Sept. 9, 1952 A. L. LEE 2,609,910

LOADING MACHINE

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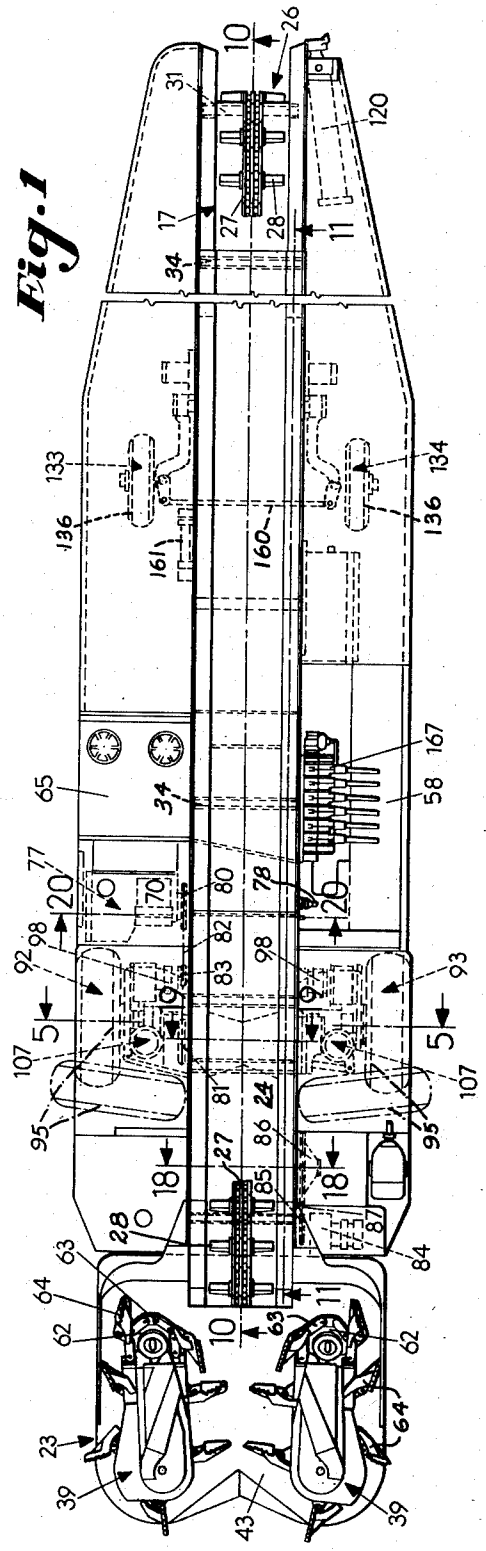


Fig. 1

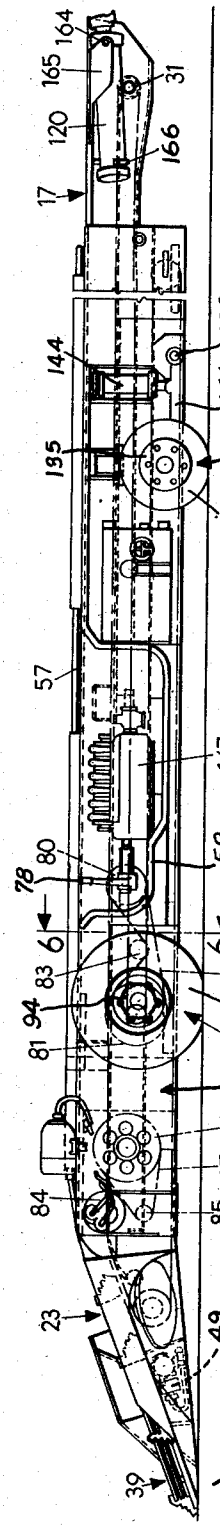


Fig. 2

INVENTOR;
ARTHUR L. LEE,
BY
Harder & Stitzel,
ATT'Y.

Sept. 9, 1952

A. L. LEE

2,609,910

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13 Sheets-Sheet 2

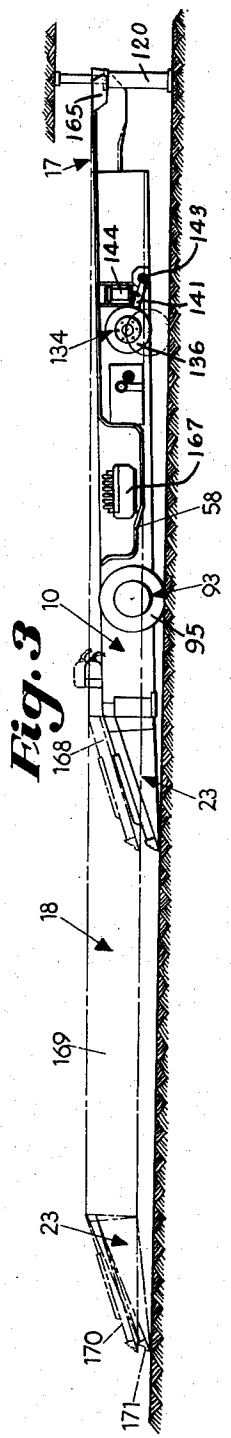


Fig. 3

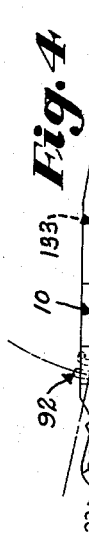


Fig. 4

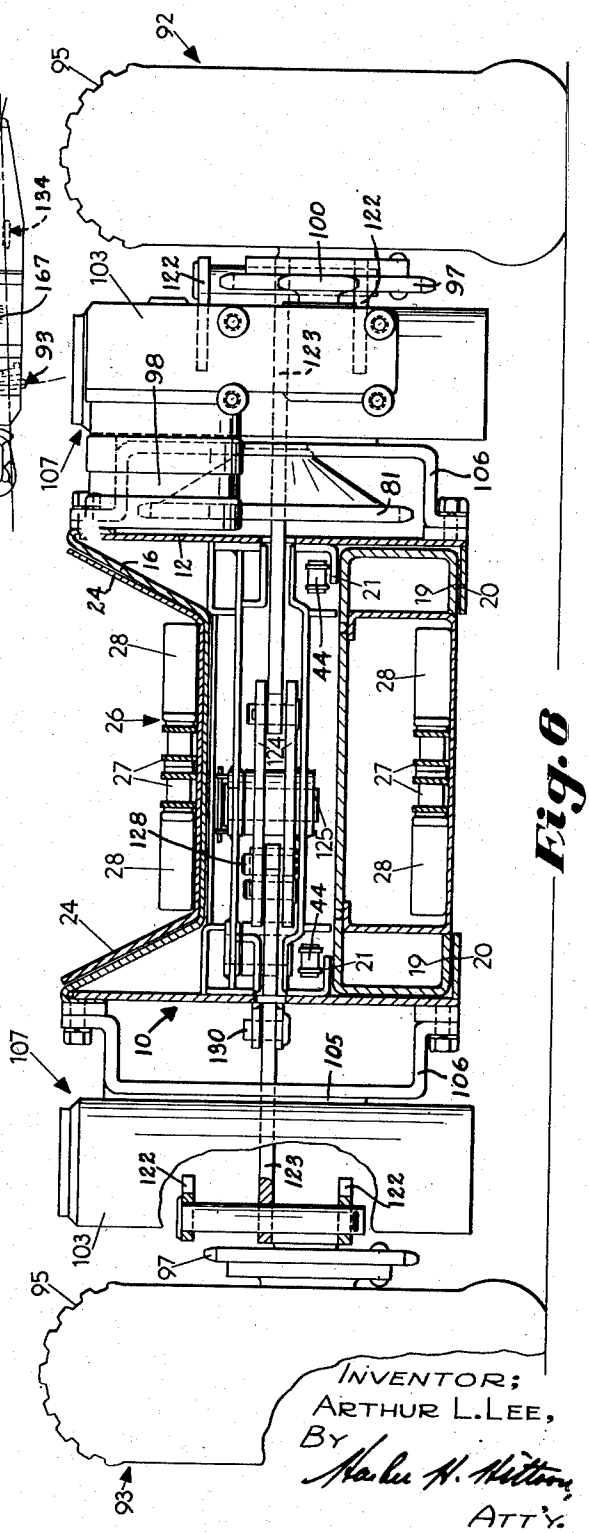


Fig. 6

INVENTOR:
ARTHUR L. LEE,
BY
Marks H. Hutton,
ATT'Y.

Sept. 9, 1952 A. L. LEE 2,609,910

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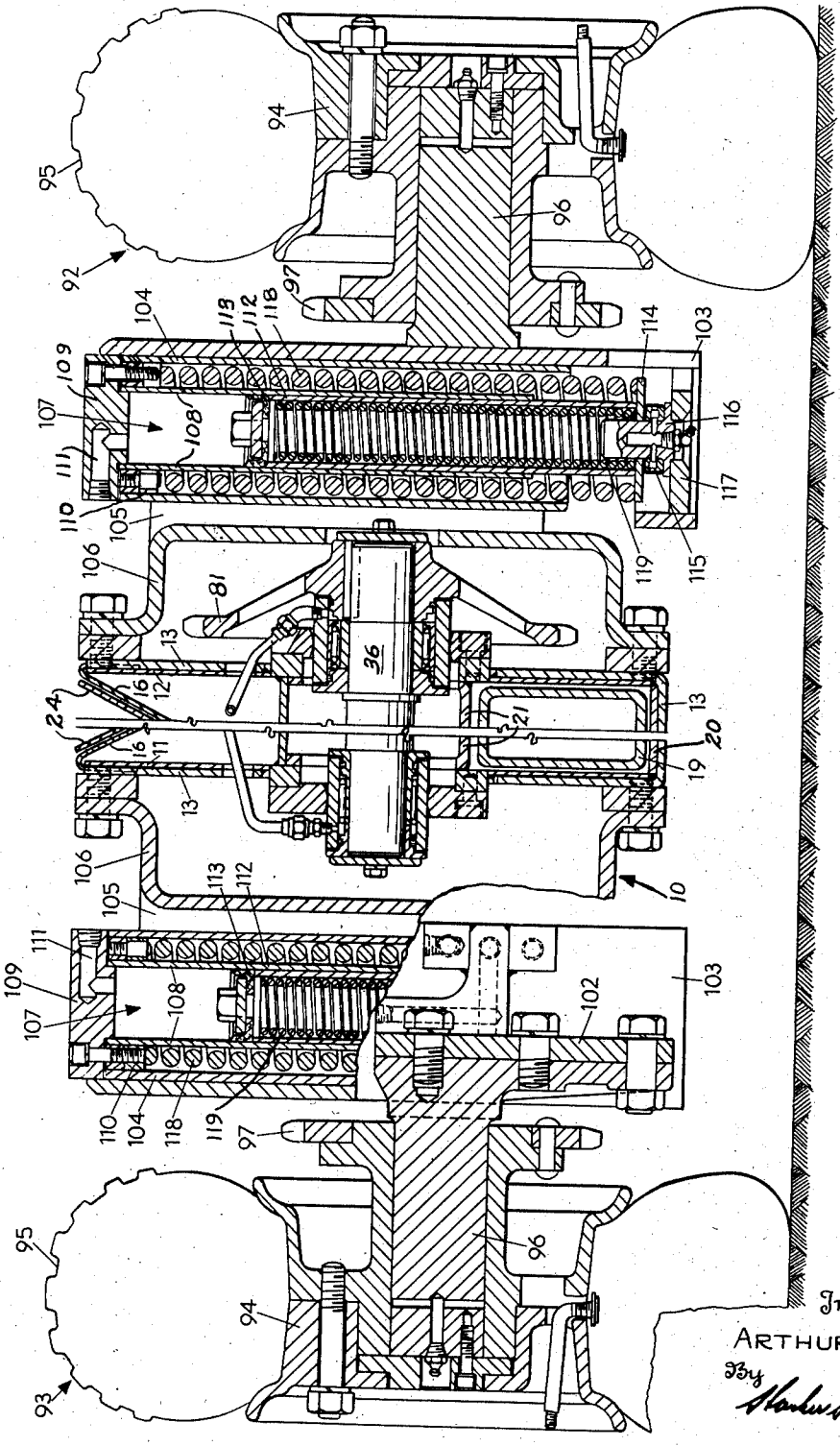


Fig. 5

Inventor;
ARTHUR L. LEE,
By Hanbury H. Hitton,
Attorney.

