

June 3, 1930.

J. E. JONES ET AL

1,762,060

LOADING MACHINE

Filed June 9, 1919

16 Sheets-Sheet 1

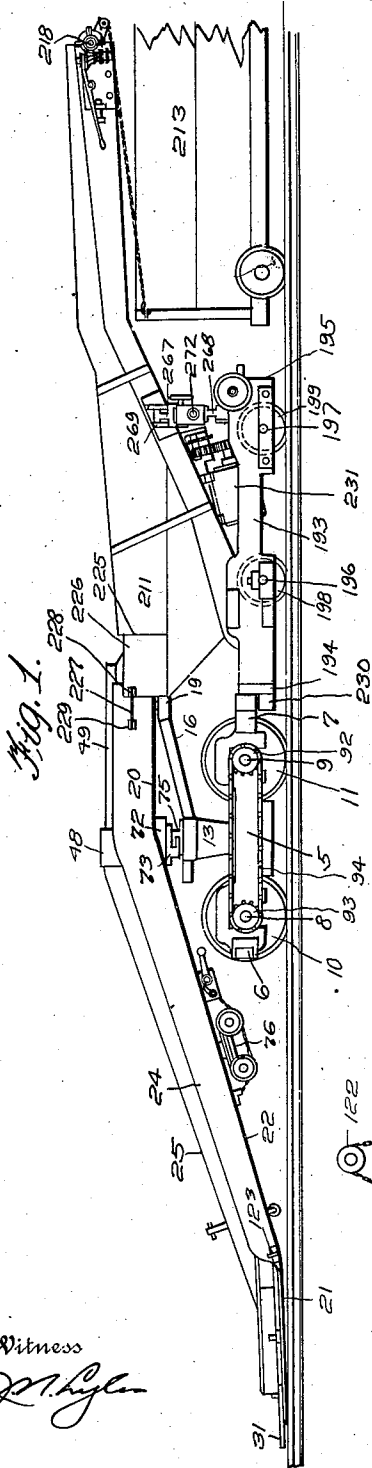


Fig. 1.

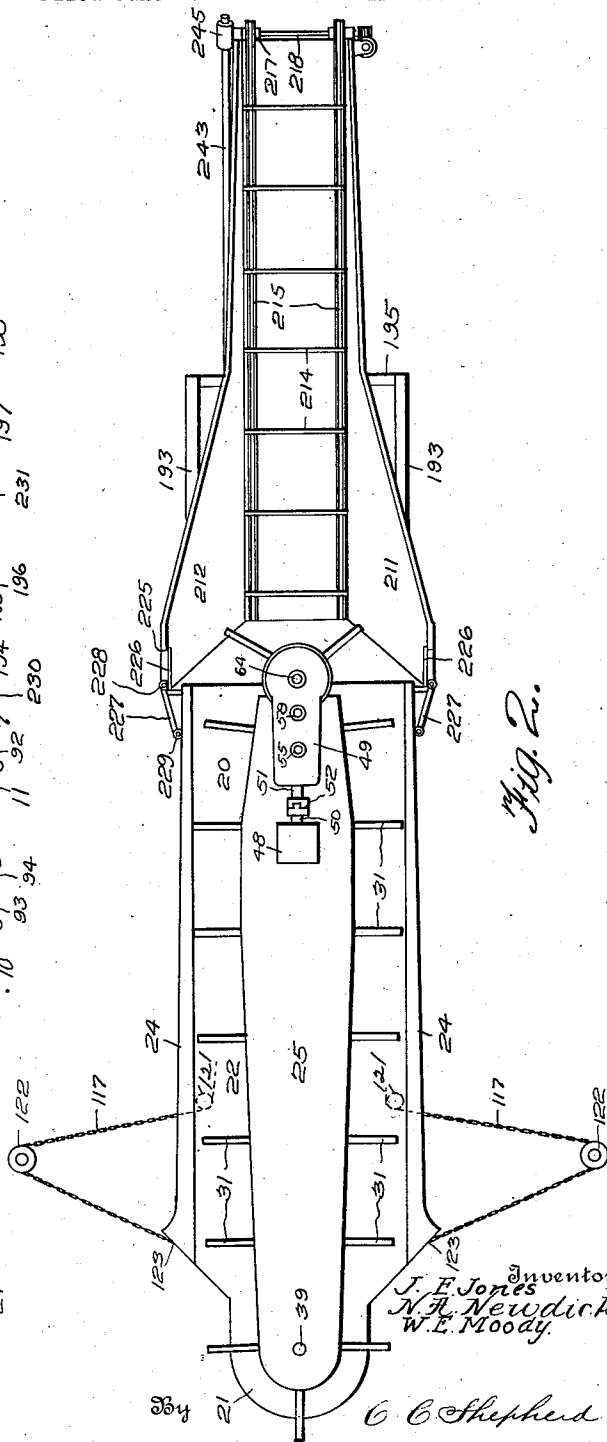


Fig. 2.

Witness

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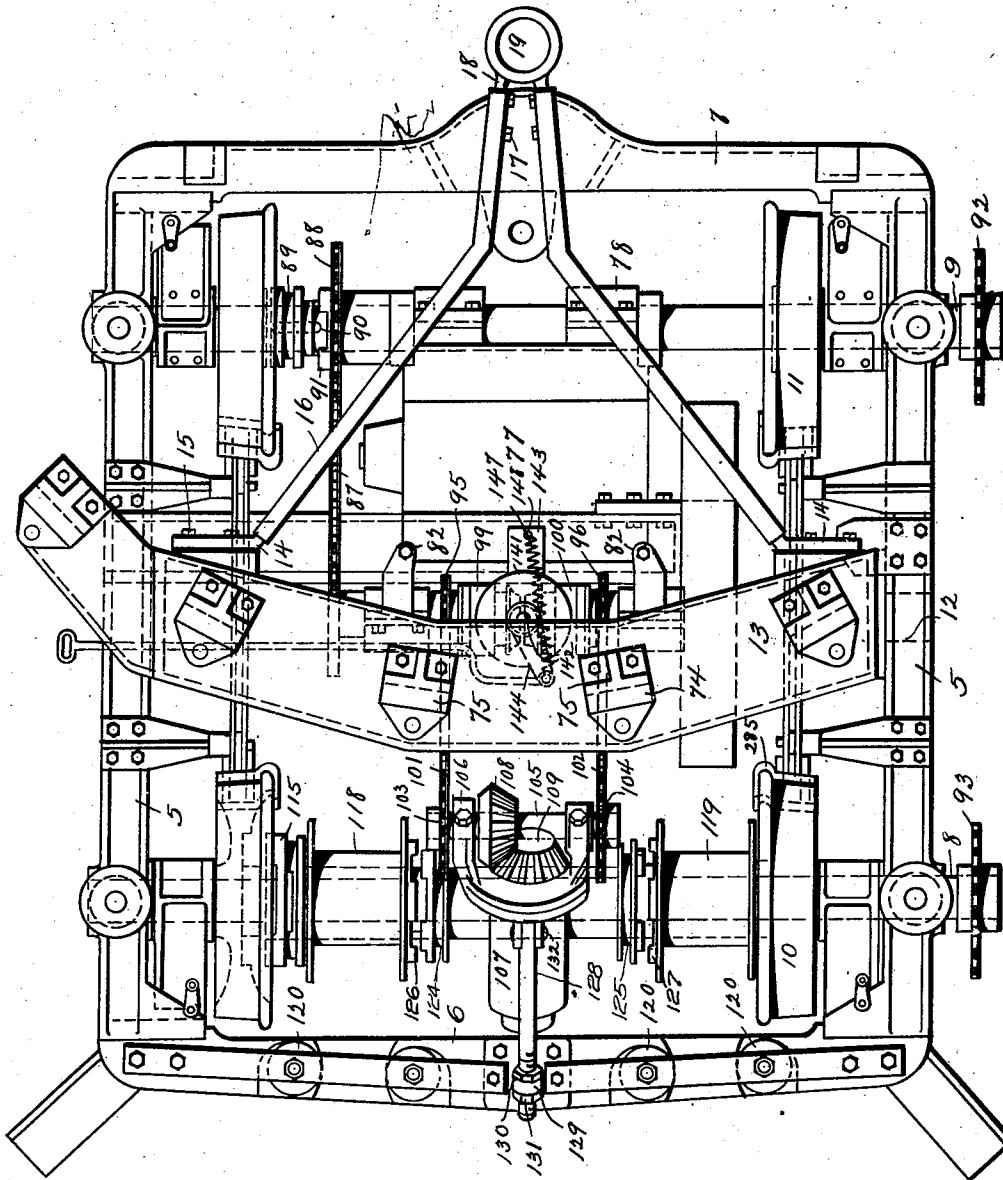


Fig. 3.

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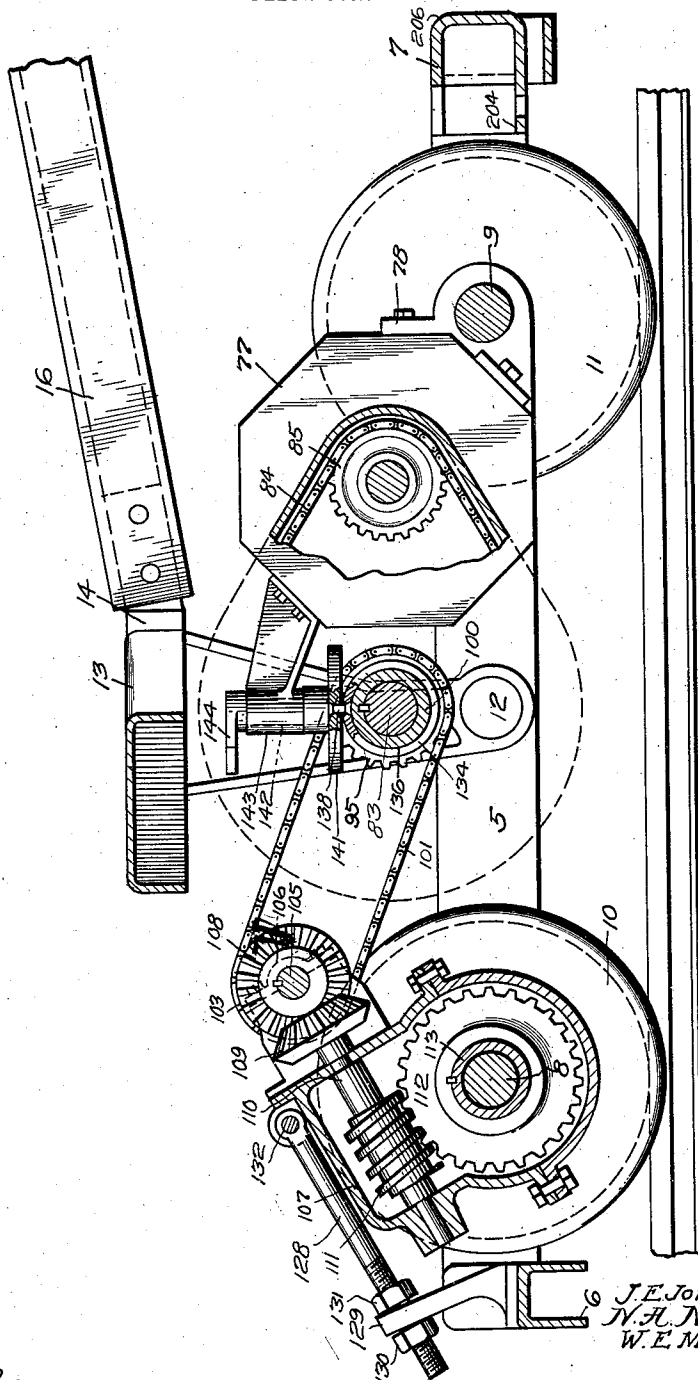
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Fig. 4.



