism mounted on the front of said main frame, means providing for pivotal adjustment of the front of said conveyor mechanism about a horizontal axis while holding it against rectilinear movement relative to said main frame whereby its front end can be raised and lowered, a discharge conveyor mounted on said main frame, said gathering conveyor mechanism including a pair of laterally spaced chain guides forming a material conveying way between them, endless gathering chain means on said guides adapted to gather coal and convey it rearwardly by a continuous uninterrupted movement from the time it is first gathered until it is delivered to the receiving end of said discharge conveyor, said discharge conveyor comprising two pivoted parts the rearmost one of which is pivotally mounted for adjustment about a vertical axis so the discharge end thereof may be shifted laterally of said main frame, a continuous conveyor mechanism running through all parts of said discharge conveyor to convey material therealong, and means for feeding said main frame rectilinearly together with said gathering conveyor mechanism to gather material.

11. In a loading machine, the combination with a frame, of means for gathering coal and delivering it upwardly and rearwardly by continuous movement and discharging it intermediate the ends of said frame, a receiving and discharge conveyor mounted on said frame and adapted to receive coal from said gathering means and convey it rearwardly by continuous action until discharged therefrom, said discharge conveyor including an endless chain extending continuously from its receiving to its discharge end, said gathering means including a forwardly extending elongated boom adapted to be fed rectilinearly while gathering coal, a plate mounted on said frame and held against tilting movement, said boom being pivotally mounted on a horizontal axis and having a bottom plate forming a continuation of said first named plate, a pair of laterally spaced power driven shafts extending upwardly through said first named plate, sprockets on said shafts, a pair of endless chains extending forwardly from said sprockets to positions adjacent the forward end of said boom, gathering flights on said chains adapted to travel beyond the front end of said boom and gather coal, a pair of laterally spaced guides on said boom bottom plate constructed to guide said chains and form a continuous material way between them extending from the front to the rear of said boom, said flight carrying chains and boom providing mechanism to gather coal adjacent the front end of said boom and convey it continuously thereby until discharged onto the receiving end of said receiving and discharge conveyor, means for adjusting said boom about its horizontal axis, and means for feeding said machine rectilinearly as a unit to force the front of said boom into coal to be gathered.

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