Sept. 9, 1952 A. L. LEE 2,609,910

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Filed July 8, 1948 13 Sheets-Sheet 4

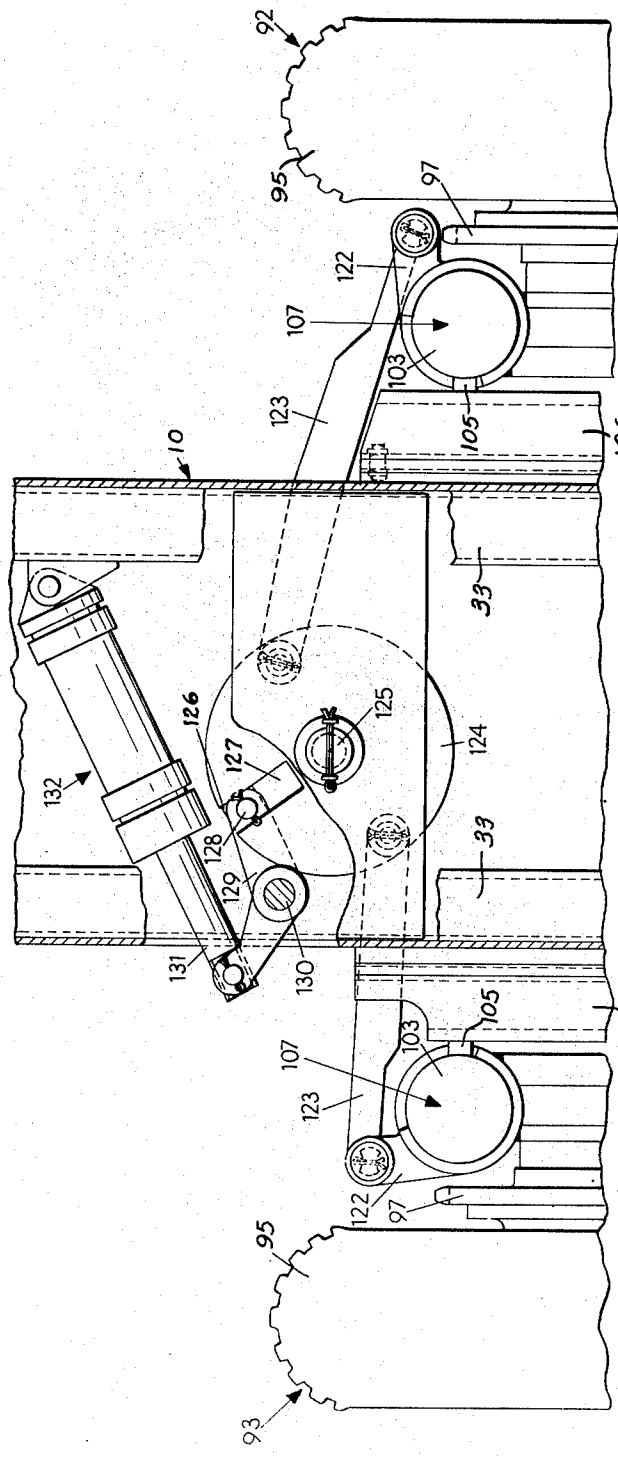


Fig. 7

INVENTOR;
ARTHUR L. LEE,
BY
Parker A. Hutton,
ATT'Y.

Sept. 9, 1952 A. L. LEE 2,609,910

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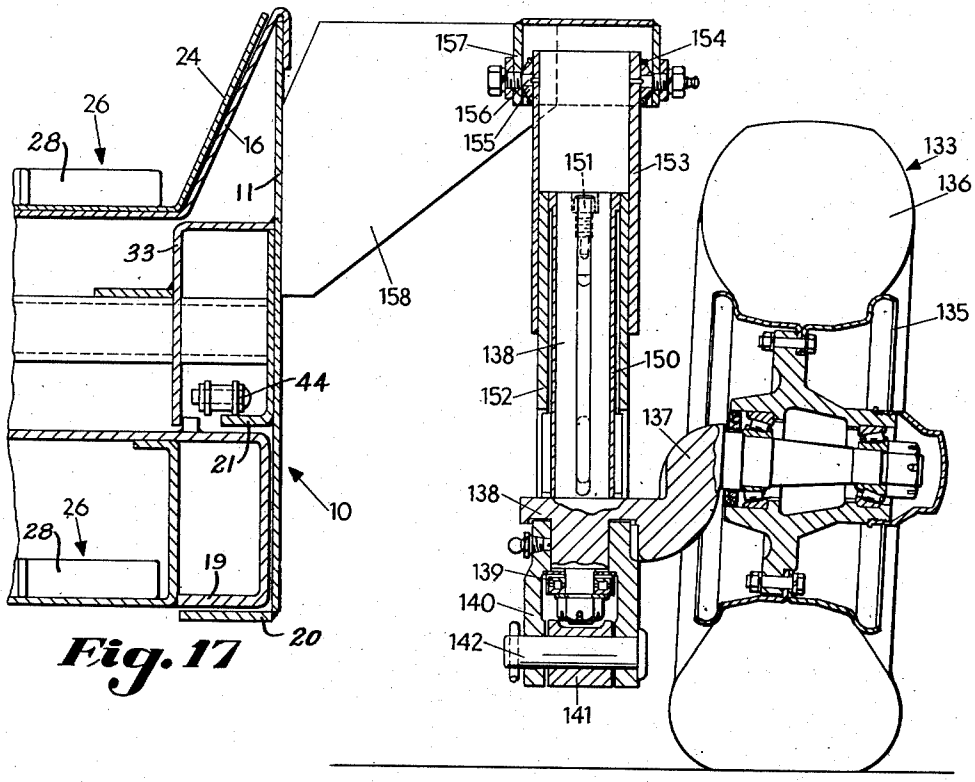


Fig. 17

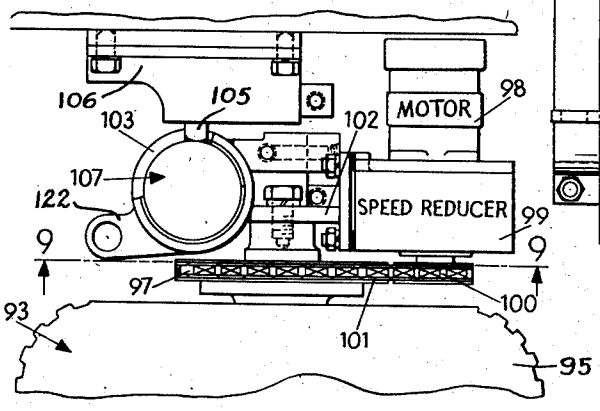


Fig. 8

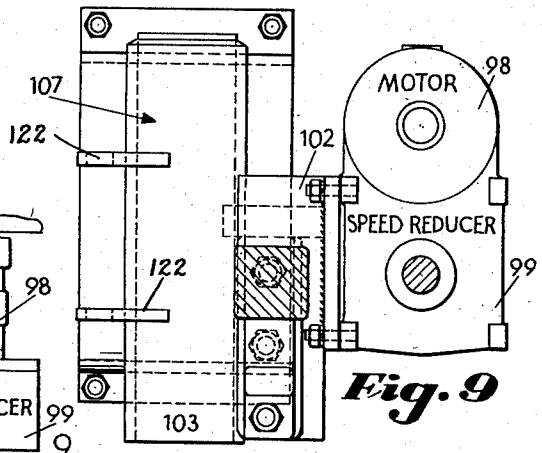


Fig. 9

INVENTOR;
ARTHUR L. LEE,
BY
Harlan A. Hutton
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Filed July 8, 1948 13 Sheets-Sheet 6

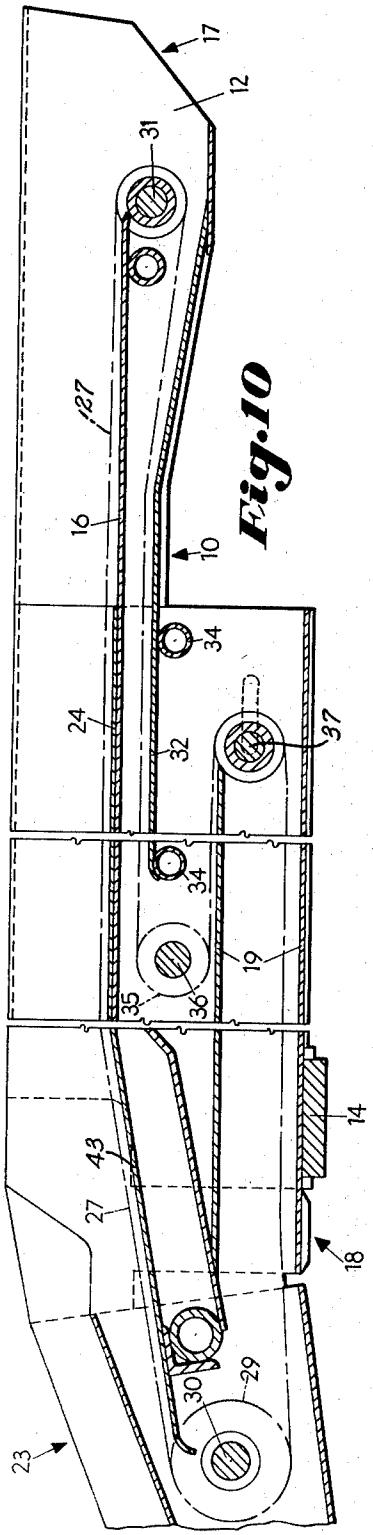


Fig.10

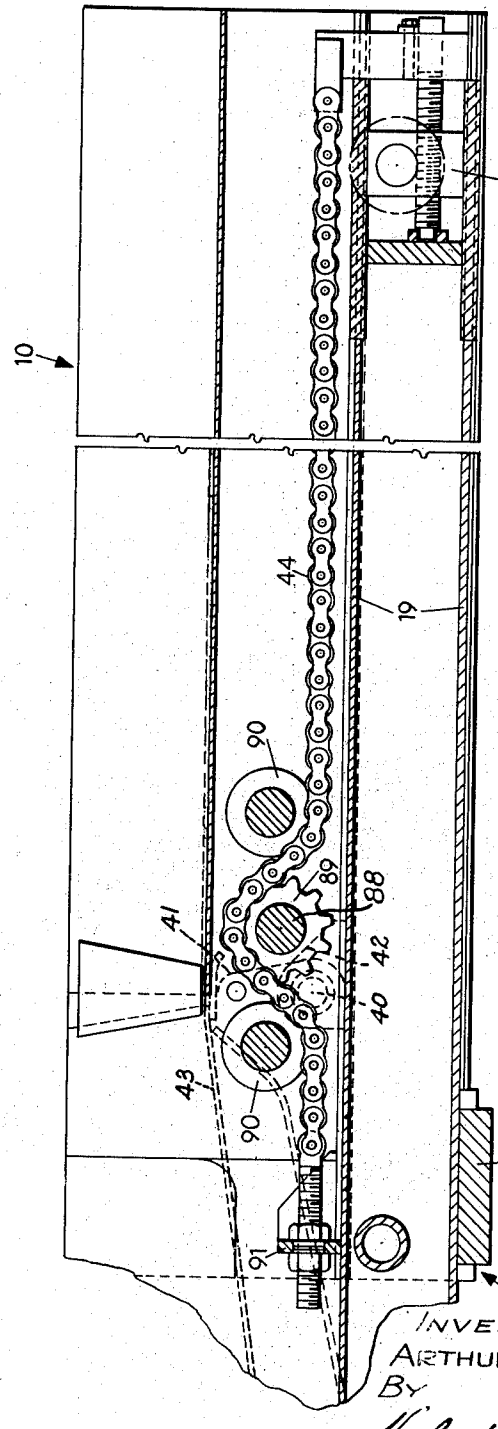


Fig.11

INVENTOR:
ARTHUR L. LEE,
BY
Charles H. Kitton
ATT'Y.