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Fig. 5.

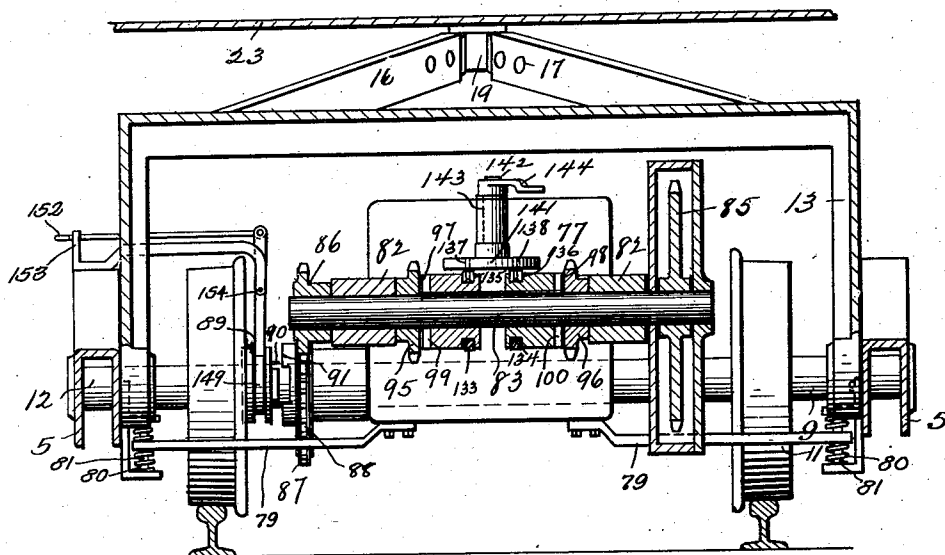
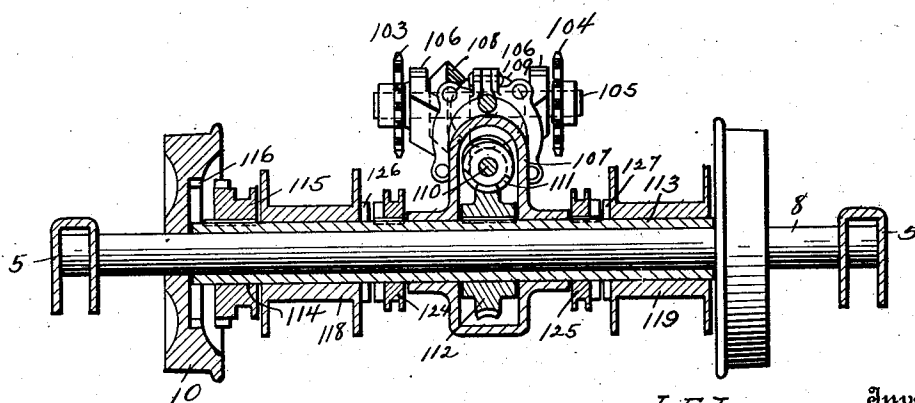


Fig. 6.



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LOADING MACHINE

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Fig. 8.

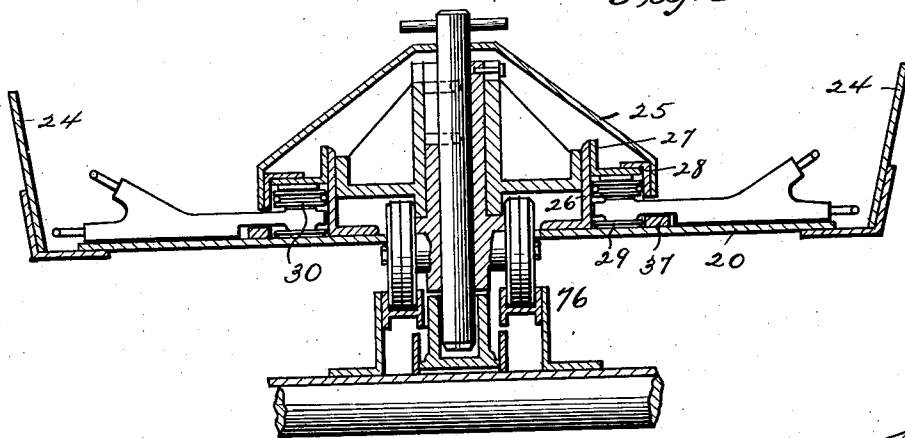
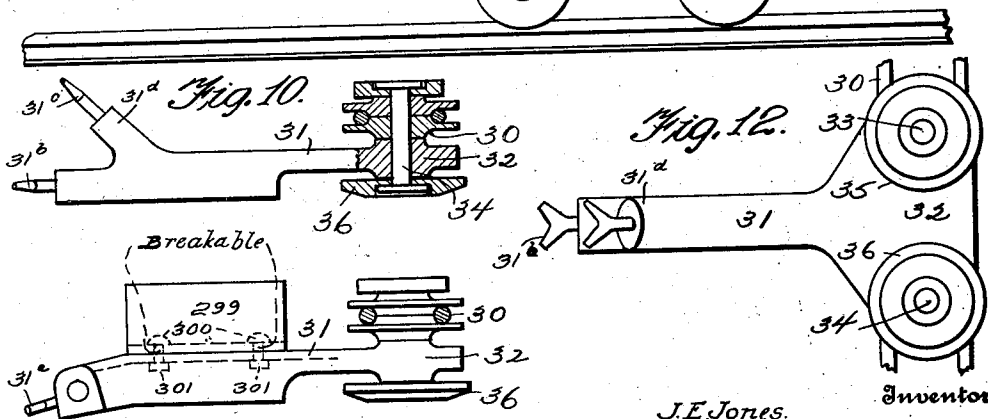
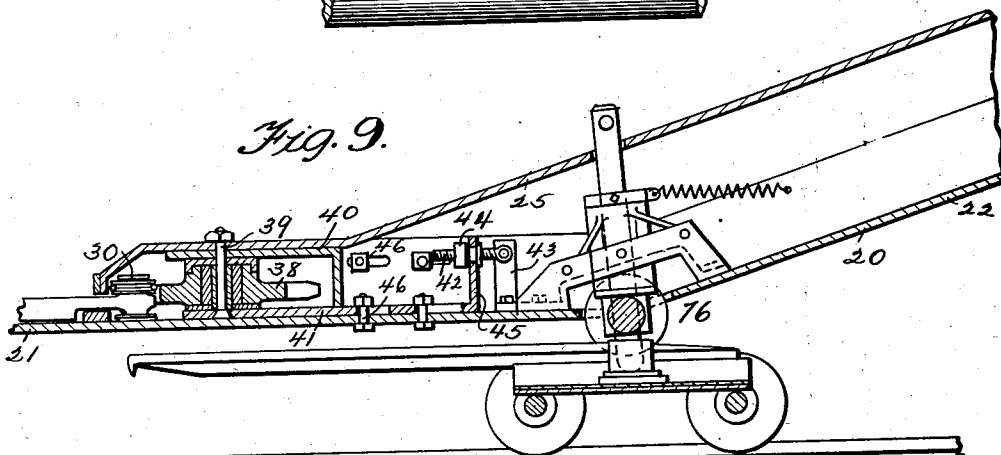


Fig. 9.



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Fig. 11.

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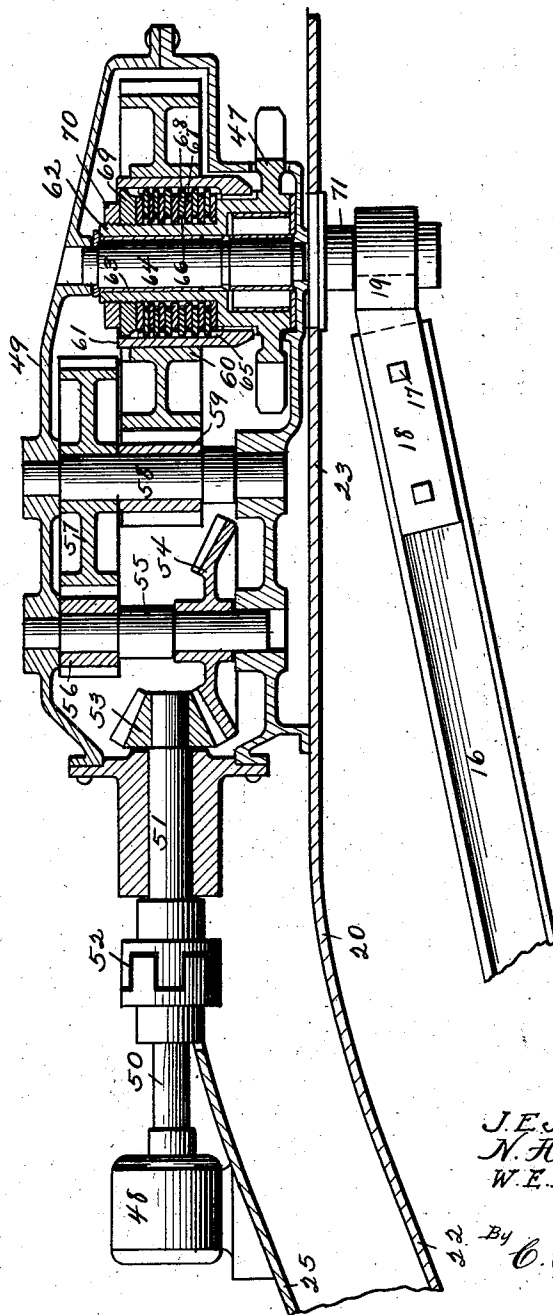
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Fig. 13.



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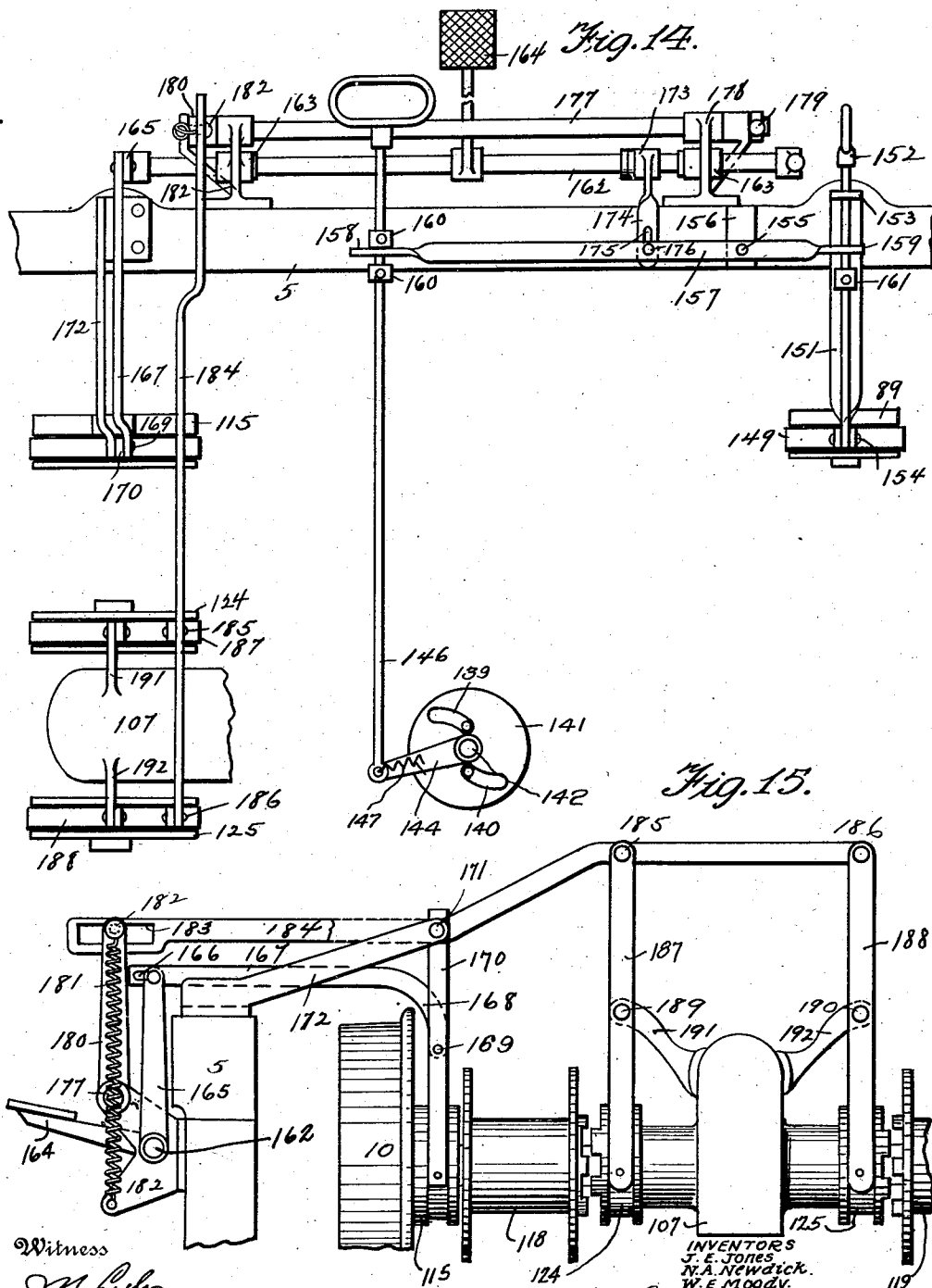
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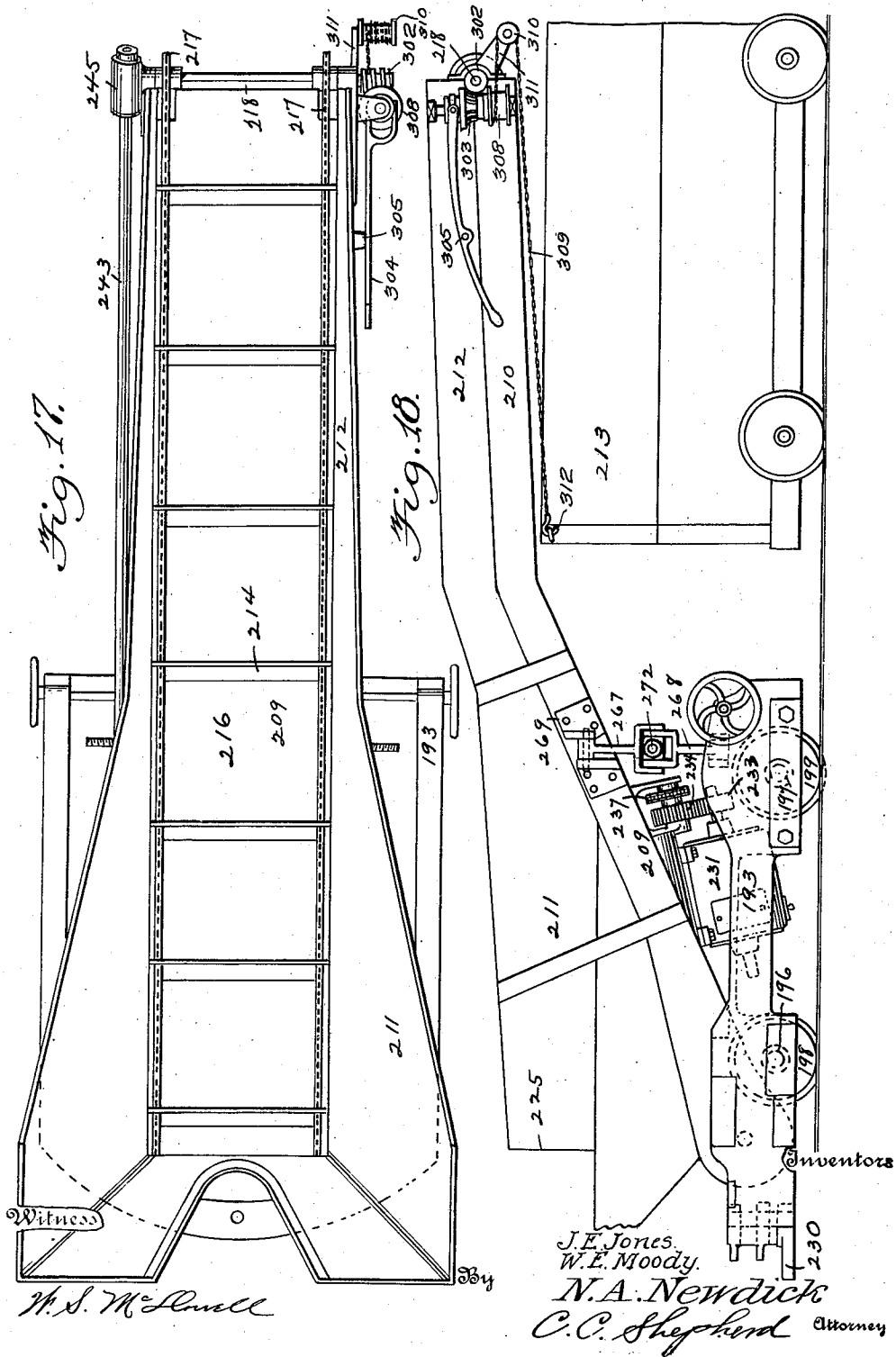
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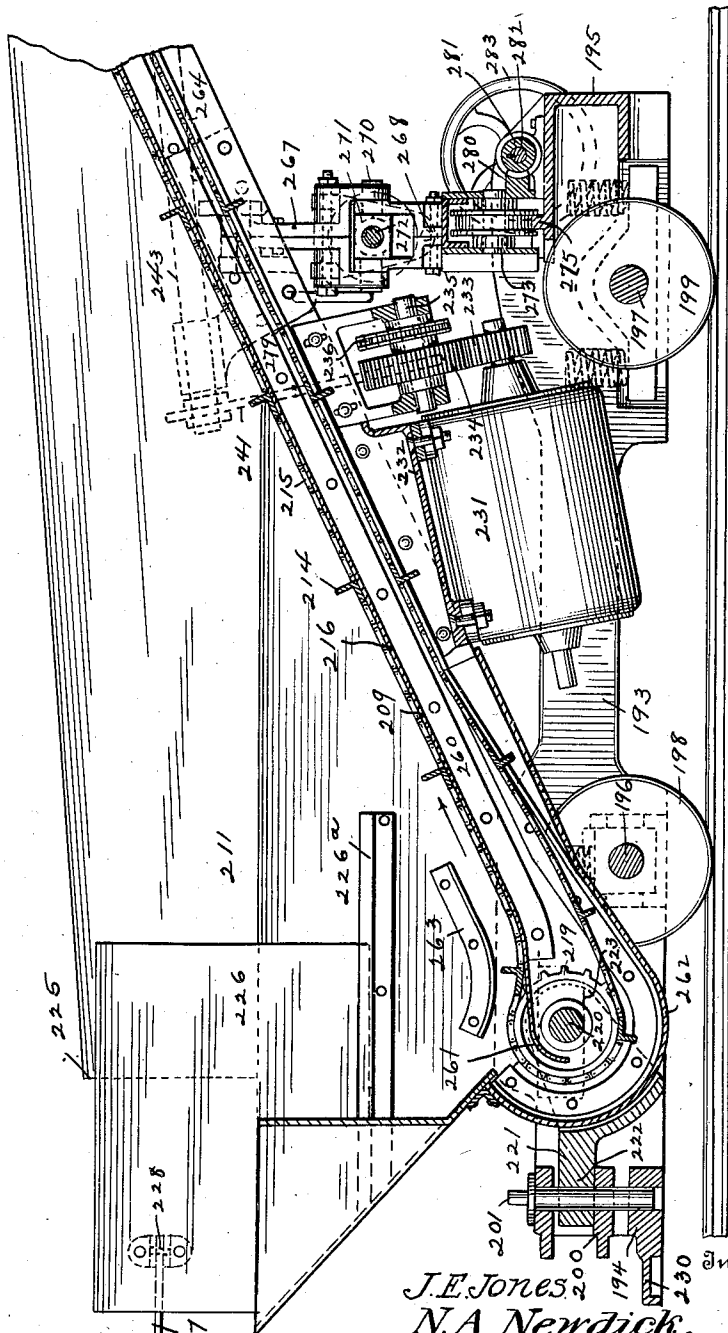
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Fig. 19.



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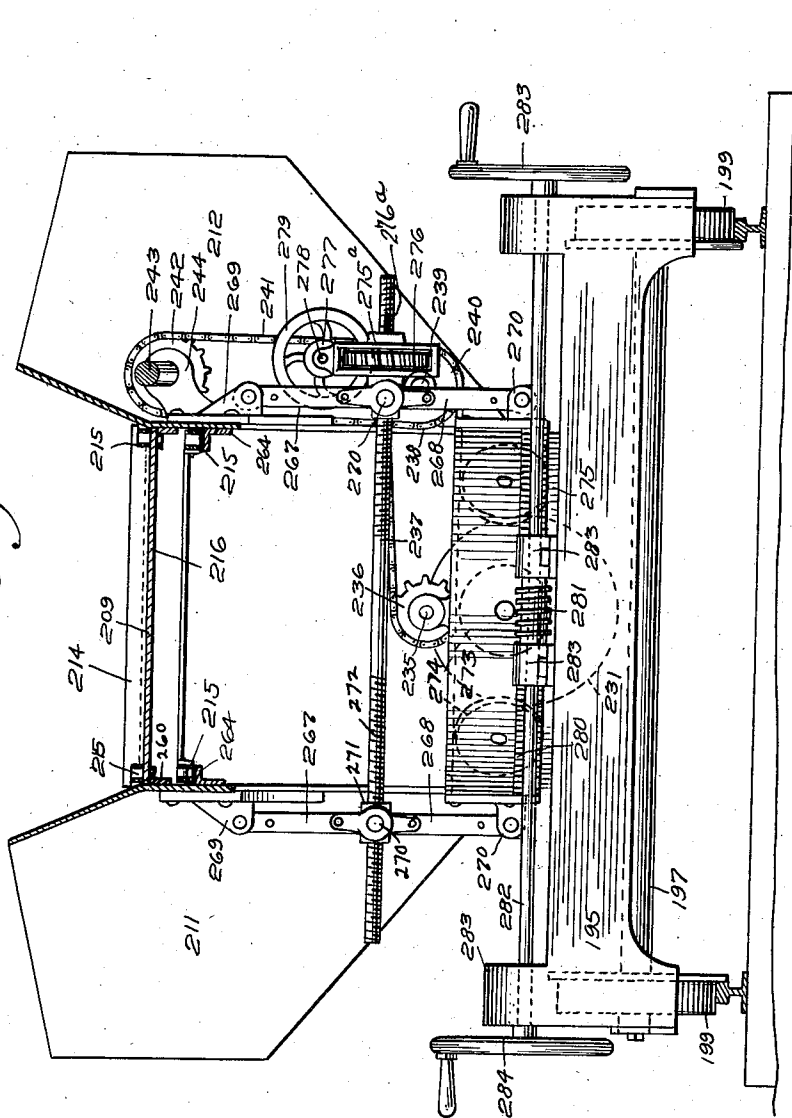
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Fig. 20.