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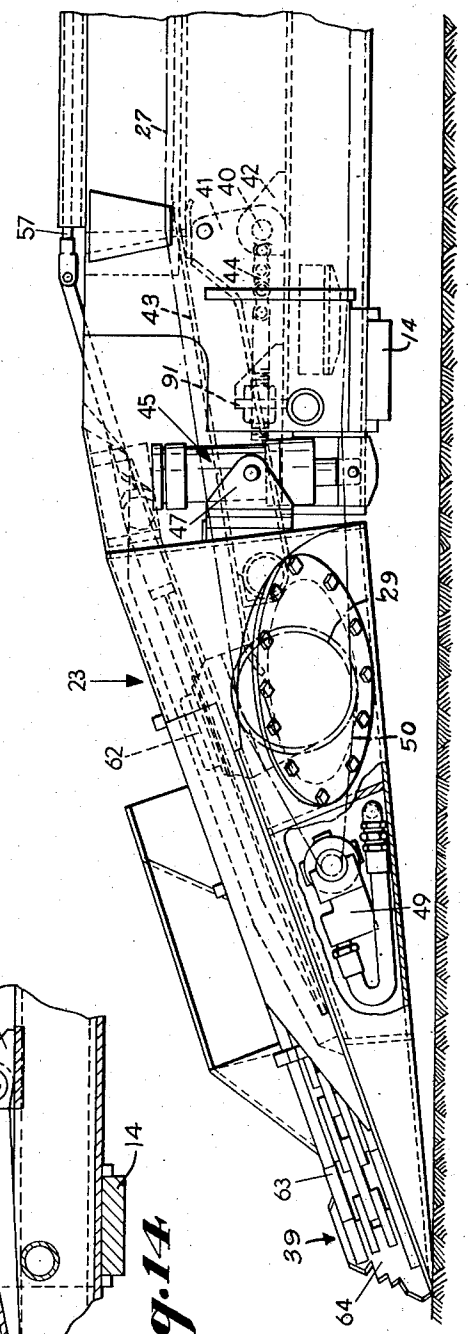


Fig. 12

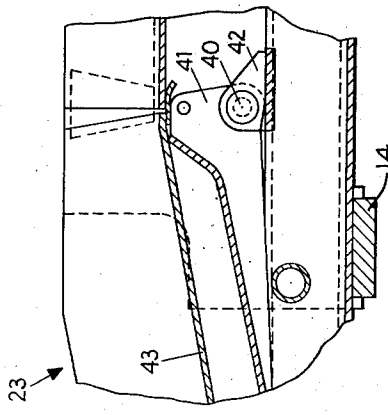


Fig. 14

INVENTOR:
ARTHUR L. LEE,
BY
Harlow N. Hitton
ATT'Y.

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Filed July 8, 1948 13 Sheets-Sheet 8

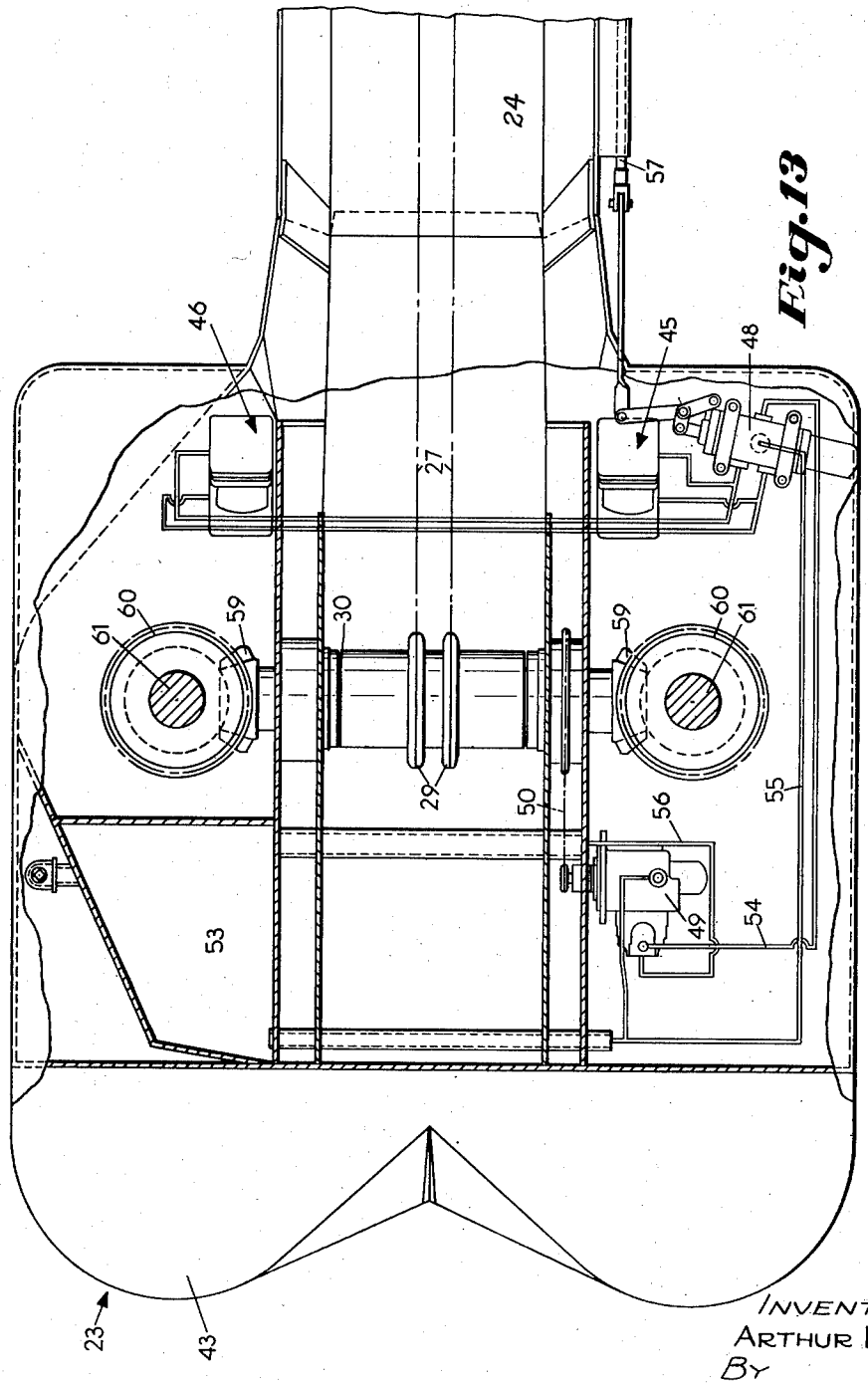


Fig. 13

INVENTOR;
ARTHUR L. LEE,
BY
Hankin & Hutton,
ATT'Y.

Sept. 9, 1952 A. L. LEE 2,609,910

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Filed July 8, 1948 13 Sheets-Sheet 9