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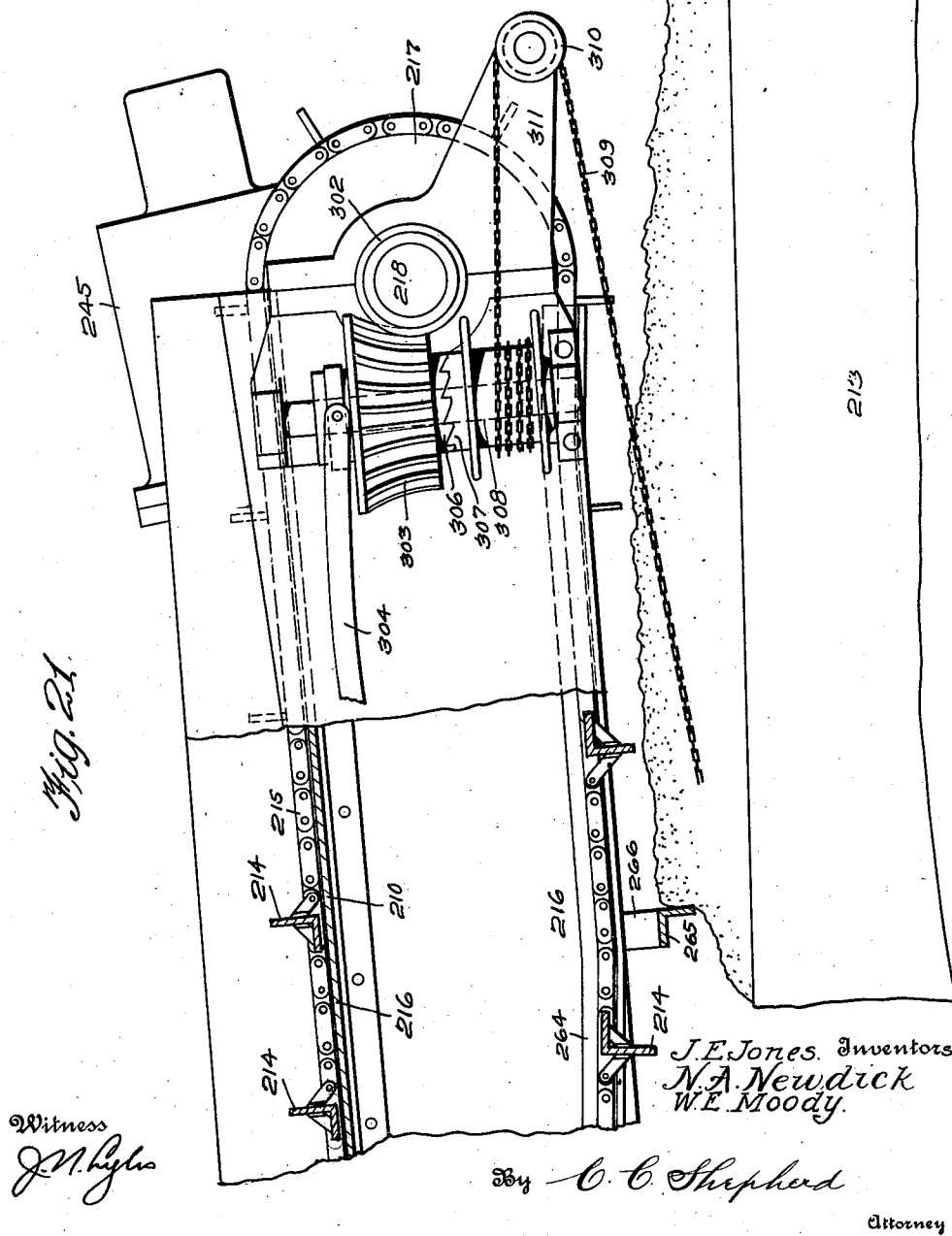
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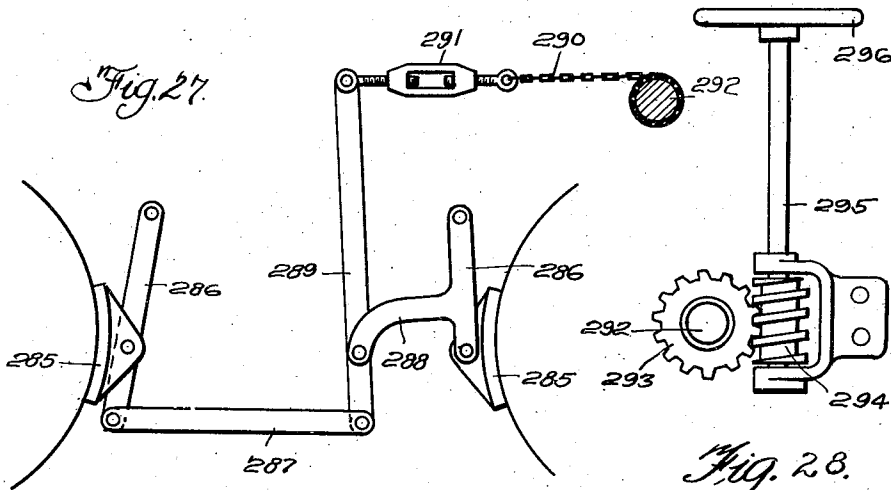
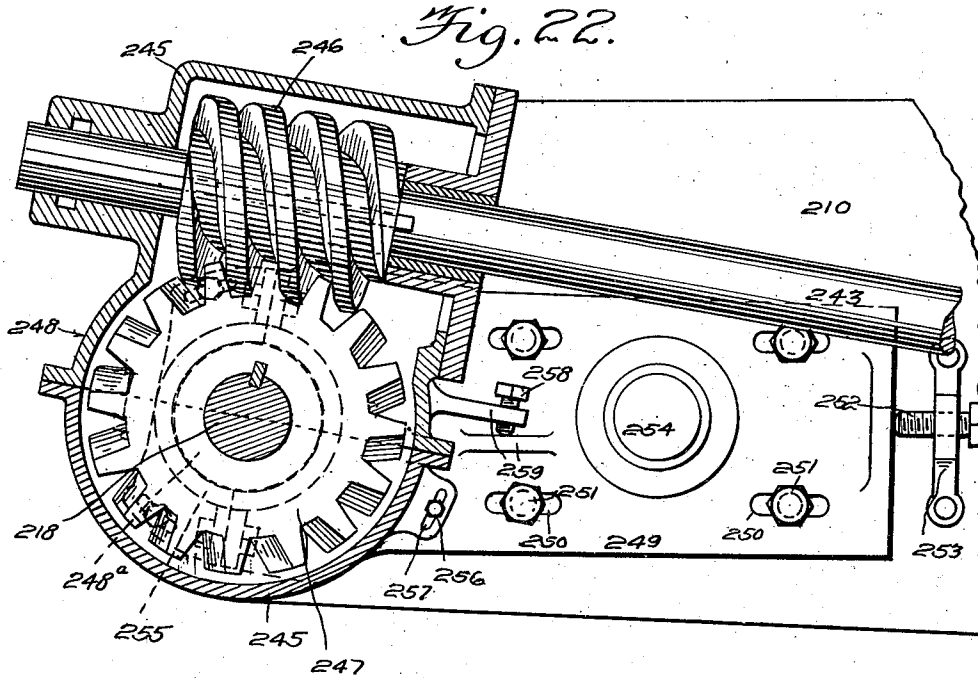


Fig. 28.

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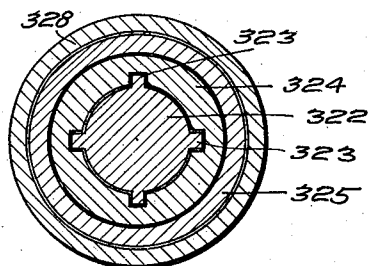
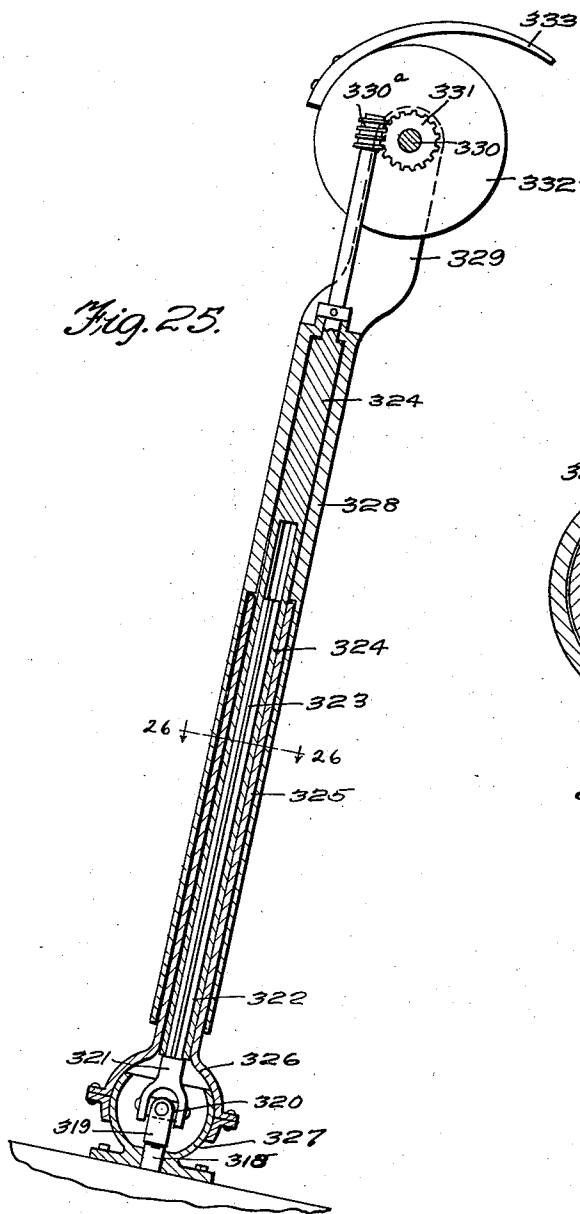
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LOADING MACHINE

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UNITED STATES PATENT OFFICE

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LOADING MACHINE

Application filed June 9, 1919. Serial No. 302,914.

This invention relates to gathering and loading mechanism capable of use for gathering and loading many kinds of material but, in the embodiment herein shown and described, being more particularly adapted for and intended to load coal in the mine, into the mine cars. Broadly stated, the object of the invention is to provide a device of the character set forth embodying a novel combination and correlation of parts by virtue of which a gathering and loading mechanism is produced which will load coal into mine cars with such marked efficiency and rapidity as to render it possible to mine coal at a cost far below what has heretofore been possible.

The machine forming the subject matter of the present application comprises a front truck upon which a gathering conveyor is mounted to swing in a substantially horizontal plane about a vertical axis so that its gathering end may sweep back and forth across a mine floor gathering up coal that has been previously shot down and discharging the same at the rear end of said gathering conveyor into a hopper located at the front end of a second truck from which the coal is carried rearwardly by a loading elevator and discharged into the mine cars which are placed beneath the rear end of such elevator, the relation of the several parts being such that the hopper is located in receiving position with respect to the discharge end of the gathering conveyor throughout all positions of angularity of the two trucks with respect to each other or of the gathering and loading conveyors with respect to each other or the gathering conveyor with respect to its supporting truck.

As will be more particularly hereinafter set forth, much of the work performed by a machine of this character is performed upon curves and frequently upon very short curves. It is therefore one of the objects of the present invention to provide a machine of the type indicated of great flexibility with respect to its capability of operation with the gathering and loading conveyors moved to varying positions of angularity throughout a wide range of adjustment while at the

same time maintaining the receiving end of the loading conveyor or elevator in operative position with respect to the discharge end of the gathering conveyor.

Since the capacity of a machine of this nature is, among other things, dependent upon the rate of travel of the flights of the gathering conveyor, it follows that if this gathering conveyor be driven at a rate of speed sufficiently high to secure a high rate of output, some of the coal and particularly lumps of some size will be thrown centrifugally from the gathering conveyor at the point of discharge.