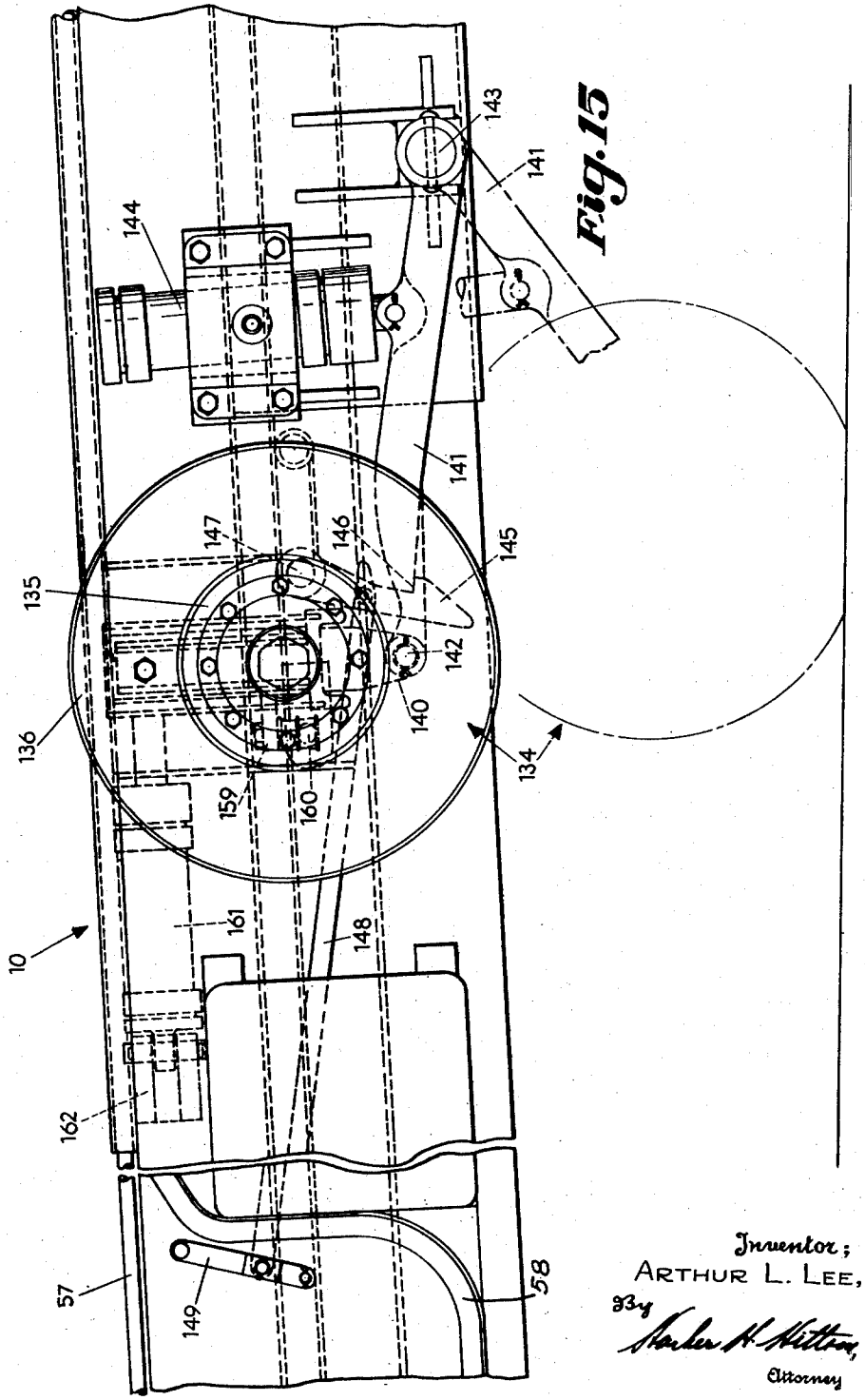


Fig. 15

Inventor;
ARTHUR L. LEE,
By
Attorney

Sept. 9, 1952 A. L. LEE 2,609,910

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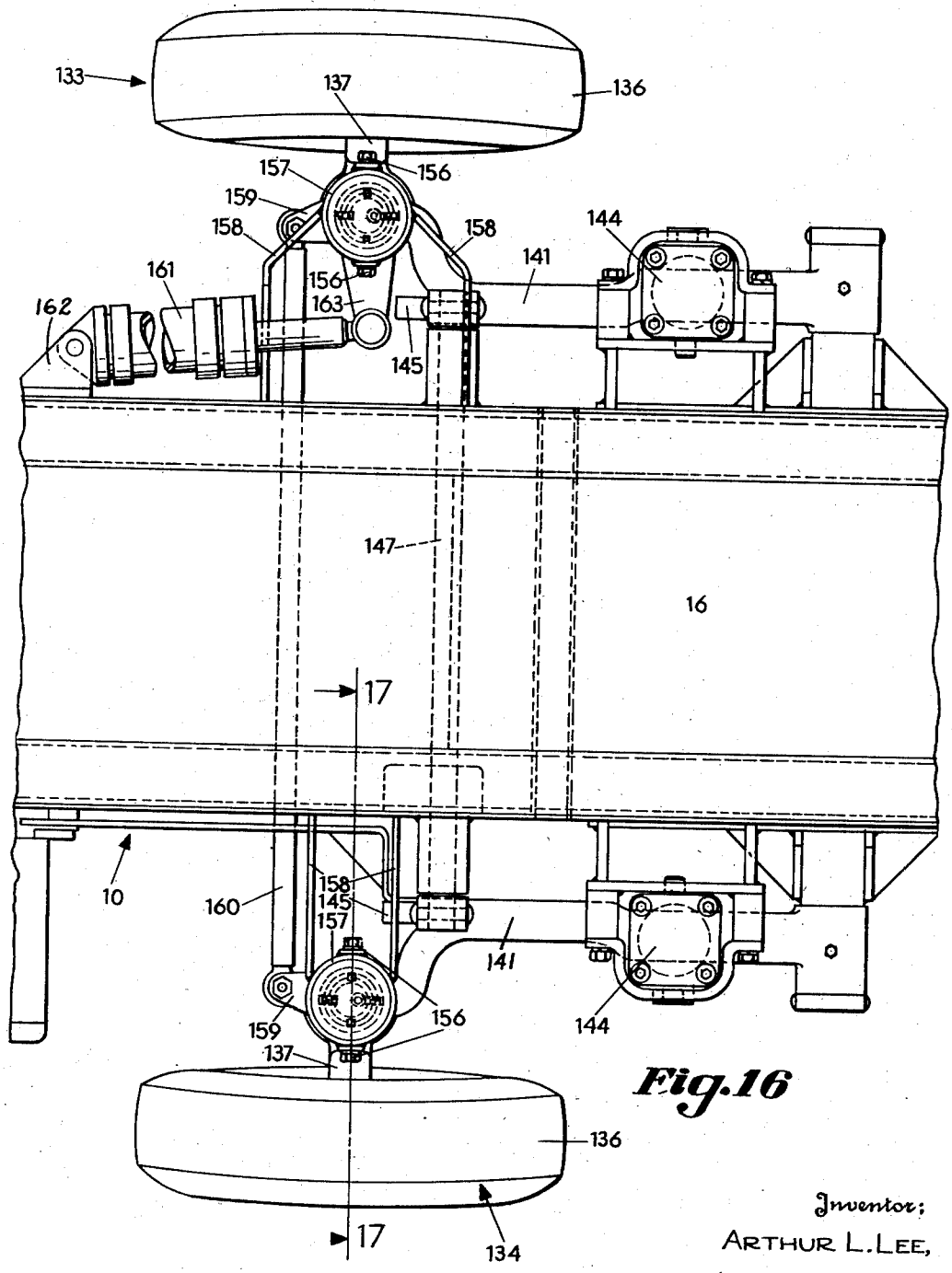


Fig. 16

Inventor;
ARTHUR L. LEE,
By
Charles H. Hettinger
Attorney

Sept. 9, 1952 A. L. LEE 2,609,910

LOADING MACHINE

Filed July 8, 1948 13 Sheets-Sheet 11

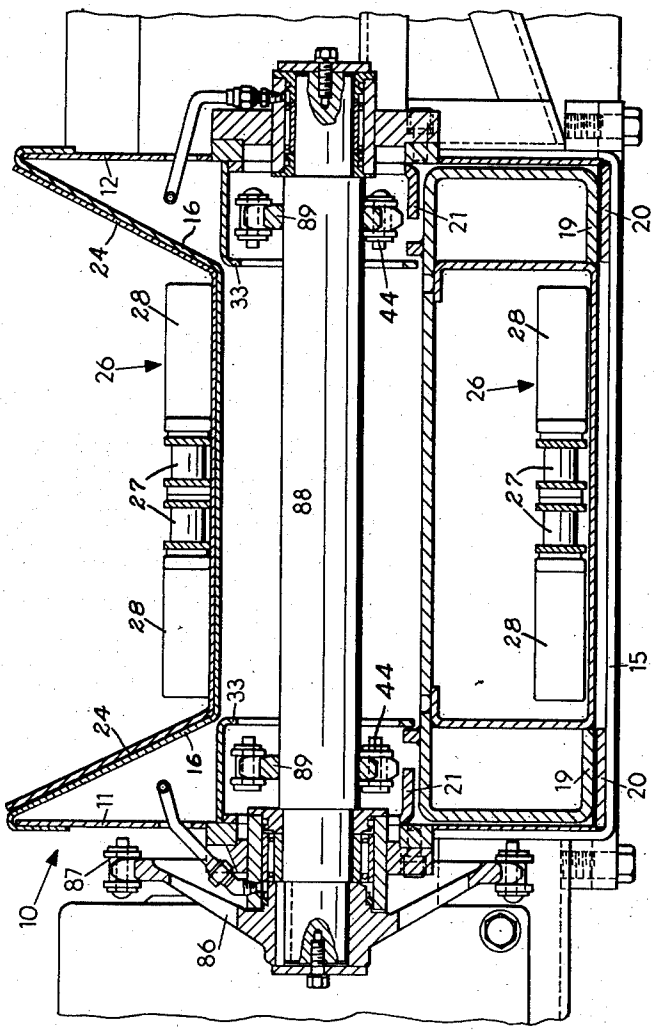


Fig. 18

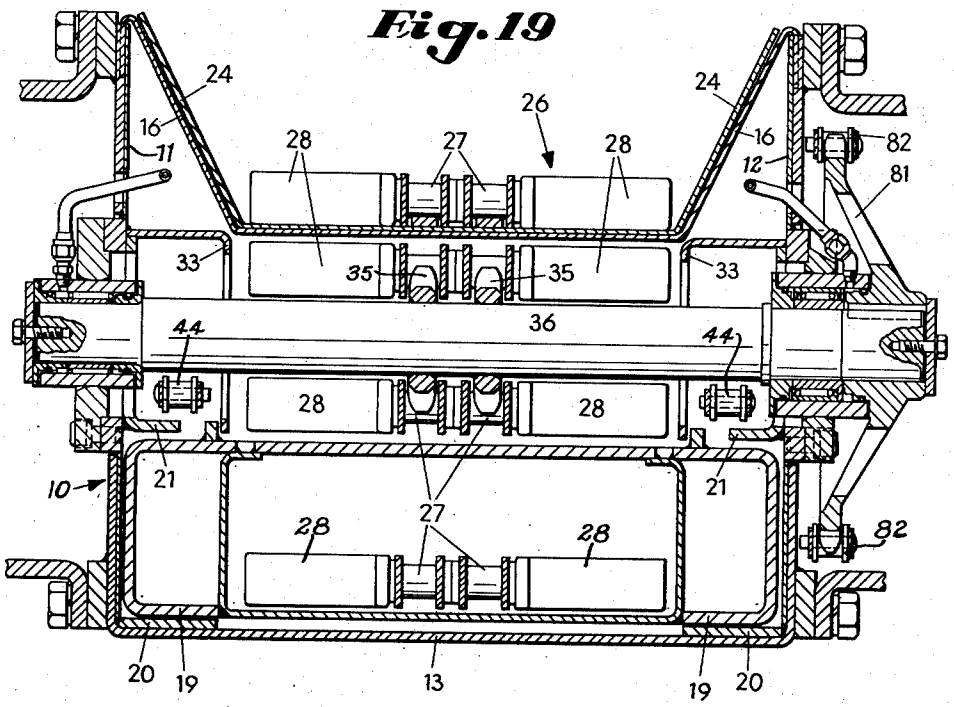
INVENTOR;
ARTHUR L. LEE,
BY
Harlan H. Hittson,
ATT'Y.

Sept. 9, 1952 A. L. LEE 2,609,910

LOADING MACHINE

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Fig. 19



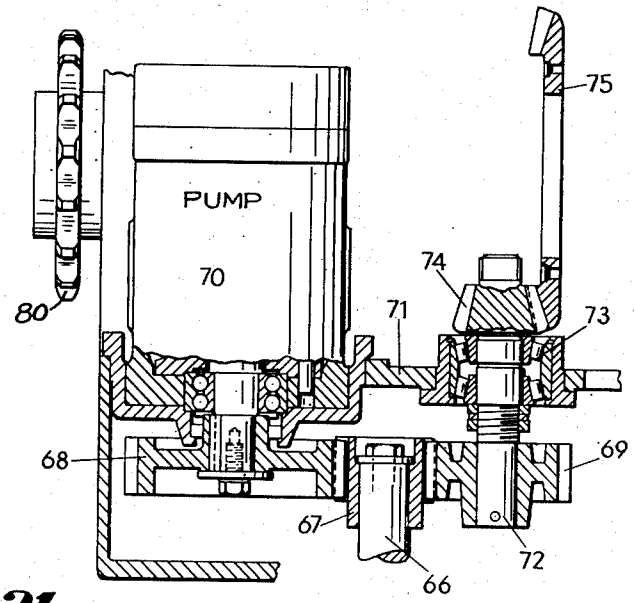


Fig. 21

INVENTOR;
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BY
ATT'Y.

Sept. 9, 1952 A. L. LEE 2,609,910

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Filed July 8, 1948 13 Sheets-Sheet 13

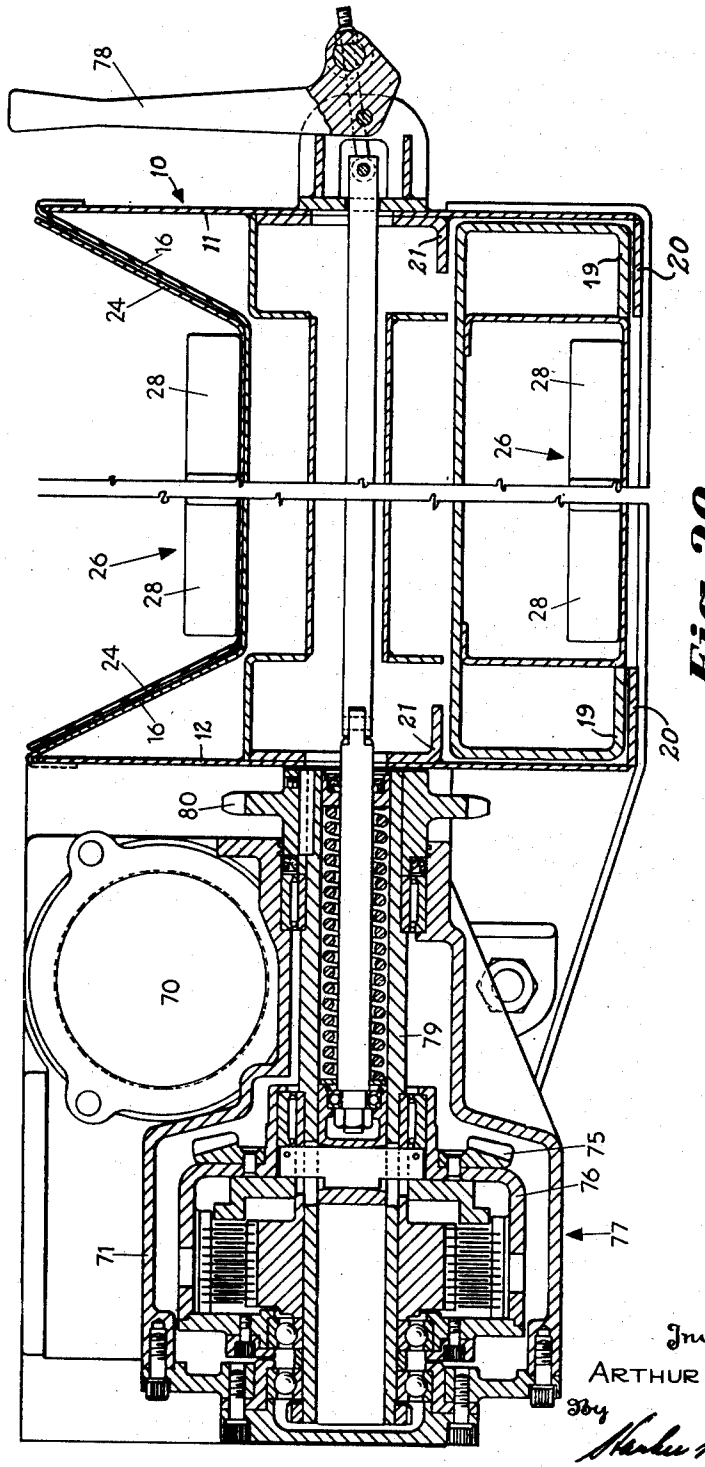


Fig. 20

Inventor:
ARTHUR L. LEE,
By
Attorney

Patented Sept. 9, 1952 2,609,910

UNITED STATES PATENT OFFICE

2,609,910

LOADING MACHINE

Arthur L. Lee, Upper Arlington, Ohio, assignor to The Jeffrey Manufacturing Company, a corporation of Ohio

Application July 8, 1948, Serial No. 37,553

6 Claims. (Cl. 198—8)

1

My invention relates to loading machines and more particularly to loading machines adapted to operate in underground coal mines.

An object of my invention is to provide an improved loading machine adapted to load coal primarily by the rectilinear feeding movement either of itself, of its gathering head, or a combination of both, into shot, semi-compact or shattered coal and which machine can be positioned to carry out rectilinear feeding movement by lateral swinging of the machine and by varying the planes in which the gathering head and its supporting means lie.

Another object of my invention is to provide a loading machine of the type set forth in the foregoing object wherein the loading machine is swung laterally about an anchor means adjacent the rear thereof and the front of the loading machine is adjustable vertically upon wheels which support it.

Another object of my invention is to provide an improved loading machine adapted to load coal by the rectilinear feeding movement of a gathering head of the loading machine into shot, semi-compact or shattered coal, which machine is adjustably carried with respect to wheels adjacent its front and rear ends and is also provided with a supporting anchoring means adjacent one pair of the wheels about which the machine may swing laterally when the adjacent wheels are lifted from the mine room floor, the other wheels being traction wheels swingable from straight ahead positions to tandem positions for swinging the machine laterally, and the machine including means for adjusting its gathering head about a horizontal axis.

In carrying out the foregoing object it is another object of my invention to provide an improved mining machine of the type therein set forth which preferably, but not necessarily, includes the supporting anchoring means and is also capable of loading coal while it is supported and/or rectilinearly bodily advanced upon all of its supporting wheel means, one of which wheel means is swingable for swinging the machine bodily about a vertical axis preferably adjacent its rear supporting wheel means for positioning the gathering head of the loading machine to attack coal to be loaded by swinging it in a generally horizontal plane about said axis.

Another object of my invention is to provide an improved loading machine adapted to load coal by the rectilinear feeding movement of a gathering head into shot, semi-compact or shattered coal which machine includes a telescoping

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frame, one member of which forms a rectilinearly reciprocal boom having the gathering head mounted for pivotal adjustment about a horizontal axis at its outer end and wherein the plane in which the gathering head lies may be varied by adjusting vertically the ends of the frame with respect to its supporting wheels and by adjusting the gathering head with respect to its supporting boom.

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 a loading machine that includes my invention;

Fig. 2 is a side elevational view of the machine shown in Fig. 1;

Fig. 3 is a more or less diagrammatic side view of the machine seen in Fig. 2 with an anchoring jack at the rear thereof anchoring the machine to the mine room and with the rear wheels elevated from the mine floor, the drawing showing in dot-dash lines different positions of the extendable loading boom and its gathering head and different positions or elevations of the body with respect to the front traction wheels of the machine;

Fig. 4 is a diagrammatic view in plan of the machine shown in Fig. 1, the traction wheels thereof being positioned to swing the machine either about its anchoring pivot or jack disposed at the rear thereof or its rear wheels;

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 1;

Fig. 6 is a transverse sectional view taken on line 6—6 of Fig. 2, looking in the direction of the arrows with certain parts omitted and certain parts broken away;

Fig. 7 is a sectional plan view showing the actuating mechanism for swinging the wheels seen in Figs. 5 and 6 in opposite directions;

Fig. 8 is a plan view with parts omitted showing one of the front or traction wheels seen in Figs. 5, 6 and 7;

Fig. 9 is a sectional elevational view taken on the line 9—9 of Fig. 8 looking in the direction of the arrows;

Fig. 10 is a sectional elevational view taken on line 10—10 of Fig. 1 looking in the direction of the arrows with the machine broken in parts to reduce the length of the view;

Fig. 11 is a sectional view taken on the line 11—11 of Fig. 1 looking in the direction of the arrows, the device being broken in two to shorten the length of the view;

Fig. 12 is an enlarged side elevational view of the gathering head and associated mechanism of the machine of Fig. 1 with parts broken away and with some parts omitted in the interest of clearness;

Fig. 13 is a plan view of the gathering head and adjacent parts of the loading machine, with the spaced gathering conveyers or mechanisms omitted and with parts broken away, showing a portion of the structure in section;

Fig. 14 is a sectional elevational view of a detail of the loading machine;

Fig. 15 is an enlarged elevational view showing one of the steerable wheels and associated mechanism of the loader;

Fig. 16 is a plan view of the mechanism shown in Fig. 15 with the conveyer trough, conveyer mechanism and wheel cover illustrated in Fig. 1 removed;

Fig. 17 is a sectional elevational view taken on the line 17—17 of Fig. 16, looking in the direction of the arrows;

Fig. 18 is a sectional view taken on the line 18—18 of Fig. 1, looking in the direction of the arrows;

Fig. 19 is a sectional view taken on the line 19—19 of Fig. 1, looking in the direction of the arrows;

Fig. 20 is a sectional view taken on the line 20—20 of Fig. 1, looking in the direction of the arrows; and

Fig. 21 is a combination plan and sectional view showing gearing details of the loader.

This application is a continuation in part of my application Serial No. 530,361, filed April 10, 1944, now Patent No. 2,589,827 dated March 18, 1952, for a Loading Machine and my application Serial No. 595,047, filed May 21, 1945, and now abandoned, for a Loading Machine and, except for variations or modifications which are indicated or disclosed, it follows the structure of the machine of said application.

Before describing in detail the loader of my invention it may be stated that the loader is designed particularly to be capable of operation in very low coal as for example in coal seams having a height from twenty-four to thirty-six inches, though the machine may be used in a coal seam of any greater height.

The machine is fundamentally a frontal attack type machine, that is, its principal loading operation takes place upon rectilinear forward feed movement of its gathering mechanism though some loading may take place while swinging the machine laterally either about a fixed pivotal axis provided adjacent its rear or discharge end preferably by means including a roof jack, or while swinging the machine laterally upon its rear supporting wheels, as hereinafter described more completely.

Another important characteristic of the loader is that its discharge position may be maintained fixed while the gathering mechanism operates over a very wide range because it may be swung in a generally horizontal or lateral direction; raised or lowered; and swung about its horizontal mounting axis.

The device is completely self-contained and may be transported under its own power by an operator who may ride upon it, thus providing for its quick and ready removal from one mine room to another or to different locations in a single mine room. Furthermore, the device is fed under power to feed the gathering head rectilinearly, to swing it about its horizontal pivotal mounting axis and to swing it laterally, rectilinear feeding being provided consistent with a uniform system of discharge by telescoping conveyer parts. Also the elevation of the pivotal mounting axis for the gathering head is adjustable under power by adjusting the elevation of the ends of the gathering head carrying mechanism, i. e. the frame of the loader, vertically either simultaneously or independently with respect to the mine room floor.

Referring first to Figs. 1, 2, 5, 18, 19 and 20 of the drawings, the loading machine includes a wheel supported main frame 10 formed by a pair of laterally spaced longitudinally extending spaced apart upright side plates 11 and 12 (see Fig. 18). Throughout the length of the main frame 10 the side plates 11 and 12 are connected together by transversely extending longitudinally spaced apart members including bottom plates, bars, etc., indicated at 13, 14 and 15, which are welded or otherwise connected to said side plates 11 and 12, all as disclosed in my parent application, Ser. No. 530,361, now Patent No. 2,589,827, above identified.

Extending transversely between said side plates 11 and 12 and forming a part of the main frame 10 is a trough shaped conveyer pan 16 (see Fig. 10 for example). The pan 16 has a substantially horizontal bottom and sloping side walls which overlap the side plates 11 and 12 and are rigidly attached thereto, thus also forming a part of the main frame 10. The pan 16 also forms part of the trough of a horizontally extending conveyer 17. It may be stated that to a large extent the main frame of the conveyer 17 and the main frame 10 of the entire loader are one and the same thing.

Telescoping within the main frame 10 and also the frame of the conveyer 17 is a longitudinally extending frame or boom member designated generally by the reference character 18 (see particularly Figs. 10 and 11) which is adapted to be adjusted with respect to the main frame 10 so as to increase appreciably the overall or effective length of the conveyer 17. The frame 18 is formed by a bottom longitudinally extending box work or column 19 (see Figs. 5, 6, 10, 11, 17 and 18) which is slidably contained between the bottom portions of the side plates 11 and 12 of the frame 10 and is supported upon longitudinally extending frame plates 20, 20 (see Figs. 6, 17, 18 and 19, for example) welded to the bottoms of the side plates 11 and 12.

Co-operating with the side plates 11 and 12 to provide guides for the upper portion of the long box or column 19 are angle members 21, 21 (see Figs. 6, 17, 18, and 19). At its forward end the box or column frame member 19 carries for adjustment about a horizontal axis a gathering head 23, to which further reference is made hereinafter. The frame or boom 18 also includes as a rigidly connected part thereof a trough or pan 24 (see Fig. 6 for example).

The trough or pan 24 rests in and is adapted to slide longitudinally and rectilinearly over the conveyer pan 16 of the main frame member 10. It is thus obvious that as the gathering head 23 is extended forwardly from frame member 10, the telescoping sections of the conveyer 17, including the frame members which are integral with the main frame 10 and the longitudinally adjustable boom or frame 18 including the box or column 19, the gathering head 23 and trough or pan 24 are slidable relative to each other, thus effectively increasing or decreasing the overall length of the telescoping conveyer 17. This pro-

vides for maintaining the position of the discharge of the conveyer 17 adjacent a fixed point while the gathering head 23 moves rectilinearly inwardly or outwardly to gather coal. Swinging movement of the conveyer in a horizontal plane as well as raising and lowering movement of it with respect to the mine room floor both while gathering coal and preparatory thereto by frontal attack is also provided, as hereinafter set forth.

In addition to the two telescoping frames 10 and 18 the conveyer 17 includes endless traveling conveyer mechanism 26 which co-operates with the conveyer pans 16 and 24 to provide a scraper type conveyer, said conveyer mechanism 26 including an endless double draft chain 27 from each side of which there extends a plurality of flights 28. The chain 27 is so reeved about head, foot and intermediate sprockets as to provide for the free extension of the adjustable frame 18 with respect to the main frame 10. To this end said chain 27 extends over sprockets 29 on a head shaft 30 (see Figs. 10 and 13) mounted in spaced journal bearings on the frame of the gathering head 23. Following the chain 27 in its normal course of travel over said sprockets 29 on shaft 30 it extends rearwardly successively over pans 24 and 16 to spaced sprockets on a discharge or tail shaft 31 journaled in appropriate bearings adjacent the discharge end of the main frame 10 or what is equivalent, the main frame of the conveyer 17. This travel of the endless conveyer mechanism 26 from shaft 30 to the shaft 31 is the working run or travel thereof and is employed to convey the material delivered to the conveyer 17 rearwardly and discharge it into a receiving conveyer, receptacle, shuttle car or the like, not shown. The subsequent run of the chain 27 extends forwardly from the shaft 31 over a supporting plate 32 (see Fig. 10). Said plate extends between and is welded to longitudinally extending inwardly positioned angle sloped members 33, 33 (see Figs. 17, 18 and 19) which members 33 are welded to the side plates 11 and 12 and form a part of the main frame 10. Transversely extending frame pipes 34 (see Fig. 10) help support said plate 33. This forward run of the chain 27 leads it to sprockets 35 (see Figs. 10 and 19) on a shaft 36 which is journaled in anti-friction bearings carried by the side plates 11 and 12 of the main frame 10, as clearly illustrated in detail in Fig. 19 of the drawings.