It is one of the objects of the present invention to provide such a correlation of parts that coal thrown centrifugally from the gathering conveyor will be collected and delivered upon the elevator or loading conveyor. It becomes necessary, as the machine gathers and loads the coal from the front edge of a pile blown down, to advance the machine or "sump in" to the pile of coal in order that the front end of the gathering conveyor may eat its way further into the pile. It is therefore an object of the present invention to provide improved means for imparting the necessary slow and powerful forward feeding movement to the gathering conveyor to accomplish this result.

Another object of the invention resides in the provision of a feeding mechanism for a loading machine of the character set forth wherein the driving wheels of the front truck may be rotated at a comparatively high rate of speed when the machine is traveling from place to place about a mine and whereby said driving wheels may be given a very slow and correspondingly powerful rotation by means of reducing worm gearing during the sumping process.

It is an object of the present invention to utilize a feed of this nature and to conjointly therewith, so mount the gathering conveyor upon the front truck that the weight will be substantially evenly distributed upon all the driving wheels of the truck and it is also an object of the invention to so shape and mount the saddle casting by which the gathering conveyor is supported from

the front truck that a threefold object is accomplished. First, as before stated, the weight is equally distributed upon the driving wheels of the truck so that the most effective traction is secured during the slow and powerful forward feeding movement imparted to said driving wheels during the sumping operation. Second, the weight of the forward end or nose of the gathering conveyor and the load thereon is in a measure counterbalanced with the result that the friction between the nose of the gathering conveyor and the mine floor is largely relieved and the machine is able without great effort or strain to start the load to moving even though the entire nose of the machine may be buried in a mass of coal shot down after the machine has reached a position at the face of the working, and, third, the pivotal point of support of the gathering conveyor is brought to such a point upon the front truck that it will be substantially coincident with the pivotal point about which the rear truck and the loading conveyor swing throughout the varying angular positions of the several elements with respect to each other.

It is a further object of the invention to provide a machine of the character indicated in which the discharge end of the gathering conveyor is disposed within and below the level of the top of the sides of the hopper of the loading conveyor or elevator so that no coal may be thrown by centrifugal force beyond the hopper, and in conjunction therewith to provide movable panels at the upper front corners of the hopper adapted to be moved to permit the gathering conveyor to swing to a sharp angle with respect to the hopper without interference from the walls thereof and adapted to be moved into position to close the spaces that would otherwise be left when the gathering conveyor swings in the opposite direction and through which spaces coal would be thrown by centrifugal force if such panels were not provided and the invention further contemplates the provision of means for automatically shifting said panels to proper position as the gathering conveyor swings back and forth.

A further object of the invention is to provide an improved form of hopper and loading conveyor by which the coal will be both elevated and conducted rearwardly, the elevation of the coal bringing it to a point from which it may be discharged gravitally into a mine car and the projection of the conveyor rearwardly providing such overhang as to permit a mine car to be moved back and forth under the discharge end of the loading conveyor in such manner as to effectually distribute the load within the mine car.

It is a further object of the invention to

provide in a structure embodying the several advantages hereinbefore set forth, mechanisms so shaped and related that the resultant loading machine, while being strong, rigid, powerful and highly flexible, will be of minimum height and adapted to operate in mines having but little overhead room and in mines where a large part of the loading is done on comparatively sharp curves.

In the drawings in which like reference characters designate corresponding parts:

Fig. 1 is a side elevation of a loading machine constructed in accordance with the invention;

Fig. 2 is a plan view thereof;

Fig. 3 is a plan view of the front truck, viz., the truck of the gathering conveyor, hereinafter described;

Fig. 4 is a longitudinal sectional view through the front truck;

Fig. 5 is a transverse, vertical section through the back gear shaft, hereinafter described;

Fig. 6 is a transverse, vertical section through the front axle of the front truck;

Fig. 7 is an enlarged side view of the front truck with certain of the parts omitted;

Fig. 8 is a transverse, vertical section through the lower portion of the pan of the gathering conveyor illustrating a pony truck construction, hereinafter described;

Fig. 9 is a longitudinal, vertical section through the lower part of the pan of the gathering conveyor;

Fig. 10 is a view partly in side elevation and partly in vertical section of one of the flights;

Fig. 11 is a side view of one of the flights illustrating a removable angle plate carried thereby;

Fig. 12 is a plan view of one of the flights;

Fig. 13 is a detail sectional view of the transmission gearing between the gathering conveyor and its motor;

Figs. 14 and 15 are respectively a plan and an end elevation of an interlocking manually operable lever system by which the several clutches upon the front truck are cooperatively controlled;

Fig. 16 is a diagrammatic view illustrating means for maintaining the pivotal mounting of the gathering conveyor in alignment with the pivotal mounting of the loading conveyor as the two trucks move to varying positions of angularity with respect to each other;

Fig. 17 is a plan view of the loading conveyor;

Fig. 18 is a side elevation of the loading conveyor;

Fig. 19 is an enlarged longitudinal sectional view through a part of the loading conveyor;

Fig. 20 is a transverse vertical sectional view through the rear portion of the load-

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ing conveyer with the carrying truck thereof in rear elevation;

Fig. 21 is a detail view illustrating a means for imparting movement to the mine car with respect to the loading conveyer so that the load may be evenly distributed in the mine car;

Fig. 22 is a detail view of an adjustment for the housing of the worm drive for the loading conveyer;

Fig. 23 is a side elevation of a power pick adapted to dislodge coal and cause it to fall upon the nose of the gathering conveyer;

Fig. 24 is a plan view of the structure illustrated in Fig. 23;

Fig. 25 is a vertical sectional view through the driving and supporting standard of the power pick;

Fig. 26 is a sectional view on line 26—26 of Fig. 25;

Fig. 27 is a detail view of the brake mechanism hereinafter described; and

Fig. 28 is a detail view of an actuating member for the brake.

By referring to the drawings, it will be seen that the truck of the gathering conveyer comprises side frame members 5, a front end member 6 and a rear end member 7. The side frame members are provided with suitable journal boxes for the reception of a front axle 8 and a rear axle 9 upon which front and rear supporting and driving wheels 10 and 11 are mounted, it being understood that these wheels are preferably of a type to engage a track such as is commonly employed in mines and upon which the mine cars travel. Trunnioned at 12 in the side frame members of the truck is an arched saddle casting 13. Brackets 14 are bolted to the upper rear edge of this saddle casting by bolts 15 and these brackets are in turn bolted to rearwardly convergent channelled arms 16. The arms 16 are in turn bolted or otherwise secured at 17 to extensions 18 of an eye 19 and this eye constitutes the pivotal mounting for the rear end of the gathering conveyer. The vertical axis of the eye 19 is the axis about which the gathering conveyer swings. The gathering conveyer comprises a pan consisting of a preferably sheet metal plate 20 shaped to form a substantially horizontal front end constituting a nose 21, an inclined portion 22 and an upper rear horizontal portion 23. From a point a short distance in the rear of the nose and at about the beginning of the inclined portion 22, the plate 20 is provided with up-turned flanges 24 along its opposite edges, which flanges in conjunction with a centrally arranged housing 25 constitute the passageways through which the coal travels on its way to the discharge end of the gathering conveyer. The housing 25 is supported from the plate 20 by means of angle irons 26, 27 and 28, these angle irons in conjunction with the housing

forming channels 29 within which a conveyer chain 30 travels. This chain carries a plurality of laterally extending arms or flights 31 having at their inner ends extensions 32 which constitute parts of the chain, these elements being pivotally connected within the length of the chain at 33 and 34. Upon these pivot points 33 and 34, anti-friction rolls 35 and 36 are mounted which bear, when load is brought upon these flights, either upon the angles 26 or upon a guide rail 37 that is secured to the plate 20 and which extends in spaced parallelism with the angle 26, according to the direction of travel of the chain, it being understood that when one of these rolls bears against the angle 26, the other of said rolls bears upon the guide rail and vice versa to resist the twisting action incident to the load upon the flight and to consequently prevent any kinking of the chain. The chain 30 passes at the lower forward end of the gathering conveyer over a sprocket 38 which is journaled upon a shaft 39 that is carried by bearing plates 40 and 41. These plates are capable of longitudinal adjustment by means of a screw 42 that is fixed to a bracket 43, supported from the plate 20 and a nut 44 which engages said screw and also engages a vertical extension 45 of the plate 41. Bolts and slots 46 provide means for binding these parts in their adjusted position and the adjustment recited provides means for taking up slack in the chain 30. At the upper rear end of the gathering conveyer, the chain 30 passes over a sprocket 47 which is driven by a train of reducing gearing from a motor 48 that is mounted upon and moves bodily with the pan. This reducing or transmission gearing is mounted in the transmission gear casing 49 and the shaft 50 of the motor 48 is connected with a shaft 51 of this transmission gearing by means of a coupling 52 which will permit slight disturbances of the alignment of the motor with the transmission gearing without effecting the driving connection between the two. Couplings of this type are well known and no further description of the same is thought to be necessary. The shaft 51 of the transmission gearing carries a beveled pinion 53 which meshes with a beveled gear 54 upon a shaft 55 and this shaft is in turn connected through a pinion 56 and a gear 57 with a shaft 58. A pinion 59 on the latter shaft meshes with a gear 60 that is carried by a sleeve 61. The sprocket 47 is carried by a sleeve 62 which is supported by means of a bushing 63 on a pin 64 and rotates thereabout. The sleeve 61 is provided upon its inner face with a plurality of vertical ribs 65 while the sleeve 62 is provided upon its outer face with a plurality of corresponding vertical ribs 66. The alternate disks 67 and 68 of a disk clutch respectively engage these ribs and provide a yielding connection

between the sleeve 61 which is driven from the gear 60 and the sleeve 62 and the degree of slippage may be determined and adjusted by adjusting nuts 69 and 70. We are aware of the fact that it is not new to provide yielding connections in mechanical devices to prevent breakage of the parts under abnormal strain but we desire to make it clear that the clutch construction just described does more than merely prevent breakage. It is frequently the case, as before stated, that a large amount of coal is shot down and completely buries the nose of the conveyor. After this load is once started, the work of completing the loading of the pile is comparatively easy. The starting of the load presents the most difficulty and the clutch construction just described provides means whereby the operator may, without injury to the mechanism, impart what is, in effect, a succession of blows to the pile of coal to start the same moving. This is accomplished by starting and stopping the motor 48 through the usual and well known controlling means of devices of that nature. The axis of the pin 64 is coincident with the axis of a stud 71 which depends from the under side of the plate 20 of the pan and has its bearing in the eye 19. An arcuate angle 72 is secured to the under side of the plate 20 and comprises a horizontal flange 73 which projects beneath extensions 74 of a plurality of clips 75 secured upon the top of the saddle casting 13 and this structure in conjunction with the stud 71 and eye 19 constitutes the connection between the gathering conveyor and the truck.

At 76 we have illustrated, in a general way, a pony truck construction upon which the forward part of the gathering conveyor is supported in elevated position and free of the mine floor during the time that the loading machine is being transported about the mine.