From the sprockets 35 the run of the chain 27 again extends rearwardly to sprockets carried by a shaft 37 which is journaled in appropriate bearings carried by longitudinally adjustable tensioning slide blocks, one of which is seen at 38 in Fig. 11 of the drawings. This shaft is thus carried by a rearward portion of the box or column 19 forming a part of the longitudinally extensible frame 18.

From the sprockets carried by the shaft 37 the chain 27 extends in its lowermost run over the bottom wall of the column or box 19 to the head shaft 30. It is to be noted that the head shaft 30 is carried by the gathering head 23 on the outer end of the box or column 19 and that the shaft 37 which is carried by the box or column 19 adjacent its rear both follow the rectilinear movements of the box or column 19. The shafts 31 and 36 are journaled on the main frame 10 and consequently are stationary relative thereto.

In view of the path of travel of the chains 27 it is obvious that their lengths need not be adjusted while permitting free rectlinear extension of the effective length of the conveyer 17 or, in other words, telescoping movement of the frame 18 with respect to the main frame 10, since the consequent movement of the shaft 37 toward the shaft 36 as the conveyer is extended will compensate for the equal forward movement of the shaft 30 with respect to the shaft 31. As shall be pointed out hereinafter, the conveyer chain 27 not only conveys material delivered at the front of the conveyer 17 and discharges it over the tail shaft 31 but it also acts to drive a pair of gathering conveyer 39, 39 mounted on the gathering head 23.

In my application Serial No. 530,361, now Patent No. 2,589,827, above identified, the gathering head is an integral part of the frame or boom member 18, however, as previously mentioned, the gathering head 23 of my improved machine is mounted on the front of the frame or boom 18 for pivotal adjustment on a horizontal axis 40. The mounting means includes a pair of rearwardly extending plates, one of which is seen at 41 in Figs. 12 and 14 of the drawings, said plates being symmetrically spaced about the center line of the gathering head 23, one on each side thereof. Each plate 41 is pivoted to a bracket 42 carried by the column or box work 19 of the frame or boom 18. The upper edges of the two plates 41 are welded to a bottom plate 43 of the gathering head 23 and their forward edges are welded to and formed as an integral part of frame members constituting elements of the gathering head 23.

The axis of the pivotal connection between the plate members 41 and the boom 18 is preferably substantially midway between the upper and lower runs of the conveyer chain 27 so that pivotal movement of the head 23 will not vary the tension of said chain. Forward and rearward movement of the boom 18 and head 23 relative to the main frame 10 is effected through drive mechanism including a chain 44 (see Figs. 11 and 12) which mechanism is described more completely hereinafter.

To effect swinging movement of the head 23 about its horizontal pivotal axis 40 relative to the boom 18, I preferably provide a pair of hydraulic piston motors or jacks 45, 46 (see Fig. 13), the cylinders of which are pivotally attached to an upwardly extending rear plate of the gathering head 23 by means of trunnion brackets, one of which is seen at 47 in Fig. 12. The piston rods of said motors or jacks 45, 46 extend downwardly and are pivotally connected to appropriate receiving brackets at the front of boom 18, as clearly illustrated in Fig. 12 of the drawings. Each of the jacks 45, 46 is of the double acting type and, as hereinafter described, may be raised or lowered by power and may be locked in any position to which it is adjusted. The two jacks 45, 46 are connected in parallel and are controlled by a single valve 48 (see Fig. 13) so that they are operated simultaneously or are both locked in position by the one valve.

Hydraulic fluid for actuating the jacks 45, 46 is provided by a hydraulic pump 49 which is mounted on and carried by the gathering head 23, preferably being contained within an enclosing compartment thereof, as illustrated in Fig. 12. The pump 49 is driven from the conveyer 17 by means of a chain and sprocket drive mechanism 50 (see Figs. 12 and 13), the drive sprocket of which is keyed to the shaft 30.

As clearly illustrated in Fig. 13 of the drawings, the gathering head 23 also provides a hydraulic fluid tank 53 which supplies hydraulic

fluid to the pump 49. Hydraulic fluid under pressure, delivered by pump 49, flows through a pipe or conduit 54 to the valve 48 and when the valve 48 is in its neutral position it provides a no-load by-pass for the hydraulic fluid which is returned by return pipe or conduit 55 to the tank 53. The hydraulic fluid or oil is derived from the tank 53 by way of a hydraulic pipe or conduit 56 leading to the pump 49.

As clearly illustrated in Fig. 13 of the drawings, similar ends of the hydraulic jacks 45, 46 are connected in parallel over separate conduits leading from the valve 48. The valve 48, per se, is of standard construction and, in addition to providing the no-load by-pass above mentioned, when in its neutral position which it normally assumes under spring bias, it locks or seals the hydraulic motors or jacks 45, 46 in any position to which they have been adjusted.

Reverse operations of the stem or spool of the valve 48 will cause reverse action of the two jacks 45, 46 together, thus providing for power adjustment of the gathering head about its horizontal pivotal axis 40, either to raise or to lower its forward end.

The operating mechanism for the valve 48 takes the form of a longitudinally extending operating rod 57 which extends forwardly along the main frame 10 and is exposed adjacent the operator's station or seat 58, seen in Figs. 1 and 2 of the drawings. An appropriate linkage is provided between the operating rod 57 and the spool of valve 48 which is clearly illustrated in Fig. 13.

In general the structure of the gathering conveyers 39 and associated mechanism, except for obvious differences, follows the structure of the gathering head disclosed in the patent to E. P. Corbin, No. 2,341,977, granted February 15, 1944. Briefly stated, each gathering conveyer 39 includes an endless chain 63 which is mounted upon a stationary guide and carries a plurality of flights 64 which in their travel extend forwardly beyond the forward tip of the bottom gathering plate 43 of the head 23 so that they can effectively dig into and tear down coal in a semi-compact, or shattered mass and can readily gather loose coal, both of which are frequently found in a mine room after the undercut coal has been shot. These two gathering conveyers 39, 39 are, of course, specific illustrations of a preferred form of gathering mechanism, other forms of which may be employed within the scope of my invention in some of its broader aspects.

The chains 63 of each gathering conveyer 39 are driven from the head shaft 30 which in turn is driven by the chain 27 of conveyer mechanism 26. As seen in Fig. 13 each end of the head shaft 30 carries a bevel gear 59 which meshes with a bevel gear 60 carried upon an upright shaft 61 mounted through suitable anti-friction bearings to the frame of the gathering head 23. The upper end of each shaft 61 is provided with a sprocket 62 (see Figs. 1 and 12) which meshes with and drives the endless chain 63 of each gathering conveyer 39.

It is obvious that the gathering conveyers 39 will operate to gather coal either while the gathering head 23 is fed rectilinearly or laterally by swinging movement. Furthermore, the gathered material is obviously carried by the flights 64 up the incline of bottom plate 43 and discharged into the path of the endless conveyer mechanism 26. The material is then carried rearwardly by the chain 27 and flights 28 over the telescoping conveyer trough and discharged over the tail shaft 31.

Attention is now directed particularly to Figs. 1, 2, 10 and 19 to 21, inclusive, and to the drive mechanism by which the endless chain 27 and the two gathering conveyers 39 are driven. As best seen in Fig. 1 of the drawings there is an electric motor 65 which is the only electric motor on the loader and which is the primary source of power for all of the power operated devices thereon. Said motor 65 is carried on an appropriate support provided at one side of the main frame 10 and is rigidly attached to said main frame. Extending forwardly from the motor 65 is its rotor or armature shaft 66 provided with a spur gear 67 which is in continuous mesh with a pair of spur gears 68 and 69, the former of which is keyed to and continuously drives a hydraulic pump 70, said pump 70 being supported in an enclosing housing 71 which also encloses the gears 67—69.

The hydraulic pump 70 supplies hydraulic fluid under pressure for the main hydraulic system of the loader. The gear 69 drives a shaft 72 which is supported in appropriate bearing means 73 carried by a wall of the housing 71. Said shaft 72 is also provided with a beveled pinion 74 which meshes with and drives a bevel ring gear 75 which is riveted or otherwise firmly attached to the housing 76 of a disc type friction clutch 77 (see Fig. 20). The clutch mechanism 77 is per se of standard design though the operating mechanism therefor was designed particularly for the loader of my invention. This operating mechanism is fully described in my parent application, Ser. No. 530,361, now Patent No. 2,589,827, above identified, and is claimed in my divisional application Ser. No. 632,437, filed Dec. 3, 1945 now abandoned, for a Loading Machine. It suffices to say here of this operating mechanism that it includes an operating lever 78 which is disposed adjacent the operator's seat 58 of the loader and a hollow drive shaft 79 which extends toward the main frame 10 and at its end carries a drive sprocket 80.

When the shaft 79 is driven upon the engagement of the clutch 77 it drives the sprocket 80 which in turn drives a sprocket 81 (see Figs. 1, 2 and 19) by means of a chain 82 which meshes with the two sprockets 80 and 81 and an idler sprocket 83.

Referring particularly to Figs. 10 and 19 of the drawings, it will be seen that by driving the shaft 30 from the sprocket 81 to which it is keyed the endless chain 27 of the conveyer mechanism 26 is driven through the sprockets 35. Thus power from the electric motor 65 is extended to drive the endless conveyer mechanism 26 and the gathering conveyers 39 under the control of clutch 77.

As was previously mentioned, the longitudinally adjustable head frame 18 which carries the gathering head 23 is shiftable longitudinally and rectilinearly with respect to the main frame 10. This shifting or telescoping movement is effected in reverse directions by power operated mechanism so that the operator may readily adjust the gathering head 23 either forwardly or rearwardly during operation of the machine. The mechanism which provides for this rectilinear movement is seen best by reference to Figs. 1, 2, 11, and 18 of the drawings, which mechanism is also described and claimed in my co-pending application, Serial No. 632,437, now abandoned, above identified.

As best seen in Figs. 1 and 2 of the drawings,

there is a rotary hydraulic motor 84 provided with an integrally formed speed reducing mechanism which may be for practical purposes considered a part of the motor 84. The output shaft of the motor 84 is provided with a sprocket 85 (Fig. 1) which drives a larger sprocket 86 by means of a chain 87. The sprocket 86 (see Fig. 18) is keyed to a shaft 88 mounted in appropriate spaced anti-friction bearings on the side plates 11 and 12 of the main frame 10. Adjacent each end of the shaft 88 is provided with a sprocket 89 rigidly attached thereto as by welding.

As best seen in Fig. 11 of the drawings, each sprocket 89 meshes with a strand of the chain 44 which is guided over the sprocket 89 by forwardly and rearwardly spaced rollers 90. One end of the chain 44 is anchored adjacent the rear end of the column or box 19 and the other end is anchored by adjustable anchorage mechanism 91 adjacent the forward end of said column or box 19 which is adjacent the gathering head 23.

It is, of course, obvious that the shaft 88, the sprockets 89 and the rollers 90 are mounted on the main frame 10 while the two chains 44 are mounted on the longitudinally adjustable frame 18. Consequently as shaft 88 and sprockets 89 rotate they produce relative rectilinear, telescoping or sliding movement between the main frame 10 and the adjustable frame 18, thus producing the above-mentioned rectilinear extension or retraction of the adjustable frame 18 with respect to the main frame 10. It is also obvious that by reversing the direction of rotation of the shaft 88 under the action of the reversible hydraulic motor 84, the overall length of the conveyer 17 may be readily increased or decreased between maximum and minimum limits.

Adjacent its front end the main frame 10 of the vehicle or loader is provided with a pair of power operated or traction wheel assemblies 92 and 93 which are disclosed and claimed in my application, Serial No. 789,382, filed December 3, 1944, now Patent No. 2,598,276 dated May 27, 1952, for an Underground Loading Machine.

The wheel assembly 92 is on the right hand side of the machine, as viewed by an operator looking toward the front of the machine and the wheel assembly 93 is on the left hand side. These two wheel assemblies are thus on opposite sides of the main frame 10 and the conveyer 17 and during transportation or rectilinear travel of the vehicle they act to drive it generally in the manner of an ordinary automobile or other power driven steerable vehicle. In other words, the wheels of these two assemblies travel parallel paths and have a common horizontal axis of rotation normally transverse to the longitudinal axis of the main frame 10 and conveyor 17. However, these wheel assemblies 92 and 93 are provided with means whereby their wheels may be swung on generally upright or vertical axes and also each wheel may be vertically adjusted with respect to its main frame 10. Stated in another way, the elevation of the entire frame of the vehicle including the frame members 19 and 18 may be raised and lowered with respect to the axes of the wheels and consequently with respect to the mine room floor upon which the wheels are resting.

Referring particularly to Figs. 5, 8 and 9 of the drawings, the two wheel assemblies 92 and 93 are similar and consequently similar reference characters will be employed to indicate the individual parts thereof. Each of said wheel assemblies 92, 93 includes a wheel 94 provided with a pneumatic tire 95 and for practical purposes the tire and wheel may be considered within the generic expression "wheel," particularly as employed in the claims. Each wheel 94 is mounted on a stub shaft or axle 96 and the two stub shafts 96 have a common horizontal axis extending transversely of the main frame 10. The hub of each wheel 94 is provided with a sprocket 97 which is driven by an individual reversible hydraulic motor 98 (see Figs. 8 and 9), operating through a speed reducer 99, the power shaft of which carries a sprocket 100 (see Fig. 8) which is geared to the sprocket 97 by a chain 101. In other words, there is a separate reversible hydraulic motor 98 for each of the wheel assemblies 92 and 93. Said stub shaft or axle 96 is rigidly attached to an upstanding plate 102 which in turn is rigidly attached as by welding to a generally cylindrical housing 103.

As clearly illustrated in Figs. 8 and 9 of the drawings, the motor 98 and speed reducer 99 are rigidly but removably attached to the plate 102, cylindrical housing 103 and stub or axle shaft 96. It is thus evident that the motor 98 and speed reducer 99 partake of all movement of the axle 96 and as hereinafter described each of the wheel units 92, 93 is both vertically adjustable and swingable about a vertical axis, the vertical adjustment providing for adjusting the elevation of the horizontal mounting axis 40 of the gathering head 23 above the floor as well as co-operating with the adjustment of the head 23 about the axis 40 for placing its forward end upon the mine room floor with pressure. In addition there is a spring connection which allows either wheel to accommodate itself to an irregular surface such as a bump or hole on the mine floor as the device travels thereover.

Each of the cylindrical housings 103 has a close but sliding or telescoping fit with a cylinder 104 which on its inner edge is welded or otherwise rigidly attached to an upright plate 105 welded to a side bracket 106 which is bolted to one of the side plates 11 or 12 of the main frame 10, as clearly illustrated in Fig. 5 of the drawings.

It is obvious that the sliding relation between the close fitting cylindrical members 103 and 104 provides for vertical adjustment of the wheel assemblies 92, 93 with respect to the main frame 10 and also provides for their swinging movement about the spaced vertical axes of the two cylinders 104. That is, each wheel assembly 92 and 93 is swingable and vertically adjustable about and along a distinct upright axis. To adjust each wheel 94, 95 vertically each of the wheel assemblies 92, 93 includes a single acting hydraulic piston motor 107 (see Fig. 5). Each of said motors 107 includes a cylinder 108 which is within and concentric with the cylinders 103 and 104 and at its upper end is closed by a head 109 which is removable but rigidly attached to the upper ends of cylinders 104 and 108 by means of machine screws which thread into a ring 110 welded to both of said cylinders 104 and 108. Each head 109 is provided with a hydraulic fitting receiving passageway 111 leading to the interior of the cylinder 108, thus providing for the feeding of hydraulic fluid thereto. Working within each cylinder 108 is a hollow cylindrical piston 112 which has a close but sliding fit with each cylinder 108. The upper end of the piston 112 carries a leak-proof packing ring 113 which is removably connected to said cylindrical piston 112. The lower end of piston 112 has a loose but abut-

ting connection with a disc 114 which rests upon the upper race of an anti-friction thrust bearing 115 carried on an upwardly extending post 116 which is rigidly attached to and mounted on a bottom plate 117 rigidly attached to and forming the bottom of the cylinder 103. Between the two cylinders 104 and 103 is a heavy coil spring 118, the top of which abuts the ring 110 and the bottom of which abuts the disc 114. The two springs 118 thus carry a portion of the load which is transferred from the main frame 10 to each wheel 94, 95, and also act as lateral stabilizing springs, particularly when the rear end of the machine is supported by its anchoring jack 120. There is also a much weaker coil spring 119 within the cylindrical piston 112 the top of which abuts the top of said piston 112 and the bottom of which abuts the disc 114 and at its bottom surrounds the post 116.

Under normal conditions with the wheel assemblies 92, 93 supporting the front end of the main frame 10 and the boom or frame member 18 that telescopes therewith, the parts will be in the position illustrated in Fig. 5 of the drawings, in which the hydraulic motor or jack 107 is partially expanded and the spring 119 is compressed the maximum amount permitted by the piston 112. If the hydraulic jack or motor 107 is contracted under these conditions the wheels 94, 95, together with the cylinder or housing 103, will slide upwardly with the piston 112 further compressing the heavy spring 118 and lowering the main frame 10 and boom 18. This is a normal working condition while the previous condition is a transporting condition.

Under the working condition it is, of course, obvious that an appreciable amount of the weight of the loader may be transferred from the wheels 94, 95 to the gathering head 23. It is desirable, however, to insure adequate traction on the wheels 94, 95 when the head 23 is resting upon the mine floor and the loader is gathering coal. This is an additional function of the spring 118 and a function of the spring 119, that is, these two springs insure that there is appreciable downward force on the associated wheel 94, 95 and should a hole or depression appear in the floor into which a wheel 94, 95 travels it is evident that the springs 118 and 119 will expand to keep some of the load on said wheel. Under such conditions the disc 114 will move downwardly and separate from its normal contact with the bottom of the piston 112.

It is, of course, obvious that by forcing hydraulic fluid into the cylinders 103 by way of passageways 111 the hydraulic motors or jacks 107 may be expanded and by draining hydraulic fluid from them they may be contracted. Thus the elevation of the front end of the loader and the mounting axis 40 of the head 23 may be adjusted vertically with respect to the axes of the axles 96 and the floor of the mine either for loading or for transportation purposes.

In addition to providing for vertical adjustment of the main frame 10 with respect to the wheels 94, 95, provision is also made to swing them about laterally spaced vertical or upright axes so that they may swing from the straight ahead position inwardly adjacent their front ends toward the main frame 10 to a position in which they are substantially in tandem, that is, a position wherein they travel substantially in the same path for swinging the loader under power either about a vertical axis provided by jack 120 anchored between the mine ceiling and floor supporting the rear or discharge end of the loader, or the machine may swing about an upright axis while being supported upon its rear wheel assemblies 133 and 134, as hereinafter described, thus maintaining the position of discharge of the loader substantially at a fixed place while the gathering head 23 is swung over a wide area which may be 360 degrees accompanied by rectilinear adjustment of the gathering head 23, rotational adjustment of the gathering head 23 about the axis 40 and vertical adjustment of the axis 40, main frame 10 and boom 18 to provide for the gathering of coal at substantially any position in a mine room having a width not greater than twice the minimum contracted length of the loader. The foregoing is illustrated in Figs. 3 and 4 of the drawings.

The relation between each of the cylinders 103 and 104 is such as to provide for the swinging movement of said cylinders 103 about their upright axes, thus providing for swinging of the wheel assemblies 92 and 93, as hereinbefore described.

In Figs. 6 and 7 of the drawings mechanism is illustrated which provides for swinging and locking the two wheel assemblies 92 and 93 in parallel and tandem positions. It may be mentioned that I prefer to embody in my loader the improvements made upon this mechanism which are disclosed and claimed by Sterling C. Moon in his application, Serial No. 607,927, filed July 31, 1945, now abandoned, for a Loading Machine, and that Figs. 6 and 7 show the mechanism as improved by said Sterling C. Moon.

Referring to Figs. 6 and 7, each cylindrical member 103 is provided with an integral arm 122 (see Fig. 7). Extending inwardly from and pivotally connected to arms 122 are operating levers 123, the inner ends of which are pivotally connected between a pair of rigidly connected spaced apart discs 124, which plate assembly 124 is mounted for rotation on an upright axis on a pin 125 which is attached to a pair of transverse plates forming part of the main frame 10.

It is evident that the cylindrical member 103, arms 122, levers 123 and disc assembly 124 cooperate to provide a linkage interconnecting the supporting axles 96 and thus the wheels 94, 95. It is further evident that when the disc assembly 124 is in the position illustrated in Figs. 6 and 7, the wheels 94, 95 will be held in parallelism for transporting the loader substantially rectilinearly. Power operated means adapted to co-operate with the hydraulic motors 98 for swinging the disc assembly 24 and wheel assemblies 92 and 93 and also for locking the disc assembly in any position to which it is adjusted, is provided.

The actuating and locking means for the disc assembly 124 includes a pair of spaced bearing blocks 126 received slidably in radially extending slots 127 formed in the spaced discs 124. Bearing blocks 126 are carried by a pivot pin 128 which is attached to one arm of a bell crank lever 129 which is pivotally attached to a plate of the main frame 10 by a pivot pin 130. The other arm of the bell crank lever 129 is pivotally attached to the free end of a piston rod 131 of a double acting hydraulic piston motor or jack 132, the cylinder of which has one end pivotally attached to the main frame 10.

It is obvious that movement of the piston rod 131 to the right, as viewed in Fig. 7, by actuation of the piston motor 132 will tend to rotate the disc assembly 124 in a counter-clockwise direction to swing the wheel assemblies 92 and 93 to their

tandem positions and that reverse actuation of the motor 132 will tend to swing the wheel assemblies to their parallel positions, seen in Fig. 7. Furthermore, when hydraulic fluid is trapped in the motor 132 the disc assembly 124 will be locked against rotation.

The swinging movement of the wheel assemblies 92 and 93 is the combined result of the action of the hydraulic motor 132 and the individual driving motors 98 for the wheels 94, 95. Because each wheel assembly 92 and 93 including its driving motor 98 is free to swing about the axis of the cylinder 103 and because the axis of each cylinder 103 is off-set forwardly from the horizontal axis of axle 96 and inwardly of the center of the wheel, tractive effort of the traction wheels 94, 95 in a forward direction, when they are in parallel position, will cause the wheel assemblies 92 and 93 to swing about the vertical axes of cylinders 103 toward their tandem position, however, in the absence of actuation of the hydraulic motor 132, which acts to lock the disc assembly 124 against rotation, the wheel assemblies 92 and 93 cannot swing as aforesaid. If, however, the motor 132 is actuated simultaneously with the hydraulic motors 98 either to swing the wheel assemblies 92 and 93 to their tandem or parallel positions the wheels will be positively swung by the combined efforts of the motors 98 and the motor 132.

Adjacent the rear end of the loader is a pair of steering and supporting wheel assemblies 133 and 134 which are described and claimed in my copending application, Serial No. 609,076, filed August 6, 1945, for a Loading Machine, now Patent No. 2,483,650, dated October 4, 1949, and which are seen in Figs. 1, 2, 3, 15, 16, and 17 of the drawings. These wheel assemblies 133 and 134 are of similar design except for certain obvious differences.