A motor 77 provides means for imparting a rapid traveling movement to the truck for conveying the machine about the mine or for imparting a relatively slow and powerful forward movement to the truck when forcing the nose end of the gathering conveyor into a pile of material to be loaded or for swinging the gathering conveyor back and forth across the mine floor and the connections are such that this swinging movement of the conveyor may be accompanied by the slow forward movement so that the nose of the gathering conveyor is caused to move obliquely into the pile of coal when such movement is best adapted to load the coal with the greatest speed. This slow positive forward movement is known in the art as a "sumping" movement. The motor is provided with brackets 78 which embrace the rear shaft 9 and with brackets 79 which rest between springs 80, which are in turn carried by rods 81 supported from the side frame members 5. This construction provides a desirable yield-

ing mounting for the motor. Supported by the bearing brackets 82 from the casing of the motor is a back gear shaft 83, this shaft being driven by a chain 84, sprocket 85 from the motor. A sprocket wheel 86 that is fast upon the shaft 83 is connected by a sprocket chain 87 with a sprocket wheel 88 that is loosely mounted upon the axle 9. A clutch block 89 is splined at 90 upon the axle 9 and when this clutch block is moved to cause it to engage with clutch jaws 91 formed upon the sprocket 88, motion is imparted to the axle 9 and to the wheels 11 at a comparatively high rate of speed. This constitutes the traveling feed of the machine or the feed by which the machine is caused to travel at a comparatively rapid rate about the mine. The axle 9 is connected by means of sprockets 92 and 93 and a sprocket chain 94 with the axle 8 so that all four of the wheels 10 and 11 are driven in unison whether the rate of feed be at the traveling rate or at the sumping in rate.

Sprocket wheels 95 and 96 are mounted to turn loosely upon the back gear shaft 83 and these sprocket wheels are provided with clutch faces 97 and 98 adapted to be engaged by corresponding clutch faces upon clutch blocks 99 and 100, these clutch blocks being splined upon the shaft 83. Means hereinafter described are provided for shifting these clutch blocks in unison toward and from each other so that both of the sprocket wheels 95 and 96 will be simultaneously forced into or out of action. These sprocket wheels are connected by sprocket chains 101 and 102 with the sprocket wheels 103 and 104 that are fixed upon a shaft 105 that is journaled in bearings 106 of a worm gear casing 107. The shaft 105 carries a beveled gear 108 that meshes with a corresponding beveled gear 109 that is fast upon a shaft 110. This shaft carries a worm 111 that meshes with a worm wheel 112 that is fixed upon and imparts motion to a sleeve 113 which extends substantially the full length of the axle 8 between the wheels 10. It is apparent that whenever through the medium of the clutch connections described, motion is imparted from the back gear shaft to the sprockets 95 and 96, this motion will be transmitted to the sleeve 113 and that the movement of the sleeve 113 will be comparatively slow.

Mounted upon an angular portion 114 of the sleeve 113 is a clutch block 115 that is adapted to be moved into clutching engagement with clutch jaws 116 upon one of the wheels 10, it being apparent that when this is done, a slow and powerful turning action will be imparted to the wheel and, through the axle upon which it is mounted and through the connections described to all of the other driving wheels to impart a powerful forward feeding action to the machine for the purpose of sumping in.

For causing the gathering conveyor to sweep back and forth across the mine floor, we preferably employ chains or other flexible connections 117 which are adapted to be wound upon drums 118 and 119. From these drums the chains pass between idlers 120 mounted in the front frame member 6 of the truck passing thence over idlers 121 carried by the gathering conveyor pan, and thence around jacks indicated at 122 that are set in position between the floor and the ceiling of the mine in a usual and known manner, said chains being then returned to and connected to the gathering conveyor pan at 123. It is apparent that if the right hand drum be rotated to wind the chain thereon, the chain will be drawn upon to pull the nose of the conveyor toward the right and that the conveyor pan may be correspondingly pulled toward the left by imparting winding movement to the left hand drum. It is desirable that this winding movement of the drums be a comparatively slow and powerful one and for that reason motion is imparted to these drums from the sleeve 113 which as before stated, is driven through the worm gearing. With this end in view, clutch blocks 124 and 125 are provided, these clutch blocks being provided with clutch faces that are adapted to engage with clutch faces 126 and 127 upon the winding drums and being splined on sleeve 113.

It will be observed that the worm gear casing has its bearing upon the sleeve 113 and in order to prevent the turning movement of this sleeve from swinging the casing bodily about the axle 8, we connect this casing by means of a rod 128 with a bracket 129 that is mounted upon end frame members 6 of the truck. This rod is rendered adjustable with respect to said bracket by means of nuts 130 and 131 which are threaded thereon and which bear upon opposite sides of the bearing ear 129. This adjustment renders it possible to impart a limited swinging movement to the casing about the axle so that the tension of the sprocket chains 101 and 102 may be simultaneously and easily effected. Since the axle 8 is mounted in journal boxes of a conventional type, it follows that the truck frame is likely to have a limited vertical movement with respect to the axle and to permit this, the rod 128 is pivotally connected with the worm gear casing at 132. Since it would manifestly be disastrous to the mechanism if the low speed feed clutch and the high speed feed clutch were accidentally simultaneously thrown into operation, we contemplate the provision of an inter-lock between the controlling levers of these clutches whereby it will be impossible to throw them into operation simultaneously, and we further contemplate the provision of means for preventing the clutch which constitutes the connection between the slow

speed sleeve 113 and the adjacent driving wheel 10, from being thrown into gear at a time when the high speed clutch has been thrown into action for the purpose of propelling the machine from place to place; it being apparent that with the driving wheels rotated at a comparatively rapid rate of speed, breakage of some of the parts would ensue if the low speed assembly were thrown into connection with these wheels at such time.

The means for shifting the clutch blocks 99 and 100 simultaneously toward and from each other comprises rings 133 and 134 that engage in grooves 135 and 136 formed in the clutch blocks, which rings carry upstanding pins 137 and 138 that are engaged in cam slots 139 and 140 of a disk 141. This disk is mounted upon the lower end of a shaft 142 that is journaled in a bracket 143, supported from the frame of the motor. A crank arm 144 upon the upper end of the shaft 142 has pivotal connection at 145 with a hand lever 146. One end of a spring 147 is connected to the frame of the motor at 148 and the other end of this spring is connected to the outer end of the crank arm 144. This spring serves to complete the throw of the crank arm 144 and disk 141 in either direction upon opposite sides of the center. It is apparent that if the handle 146 be pulled outwardly, the cam slots in the disk 141 will act through the connections described to throw the clutch blocks away from each other and into engagement with the clutch faces 97 and 98 upon the sprockets 95 and 96 thereby imparting rotation to these sprockets, and, through the connections described, to the slow speed sleeve 113. This, however, effects no movement of any of the parts driven from said sleeve, it being necessary to additionally actuate the several clutches mounted upon said sleeve before the sleeve is effective to drive any of the other parts. It is apparent that if the inter-engaging elements of the clutch blocks 99 and 100 and the sprockets 95 and 96 respectively do not happen to be in position to mesh at the moment that the operator actuates the handle 146, spring 147 will act to complete the throw of the parts when, during the rotation of the clutch blocks, meshing position is reached. It is thus unnecessary for the operator to use great care in effecting this engagement. He is only required to give the necessary initial movement to the handle. The high speed clutch block 89 upon the rear axle 9 is grooved in the usual way to receive an operating fork 149 see Fig. 14 that is pivoted at 150 upon a bracket 151 mounted upon one of the side frame members. An operating handle 152 is slidably mounted in an extension 153 of the bracket 151 and is pivotally connected at 154 with the upper end of the fork 149. It is apparent that an outward pull upon the handle 152 will throw the clutch block 89

into engagement with the clutch jaws 91 of sprocket 88 to effect the high speed drive of the truck. Pivotaly mounted at 155 upon a bracket 156 is an inter-locking link 157, the ends of which are forked at 158 and 159 to respectively engage the operating handles 146 and 152, these forked ends lying in the path of movement of stops 160 and 161 upon said handles. This construction provides means whereby the handle 146 will be automatically thrust inwardly to disengage the clutch blocks 99 and 100 from the sprockets 95 and 96 whenever the handle 152 is pulled outwardly to throw the high speed clutch into gear. The mechanism for operating the sump feed comprises a rock shaft 162 that is journaled in brackets 163 that are supported from one of the side frame members of the truck. Rocking movement may be imparted to this shaft by a pedal 164. A crank arm 165 that is fast upon one end of the rock shaft has a loose pivotal connection 166 with an arm 167, the latter having a downwardly bent end 168 that is pivotally engaged at 169 with the operating yoke 170 of the sumping in clutch block 115. This yoke swings from a pivotal point of support 171 upon a bracket 172. It is apparent that downward pressure upon the pedal 164 will throw this clutch block into engagement with the clutch jaws 116 of the wheel 10 and thereby effect a connection between said wheel and the slow speed sleeve 113. When the high speed clutch is in gear and the machine is traveling from place to place, it becomes necessary to guard against the possibility of the sump clutch being thrown in, irrespective of whether the sleeve 113 is receiving movement through the worm drive or not because if the sump clutch was thrown in at this time, there would be a tendency to impart motion from the driving wheels to the worm gearing with the result that breakage of the parts would occur. To guard against this possibility, the rock shaft 162 is provided with a crank arm 173, to the upper end of which a link 174 is pivoted. This link is slotted at 175 and a pin 176 of the inter-locking lever 157 engages in this slot. It is apparent that whenever the handle 152 is drawn outwardly, the pin 176 lies at the inner end of the slot 175 so that if the sump pedal 164 be depressed at this time, the link 174 will act upon the pin 176 and throw the handle 152 inwardly to disengage the high speed clutch but when the handle 152 is already in and the high speed clutch is disengaged and the handle 146 has been pulled out to impart movement to the sleeve 113, the inter-locking lever 157 lies at such an angle with relation to the side frame that its pin 176 lies in that end of the slot 175 towards the side frame member of the truck. This affords a lost motion connection between link 174 and inter-locking lever 157 which per-

mits the pedal to be actuated at this time without imparting movement to said inter-locking lever. A rock shaft 177 is mounted in bearing 178 and is provided with operating hand lever 179. This rock shaft carries a crank arm 180. A spring 181 is connected at one end to the bracket 182 and at its other end to the extremity of the crank arm 180, this pin serving to effect a "past center" throw of the crank arm 180 for a purpose which will be presently set forth. The crank arm 180 carries a pin 182 that travels in a slot 183 formed in the outer end of an arm 184. This arm has pivotal connection at 185 and 186 with the upper ends of yokes 187 and 188 that are pivoted at 189 and 190 to brackets 191 and 192 and these yokes engage and actuate the clutch blocks 124 and 125. It will be noted that the arm 184 constitutes a common actuating means for the yokes 187 and 188 and that when the arm 184 is moved in one direction, one clutch block will be thrown into action and the other will be thrown out and vice versa. This construction is desirable because it results in freeing one of the drums 119 during the time that the other drum is in action and this renders it possible for the workman whose duty it is so advance the jacks, to freely pull the chain from the free drum and adjust it about the jack upon one side of the gathering conveyor during the time that the gathering conveyor is moving toward the jack upon the other side so that by the time the gathering conveyor has made a complete sweep in one direction, the parts will have been set in position to immediately take up the sweep in the opposite direction. The spring 181 serves the same function with respect to the clutch blocks 124 and 125 that the spring 147 serves, that is, it completes the throw of the parts after the operator gives the necessary initial movement to the operating handle and effects the engagement of the clutches when, during their rotation, meshing position is reached.

The loading conveyor is mounted upon the truck comprising side frame members 193, a front frame member 194 and a rear frame member 195. The frame of this truck is supported upon axles 196 and 197 which carry wheels 198 and 199, these wheels being preferably, though not essentially, of a nature to engage the mine car track. The loading conveyor truck is connected to the front truck by means of a draw bar 200. This draw bar is engaged at one end with a pin 201 which not only serves as the center about which the draw bar swings but also serves as the pivotal point about which the elevator or loading conveyor moves as will be presently set forth. The forward end of the draw bar 200 is pivoted at 203 to an ear 204 of the front truck. The rear frame member 7 of the front truck is provided with a

convex portion or swell 205 and the front frame member of the rear truck is provided with a hump 206. The length of the draw bar 200 and the curvature of the swell 205 and 206 bear such relation that as the trucks move to varying positions of angularity with respect to each other during the working of the machine upon curves, the pivotal point of the gathering conveyor in eye 19 will be maintained in substantially concentric relation with the pin 201 throughout all positions of angularity of the two trucks with respect to each other. This is due to the fact that as the trucks move out of alignment with respect to each other, the convex front edge 207 of the rear truck rocks down into the concave rear edge 208 of the front truck much after the manner of a gear tooth, the resultant slight movement of the rear truck as a whole toward the front truck being sufficient to compensate for the tendency of the pivot points of the two conveyors to move apart as these pivot points move outwardly beyond the track center in one direction or the other when the trucks are on curves.

The elevator or loading conveyor comprises a sharply inclined portion 209 and a substantially horizontal portion 210. Walls 211 and 212 are formed with the sides 209 and 210 respectively and the walls 211 constitute a hopper of considerable depth while the walls 212 in conjunction with the remainder of the structure, serve to retain and confine the coal as it is carried rearwardly to be discharged into the mine car indicated at 213. Traveling flights 214 are carried by chains 215, these flights traveling upwardly and rearwardly over the floor 216. At their rear ends, the chains pass over sprockets 217 that are mounted upon a shaft 218, while at their forward ends, these chains pass over sprockets 219 that are mounted upon a shaft 220. The shaft 220 is in turn supported in a yoke 221, said yoke having an ear 222 engaged by the pin 201. Thus it will be seen that the loading conveyor or elevator together with the yoke swing bodily about the pin 201 and that this loading conveyor may be moved to varying positions of angularity with respect to the rear truck. It is apparent that if the entire weight of the loading conveyor rested upon the pin 201, said pin would be subjected to severe strain. In order to relieve this pin of undue strain and in order to securely support the loading conveyor against any tendency to tilt laterally in either direction, the shaft 220 is extended beyond the yoke 221 at each end thereof and the projecting ends of this shaft enter and are supported upon the bottoms of pockets 223 formed directly in the side frame members of the rear truck. Cap plates 224 are bolted into position over the projecting ends of this shaft. The rear end of the gathering con-

veyor projects into the hopper 211 and it is to be noted that the level of the gathering chains is materially below the level of the top of the hopper so that coal discharged centrifugally from the gathering conveyor cannot be thrown over the sides of the hopper but will be caught thereby and directed by the steep side walls of the hopper upon the bottom 216 of the hopper and into the path of movement of the flights 214. The sharp incline given the forward part of the conveyor and hopper as indicated at 209 serves to bring the forward end of the hopper to a very low point so that it may be supported as shown, directly within the truck frame. This not only adds to the rigidity and strength of the structure but renders the machine, as a whole, a very low one, adapting it to operate in mines in which there is very little head room. A further feature of advantage in this construction is that not only is the capacity of the hopper increased but the coal is caused to travel up a comparatively sharp incline during its initial engagement by the flights and while the coal is still within the high side walls of the hopper proper. This is important because it insures proper engagement of the flights with large lumps of coal before these lumps pass out of the hopper proper. In other words, if a very large lump of coal (and the machine is frequently called upon to handle huge lumps) is not securely engaged with the flight when it starts to move up the sharp incline, it will move only a very short distance before the flight will pass from under it, while if it is engaged securely enough by the flight to travel up the sharp incline, the engagement will be such that it will travel the rest of the distance without danger of dislodgment from the flight. This is important because it guards against the possibility of a large lump of coal being carried along while resting upon a flight in a teetering and insecure position to the relatively shallow portion 212 of the conveyor with the possibility that when it reached this shallow portion of the conveyor, it would roll from the flight and fall over the side of the conveyor and injure some of the workmen.

It is desirable to avoid excessive width of the hopper both because the confines in which the machine moves are limited and because by keeping the hopper narrow, the side walls are rendered correspondingly steep so that the angle of repose of the coal will never be reached and so that the material discharged into the hopper will always be directed quickly upon the conveyor. However, it is equally necessary that the gathering conveyor be permitted to swing to sharply angular positions with respect to the hopper despite the fact that its rear end is disposed therein. To accomplish both of these objects and at the same time avoid interference between the forward

corners of the hopper and the gathering conveyor, we cut away the forward corners of the hopper as indicated at 225 and provide filling plates 226 that are slidably mounted in cleats 226^a. These plates may be slid back by hand when the gathering conveyor swings toward them or they may be connected to move automatically to and from operative positions by means of links 227 which are pivotally connected at 228 with the plates and at 229 with the sides of the gathering conveyor. Provision of these plates is rendered necessary because, as before stated, if the capacity of the machine is to be maintained, the gathering conveyor must travel at a considerable rate of speed and these plates prevent coal being thrown by centrifugal action through the openings that would be left if these plates were not provided.

It is manifestly desirable to have a reasonable degree of overhang of the loading conveyor beyond the end of the rear truck so that not only may mine cars of considerable capacity be run therebeneath but said cars may be manipulated in the most efficient way to distribute the load. In order to obviate any tendency of this overhanging structure to tip the front end of the rear truck upwardly, we provide upon the forward end of said truck a projection 230 which projects beneath the rear frame member 7 of the front truck.

Motion is imparted to the shaft 218 to drive the chains 215 and flights 214 by a motor 231 that is slung from the under side of the frame of the loading conveyor by means of a bracket 232. The shaft of this motor carries a pinion 233 which meshes with a gear 234 upon a shaft 235. This shaft carries a sprocket wheel 236 which is connected by a sprocket chain 237 with a sprocket 238 upon a shaft 239. This shaft is in turn connected by sprocket 240, chain 241 and sprocket 242 with a shaft 243, the inner end of which is journaled in a bearing 244 and the outer end of which is journaled in a worm gear housing 245. A worm 246 upon the shaft 243 meshes with a worm wheel 247 upon the shaft 218. The shaft 218 is mounted in bearings 248 which are carried by plates 249 that are slotted at 250 for the reception of bolts 251 by which these plates may be given an endwise adjustment with respect to the bolts, said bolts supporting the plates from the fabricated steel walls 210 of the loading conveyor. Adjusting bolts 252 threaded into the bracket 253 provide means for thrusting the plates 249 rearwardly to thereby adjust the tension of the chains of the loading conveyor. A transversely extending rod or shaft 254 unites the plates 249 and causes them to move in unison so that these plates will have an equal degree of movement. Since the shaft 243 lies at an angle to the plates 249, it becomes desirable to provide a limited rotative adjustment for the housing 245 to prevent binding

of the bearings of the housing upon the shaft 243 as the plates 249 are adjusted rearwardly. To this end, the bearing 248 is shaped to constitute a hub 248^a and the housing 245 is provided with bearings 255 which are mounted upon the hub 248^a for limited turning movement. The housing and associated parts are adapted to be bound against turning movement by bolts 256. The parts through which these bolts pass are appropriately slotted as indicated at 257 to permit a limited turning movement of the housing about the shaft 218, it being understood that these bolts are loosened during the time that the plates 249 are being adjusted to thereby permit the housing to adjust itself to variations in the angle of shaft 243, these bolts being tightened after the adjustment of the plates has been completed. Set screws 258 threaded in the bosses 259 of the plates 249 aid in holding the housing 245 against turning movement after the adjustment has been completed. The bottom 216 of the loading conveyor is united to the sides 209 and 210 by angle irons 260 and this bottom is continued to form a curved extension 261 at its lower end in such manner as to overlie the shaft 220. A plate 262 unites the side walls of the conveyor at the lower portion thereof and forms a closed receptacle at that point to constitute a pocket to prevent coal from falling through. The flights sweeping downwardly through said pocket are then guided by curved plates 263 to move into close relation to the bottom 216 and efficiently engage and carry the coal up the incline. The returning runs of the chain travel upon and are supported by angles 264 that are riveted, bolted or otherwise secured to the side walls of the conveyor. It is sometimes the case that, when the mine car is loaded to such an extent that coal is heaped high thereon and the pile nearly reaches the rear end of the conveyor that the returning flights of the chain have a tendency to drag some of the coal back beneath the under side of the conveyor and in order to prevent this coal from being dragged over the front end of the mine car, we locate a transversely extending angle 265 beneath the conveyor and support the same by clip angles 266 from the sides of the conveyor in such position that this coal will be caught and retained.

For adjusting the loading conveyor vertically and about the horizontal axis provided by the shaft 220, we employ toggle links 267 and 268. The upper ends of the links 267 are pivoted between brackets 269 that are carried by the side walls of the conveyor and the lower ends of these links are pivotally mounted upon trunnions 270 that project from nuts 271 that are threaded upon a shaft 272. The upper ends of the links 268 are likewise engaged with these trunnions while the lower ends of said links are pivotally connected to

a laterally traveling carriage 273, said carriage being provided with wheels 274 that are mounted to travel upon an arcuate rib 275 formed upon the rear portion of the truck frame and struck from the center constituted by the pin 201. The shaft 272 is threaded in such manner that when it is rotated in one direction, the nuts 271 will be drawn toward each other to thereby bring the toggle links into a straight line and when said shaft is rotated in the opposite direction, these nuts will be moved away from each other to bring these links into angular relation and thereby lower the rear end of the conveyor. In order to render it possible for one man to easily manipulate the very considerable load constituted by the conveyor and the coal therein, one of the nuts 271 is extended to form an enclosing housing 275^a within which a worm wheel 276 is located, this wheel being splined upon the shaft 272 so that rotation of the worm wheel will impart rotation to the shaft 272, while at the same time the gear wheel 276 may have the necessary end-wise movement with respect to said shaft 272. A worm 277 is fast upon a shaft 278 that carries a hand wheel 279 and this worm meshes with the worm gear 276 and the pitch of the teeth of these parts is such that the worm and worm gear constitute a reducing gearing between the hand wheel and the shaft 272. For imparting a lateral traveling action to the carriage 273 to thereby adjust the conveyor in a horizontal plane about the axis formed by the pin 201, we provide an arcuate rack 280 upon the rear face of said carriage with which a worm 281 that is mounted upon a shaft 282, meshes. This shaft is mounted in bearings 283 upon the truck frame and carries hand wheels 284 by which rotation may be imparted to the shaft 282 to adjust the carriage 273 back and forth as before stated. 285 designate brake shoes for engaging the driving wheels of the gathering conveyor truck, these brake shoes being carried by swingingly mounted levers 286 that are connected by arms 287 and 288 with a floating equalizing lever 289. A flexible connection 290 comprising in its length an adjustable turnbuckle 291 has engagement with a shaft 292 upon which a worm wheel 293 is mounted. A worm 294 that is carried by a shaft 295 meshes with the worm wheel 293. A hand wheel 296 provides means for imparting a slow and powerful rotation to the shaft 292 to set the brakes. These brakes may be utilized not only in controlling the movement of the machine in running about the mine but also serve to hold the machine up to the work and against the action of the load after sumping in and during the operation of the gathering conveyor. If desired, sand boxes 297 provided with controlling levers 298 may be located in such position as to sand the track and

to further aid in increasing the tractive power of the machine in sumping in.

From the foregoing description, it will be seen that a loading machine of great utility is provided capable of use under the varying adverse conditions met with in mining in confined and cramped places, upon short curves and in rooms where the overhead space is greatly limited. By virtue of its flexibility and rapidity of operation, a machine is provided whereby it is possible to recover a much greater percentage of the coal in the mountain than could be recovered by hand loading. This is due to the fact that in many mines the procedure is to drive rooms through the seam of coal, leaving what are termed pillars to support the roof which is usually of slate. After the mountain has been largely undermined by these rooms, "pillar robbing" begins. The miner takes the coal from these pillars and retreats finally from the mine, leaving the mountain to settle behind him. The settling of the roof is usually more or less gradual. Where the coal is mined and loaded by hand, the danger of remaining too long in a part of the mine from which the supporting pillars have been removed is such that the coal is not usually thoroughly recovered. The machine herein shown and described work so rapidly and with such efficiency about these pillars that all of the coal may be recovered, while at the same time, ample time is permitted the workmen to reach a safe place before any considerable settling of the roof takes place.

It is frequently the case that after the machine has loaded, a part of the coal loosened by the shooting operation, coal is encountered which, while having been more or less shattered by the shot, is not sufficiently loosened to fall of its own accord. Furthermore, it is found that the coal is not sufficiently loosened from the mine floor by the shooting operation. To aid in dislodging the coal adhering to the mine floor and to aid in causing the coal to fall upon the nose of the gathering conveyor, the arms or flights 31 of the gathering conveyor are so shaped that each alternate arm has its outer end slightly downturned and is provided with a fish tail bit 31^a which dislodges the coal adhering to the mine floor while the intermediate arms have fish tail bits 31^b in the outer ends and fish tail bits 31^c in upwardly inclined extensions 31^d thereof, these latter bits biting into the mass of coal thereabove and tending to cause the mass to fall upon the nose of the gathering conveyor. The arms 31 are preferably provided upon their upper faces with angle plates 299 that are held to said arms by bolts 300 and nuts 301. These bolts 300 are designedly of small size so that they will break under undue strain and if the load upon the gathering conveyor is abnormally great or if large lumps of coal become wedged in

such manner as to render it so difficult to start the load that there would be danger of breakage of the arms 31, the bolts 300 will yield and relieve the arm of the strain.

In Figs. 17, 18 and 21 we have illustrated power means driven from the shaft 218 of the loading conveyor for imparting movement to a cable or other flexible element by means of which the mine car may be moved outwardly during the loading operation to thereby effectually distribute the load throughout the length of the same. The structure in question comprises a worm 302 upon shaft 218 which imparts movement to a sliding worm gear 303 continuously in mesh therewith and movable by means of a handle 304 that is pivoted at 305. The teeth of the worm gear are of such length as to permit of its being moved to bring ratchet teeth 306 thereof into and out of engagement with teeth 307 of a winding drum 308. A chain 309 is wound upon this drum and passes over a pulley 310 that is carried by a bracket 311. This chain is adapted to be connected by means of a hook 312 to the mine car 213. It is apparent that this structure provides means for drawing upon the chain to move the mine car outwardly to distribute the load therein, it being understood that when the mine car is first moved into place it is shoved inwardly by a mine locomotive to such position that its outer end is loaded first.

In Figures 23 to 36 we have illustrated a power pick mounted upon and bodily movable with the gathering conveyor and preferably driven from one of the flight carrying sprockets of the gathering conveyor. In the structure illustrated in the aforesaid figures the shaft 39^a of the forward sprocket 38 is extended and carries a worm 313 which meshes with a worm wheel 314 on a shaft 315. This shaft carries a bevel gear wheel 316 meshing with a bevel gear wheel 317 on a shaft 318. The shaft 318 carries one of the members 319 of a universal joint 320. The other member 321 of this universal joint carries a shaft 322 that has splined engagement at 323 with a hollow shaft 324. The latter is journaled to turn in a housing 325, the lower end of which carries a spherical enlargement 326 which co-acts with a spherical segmental member 327 to permit the housing and the shaft to have universal movement while at the same time driving connection is maintained between the shaft 39^a and shaft 322. A housing 328 is slidably mounted upon the housing 325 and carries bearings 329 at its outer end which support a shaft 330. This shaft is driven by means of a worm and worm gear 330^a and 331 from the shaft 324. The shaft 330 carries discs or drums 332 and these drums in turn carry tangentially disposed pick points 333. By slidably mounting housing 328 on housing 325 and

by splining the outer shaft 324 upon shaft 322 the structure as a whole is rendered telescopic or extensible and this in conjunction with its capacity for swinging back and forth laterally and forward and backward enables the person manipulating the same to direct the pick points to any desired point upon the face of a wall of coal. To relieve the operator of the greater part of the work of lifting the extensible portion of the pick, we provide a strong spring 334 one end of which is connected at 335 to a seat support 336 and the other end of which is connected to a cable which passes over a pulley 337 mounted upon a standard 338 that is carried by a housing 339 within which certain of the aforesaid gearing is located. The spring counterbalances the weight of the structure and if an operator seated in a seat 340 brings his weight to bear upon the foot-board 334^a the telescopic housing and the shaft of the pick will be projected upwardly and outwardly. To provide means for swinging the pick points back and forth laterally, cables 341 are attached at 342 to the housing 328 and are passed over pulleys 343 mounted upon outwardly flaring standards 344. These cables are provided with handles 345.

It is apparent that an operator seated in the seat 340 may by drawing upon the one handle or the other move the picks laterally and that he may by pressure upon the foot-board move the picks vertically. Since the drums or discs 332 are comparatively heavy and since the pick points deliver only one blow in each rotation of said drums it follows that these drums gain sufficient momentum to deliver a very powerful blow. Springs 346 tend to maintain the pick in vertical position, laterally, and relieve the cables of the weight of the pick when the latter swings beyond the center to one side or the other.

The present mechanism comprises a novel combination and correlation of parts which results in producing a loading machine of remarkable efficiency. The counter-balancing of the gathering conveyor by locating the point of support of the saddle casting upon trunnions disposed substantially centrally of the front truck relieves the weight of the load upon the nose thereof, permitting a more facile manipulation of the gathering conveyor and consequently permitting the conveyor chain to be driven at a high rate of speed, which of necessity results in a marked increase in the number of tons of coal per hour that can be handled. The relation brought about between the rear end of the gathering conveyor and the hopper by which coal discharged centrifugally is collected and delivered to the loading conveyor, constitutes features which further aid in increasing the output of the machine. The distribution of the weight upon the driving wheels together

with the provision of the slow and powerful feed thereto renders it possible to force the nose of the gathering conveyor into the pile in a most efficient way. The provision of means for swinging the loading conveyor to varying positions of angularity upon its truck both vertically and horizontally provides for an even distribution of the load in the mine car and for the most effective disposition of the two conveyors with respect to each other when working upon curves. The provision of the power pick mounted upon and bodily movable with the gathering conveyor provides means for knocking down the loose coal left in a ruptured condition by a shot, so that the gathering conveyor will always find a sufficient amount of material to enable it to work at its maximum capacity throughout its swinging movement.

The invention is not limited to the particular mechanisms herein shown and described. It is manifest that various mechanical embodiments of the principles involved will readily suggest themselves to the mechanic and engineer skilled in the art. Many of the advantages recited would be present irrespective of the particular mounting of the mechanism. For example a portable frame other than a wheeled truck might be employed, such for example as a caterpillar tractor, or a skid having means for moving the same. Therefore the term truck is intended to be broadly construed in the interpretation of the accompanying claims. It is to be understood that the invention includes within its purview whatever changes come within either the terms or the spirit of the appended claims.

Having described our invention, what we claim is:

1. In a loading machine of the character described, the combination with a front truck and a rear truck, the said trucks being arranged in tandem relationship, of a gathering conveyor mounted to have a swinging movement in a substantially horizontal plane about a vertical axis provided upon said front truck and located substantially over the rear end thereof, a hopper within which the rear portion of the conveyor lies, the sides of which hopper project above the level of the rear or discharge portion of said conveyor to confine the material discharged from said conveyor within the limits of the hopper, said hopper being mounted adjacent to the front end of the rear truck, said gathering conveyor comprising travelling flights which travel in a substantially horizontal semi-circular path within the hopper, and a loading conveyor carried by the rear truck and to which the material is conducted by said hopper.

2. In a loading machine of the character described, the combination with a wheeled base unit, a gathering conveyor mounted to have a swinging movement about a vertical axis located at the rear end of said conveyor

and carried by said base unit, a hopper within which the rear portion of the conveyor lies, the sides of said hopper being disposed to project above the level of said conveyor, said gathering conveyor comprising travelling flights which travel in a substantially horizontal semi-circular path within the hopper, said flights thereby serving to discharge material carried thereby centrifugally into said hopper, and a loading conveyor for leading the material out of said hopper.

3. In a loading machine, the combination with a portable base structure, a gathering frame, a pivotal mounting between said gathering frame and said base structure, said mounting serving to permit the frame to oscillate in a substantially horizontal plane, a gathering conveyor carried by said frame, a driven sprocket situated contiguous to the rear end of said frame for driving said conveyor, laterally extending flights carried by said conveyor for conducting material longitudinally of the frame, said flights being arranged to project over the rear end of said frame, a hopper in which the rear end of said frame is situated, the walls of said hopper being extended above the rear end of said frame to confine the material discharged from said gathering conveyor within the confines of the hopper, and a loading conveyor leading out of said hopper.

4. In a loading machine of the character described, the combination with a front and a rear truck pivotally connected to each other, a gathering conveyor pivoted upon the front truck to sweep horizontally back and forth, a loading conveyor pivoted for lateral swinging movement upon the rear truck, the pivotal connection of the gathering conveyor with the front truck, the pivotal connection of the front truck with the rear truck, and the pivotal connection of the loading conveyor being substantially coincident, and a convex element upon the end of one truck disposed in engagement with a concave portion upon the end of the other truck serving to maintain substantial coincidence of the pivotal mountings of the several parts aforesaid when said trucks assume positions of angularity with respect to each other.

5. In a loading machine of the character described, a front truck and a rear truck, a gathering conveyor pivotally mounted upon the front truck to sweep back and forth across a mine floor, a hopper mounted upon the rear truck, a discharge conveyor operatively related to said hopper, means for swinging the said hopper and discharge conveyor bodily to varying positions of angularity laterally with respect to the rear truck, and supplemental means for adjusting the hopper and discharging conveyor bodily and vertically with respect to the rear truck, and substantially registering pivotal connections

between the trucks of the loading and discharging conveyors respectively.

In testimony whereof we affix our signatures.

JAMES ELLWOOD JONES.
NORTON A. NEWDICK.
WILLIAM E. MOODY.

6. In a loading machine, the combination with a front and a rear truck, of a gathering conveyor mounted for horizontal swinging movement upon the front truck, means for pivotally connecting said trucks together, a hopper supported upon the rear truck in receiving position with respect to the discharge end of the gathering conveyor, means for actuating said gathering conveyor, a loading conveyor leading from the hopper, and a mounting for the hopper and loading conveyor permitting the latter to swing about a vertical axis that is substantially coincident with the pivotal connection between the trucks.

7. In a loading machine of the character described, front and rear trucks, a draw bar connecting said trucks, convex abutting elements upon the ends of said trucks, the confronting ends of said trucks being respectively convex and concave upon opposite sides of said abutting elements, a gathering conveyor upon the front truck, and a loading conveyor upon the rear truck.

8. A conveyor comprising a plurality of line sections arranged to deliver material from one to the other, the delivery end of one section being positioned above the receiving end of the next adjacent section in line, each of said sections embodying an endless conveyor belt and means for imparting travel thereto, side plates extending longitudinally of the conveyor stretch of the belt, the delivery end of one section being spaced from the adjacent ends of the side plates of the other section to permit of relative displacement of said sections in a lateral direction, and plate sections slidably associated with the side plates and adjustable to a position spanning the space between the delivery end of one section and the side plates of the next section.

9. A conveyor comprising a plurality of line sections arranged to deliver material from one to the other, the delivery end of one section being positioned above the receiving end of the next adjacent section in line, each of said sections embodying an endless conveyor belt and means for imparting travel thereto, side plates extending longitudinally of the conveyor stretch of the belt, the delivery end of one section being spaced from the adjacent ends of the side plates of the other section to permit of relative displacement of said sections in a lateral direction, and a baffle plate extending between the said plate sections above the conveyor stretch of the belt.

10. The structure as specified in claim 9 in connection with means for automatically shifting said baffle plate upon lateral movement of at least one of said sections.

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