Rear wheel assembly 133 is on the right hand side of the vehicle, as viewed from the rear end thereof looking forward, and rear wheel assembly 134 is on the left hand side. The two assemblies are thus laterally spaced on opposite sides of main frame 10 or, in other words, the main frame 10 and conveyer 17 extend between them, as in the case of the wheel assemblies 92 and 93.

In the operation of the loader once it has reached the position at which it is to gather and load coal its rear end may be anchored to the mine room by the jack 120 or, if preferred, and under other circumstances hereinafter described, its rear end may be supported upon the steering wheel assemblies while the machine loads coal. Assuming that the jack 120 is employed, it is necessary to lift the wheel assemblies 133 and 134 from the mine floor to permit the above-described swinging movement of the loader under the influence of the traction wheel assemblies 92 and 93. Furthermore, the wheel assemblies 133 and 134 provide for steering the loader as it is operated as a self-contained vehicle or unit. These two characteristics require certain special design which is, of course, complicated by the presence of the conveyer 17 between the wheel assemblies 133 and 134.

Briefly described, each of the steering wheel assemblies 133 and 134 includes a wheel 135 provided with a pneumatic tire 136 which together may be referred to as the wheel, particularly in connection with the claims.

Referring particularly to Figs. 16 and 17, it will be seen that each wheel 135 is mounted on a stub axle 137 which is formed as an integral part of an upstanding shaft 138. The lower portion of the shaft 138 is provided with a reduced neck which receives a thrust bearing 139 received in a bracket 140 through which is transmits the load to the outer end of a pivoted lever or arm 141 through a pivot pin 142. The arm 141 extends rearwardly from the wheel and is pivotally connected by a stub shaft 143 to the main frame 10. Up and down adjustment of the wheel 135 is effected by a double acting hydraulic piston motor 144 the cylinder of which is pivotally attached to the main frame 10 and the piston rod of which is pivotally attached to the arm 141. By means of the motor 144 the wheel 135 may be adjusted to various up and down positions relative to the main frame 10 and locked in adjusted position.

The up and down adjustment of the wheels 135 relative to the main frame is useful while the machine is being transported and while it is loading coal particularly over a rough mine floor and, furthermore, the up and down movement or adjustment of the wheels 135 provides a self-contained jack for the discharge end of the vehicle so that when the jack 120 is to be employed as a pivot for the rear end of the loader the wheels 135 may be employed to elevate and lower the rear end of the machine to aid in positioning and locking the anchor jack 120 to the mine room, as hereinafter described.

In order to relieve the motors 144 of their holding wheels 135 in elevated position, I employ a locking and latching means which automatically latches said wheels in their elevated positions and which can be released when it is desired to lower them. This latching means includes a pivotal latch 145 having a notch adapted to support a ledge 146 formed on the arm 141. The two latches 145 are connected together by a cross rod 147 to which an actuating rod 148 that extends to an operating lever 149 positioned adjacent the operator's seat 58 is attached.

The shaft 138 which includes the stub axle 137 receives a concentric sleeve 150 which is keyed to rotate therewith and retained thereon by a screw 151 and the axis of these concentric parts is the steering axis of the wheel 135. A second sleeve 152 is received by the sleeve 150 and is keyed thereto to rotate therewith while permitting telescoping movement of the sleeve 150 therein. The sleeve 152 is also mounted for telescoping movement in and is keyed to rotate with a sleeve 153 that is held against axial or up and down movement with respect to the main frame 10 by a pair of axially spaced rings 154 which are rigidly attached to the sleeve 153 and which receive a split collar or ring mounted in trunnions 156 carried in a bracket ring 157 mounted on a supporting bracket 158 rigidly attached to the main frame 10.

From the foregoing it is evident that the sleeves 153, 152, and 150 co-operate with the upper portion of shaft 138 to provide a telescoping adjustment between the sleeve 153 and the shaft 138 so that relative axial or rectilinear adjustment between them is permitted while at the same time permitting a rotational or torque driving relation between sleeve 153 and shaft 138 through the intermediary of tubes 152 and 150. In other words, any steering or rotational movement or torque applied to sleeve 153 will produce similar movement of axle 137 and wheel 135. It is also evident that the trunnions 156 provide for swinging or pivotal movement of the sleeve 153 on a horizontal axis, while the spaced rings 154 provide

for turning or rotational movement of the sleeve 153 relative to the split collar 155.

To the end of rotating the wheel assemblies 133 and 134 about their steering axes in unison and thus steering the machine, the sleeves 153 are each provided adjacent their lower ends with a bracket or arm 159 which is interconnected by a cross tie rod 160. Actuation of the steering mechanism is effected by a double acting hydraulic piston motor 161, the cylinder of which is pivotally connected by a bracket 162 to the main frame 10 and the piston rod of which is connected to an operating lever or arm 163 which is rigidly attached to one of said sleeves 153. It is evident that actuation of the motor 161 in either direction will rotate one of the sleeves 153 and that its rotational or torque movement will be transmitted to the other sleeve 153 through the tie rod 160 and arms 159 and that the rotational movement of these two sleeves 153 together will be transmitted through their associated telescopic mechanisms to the axles 137, thus swinging the wheels together to effect steering adjustment thereof.

As previously mentioned the rear or discharge end of the loader is provided with the anchoring jack 120 which, if desired, may be used to anchor the machine to the mine room and to support pivotally its rear end for swinging movement in a generally horizontal direction. Sterling C. Moon, application Serial No. 607,928, filed July 31, 1945, now abandoned, for a Loading Machine, discloses two forms of such jack structure and I have herein shown the pressure operated or automatic jack of that disclosure. Briefly described, the jack 120 is a single acting piston motor the cylinder of which is mounted to the rear end of the discharge boom of the loader through trunnions 164 and a bracket 165. The cylinder of jack 120 is carried for rotational movement about its axis through a ball and socket connector, the socket of which is formed by the trunnion member 164. The jack 120 may be swung to an inoperative position (see Figs. 1 and 2) where it is carried by a pivoted bracket 166. When the jack 120 is to be employed to support and anchor the rear of the machine the bracket 166 may be swung against the discharge boom to permit the jack 120 to be swung to an upright position, said upright position being illustrated in Fig. 3 of the drawings.

As previously mentioned, the loader includes only one electric motor 65 or primary source of power. This electric motor 65 is carried by the main frame 10 at one side of the loader and substantially directly opposite the operator's seat 58 and the main control valve unit 167 of the loader (see Figs. 1, 2 and 3). Electric motor 65 drives the main hydraulic pump 70 as well as the clutch 77 that controls the operation of the conveyer mechanisms of the loader. Pump 70 supplies hydraulic fluid for operating all of the hydraulically operated mechanisms of the loader except the motors 45 and 46 of the gathering head 23 which receive hydraulic fluid from the pump 49 carried by the gathering head 23, as hereinbefore described in detail in connection with Fig. 13 of the drawings. All of the hydraulic apparatus of the machine, except that carried by the gathering head 23, is controlled by the valve unit 167.

The hydraulic system of the machine is similar to the system disclosed in my application, Serial No. 530,361, above identified, now Patent No. 2,589,827, except for the hydraulic mechanism carried by the gathering head 23, herein described, and except for modifications thereto causing the system to include the anchoring jack 120 and its control mechanism, which modifications are apparent from the disclosure in the application of Sterling C. Moon, Ser. No. 754,516, filed June 12, 1947, now Patent No. 2,591,584 dated April 1, 1952, for an Underground Loading Machine.

The loader which embodies my invention is highly versatile in operation and some of its operations will now be described.

During transportation of the loader its gathering head 23 will be elevated slightly from the position in which it is illustrated in Fig. 2 of the drawings so as to clear the mine floor and the loader or vehicle will be driven much in the fashion of an automobile, mine shuttle car, or the like, by an operator who can sit on the seat or platform 58 in a semi-inclined position and facing either the front or rear of the loader. The electric motor 65 will supply the primary source of power on the loader and this motor 65 derives power from an electrical system over an extensible cable, not shown. The loader is driven by applying power to the two traction wheel assemblies 92 and 93 when they are in their parallel positions, as illustrated in dotted lines in Fig. 1 and in Fig. 5 of the drawings, in the manner previously described. It is obvious that the vehicle may be driven from place to place in reverse directions, if necessary, the steering being effected by the dirigible type steering wheel assemblies 133 and 134.

It will also be obvious from the following description that the traction wheels 92, 93 may be employed, if necessary, when swung to their tandem positions to swing the front end of the loader around sharp corners, mine posts, and the like.

Assuming that the loader has reached a position in a mine room where coal has been undercut and shot or is otherwise prepared to be loaded out, and the loader is to be anchored to the mine room by the motor or jack 120, the operator by operating the proper valves of valve bank unit 167 will cause the two hydraulic motors or jacks 144 associated with steering wheel assemblies 133 and 134 to be expanded and if necessary hydraulic motors or jacks 107 (Fig. 5) associated with traction wheel assemblies 92 and 93 to be contracted so as to elevate the rear end of the main frame 10 and the conveyer 17 of the loader. The operator of the machine will then remove the jack 120 from its supporting bracket 166 and permit the jack 120 to swing about its trunnions 164 to a vertical position, then by operating one of the valves of the valve bank unit 167 he will cause the anchoring jack 120 to expand to anchor the rear end of the loader to the mine room for horizontal swinging movement about the vertical axis of the jack which is secured to the mine room between the mine room floor and ceiling, as shown in Fig. 3. With the discharge end of the loader thus pivotally anchored to the mine room by the jack 120, the hydraulic motors or jacks 144 associated with the steering wheel assemblies 133 and 134 are caused, by operation of one of the valves of the valve bank unit 167, to elevate the wheel assemblies 133 and 134 from the mine room floor. The steering wheel assemblies will be locked in an elevated position by the latch members 145 and ledges 146 on the levers or arms 141, as seen in Fig. 15, to support the wheels in their elevated positions. It will be seen that when the steering wheel assemblies 133 and 134

are elevated from the mine room floor the machine will be supported at its rear end by the jack 120 and at its front end by the traction wheel assemblies 92 and 93.

The traction wheel assemblies 92 and 93 are next swung from their parallel positions to their tandem positions, indicated in Figs. 1 and 4 of the drawings. This swinging of the traction wheel assemblies is accomplished by operating simultaneously the hydraulic motors 98 (seen in Fig. 8) and the hydraulic motor 132 (seen in Fig. 7) to cause the wheels to swing forwardly about the vertical axes of the hydraulic motors 107 and when the wheels swing to their tandem position the operation of the motors 98 and 132 will be stopped by shifting their respective control valves in the valve bank unit 167 to neutral positions. By placing the control valve for the motor 132 in its neutral position the motor 132 is effectively locked by hydraulic fluid blocked therein by the control valve and this prevents rotation of the traction wheels about the axes of motors 107. When the wheels are swung to their tandem positions, the axes of rotation of the two wheels 94 of the traction wheel assemblies 92 and 93 will not be parallel but they will intersect at approximately the vertical axis of the anchoring jack 120 so that they will drive the loader through a circular or swinging motion in a horizontal plane, the center of which is the vertical axis of the jack 120. In order to swing the loader about the axis of the jack 120, one of the valves of valve bank unit 167 is operated so as to reverse the hydraulic connections of one of the motors 98 with respect to the other so that when these motors are thereafter actuated selectively in reverse directions they will both tend to rotate in the same direction and thus operate to swing the loader about the axis of jack 120.

With the loader thus anchored to the mine room and with the traction wheels swung to and locked in their tandem positions the operator of the loader will then adjust the elevation of the main frame 10 of the loader and consequently the elevation of the boom 18 of the conveyer to a desired elevation with respect to the horizontal plane in which the stub shafts or axles 96 of the traction wheel assemblies 92 and 93 lie, one purpose of this adjustment being to adjust the elevation of the horizontal axis 40 about which the gathering head 23 is swingable with respect to the mine room floor. The operator will then engage the clutch 77 to drive the conveyer 17 and the conveying elements of the gathering head 23, as previously described, and by operating the control valve for the motor 84 in the valve bank unit 167 he will cause the hydraulic motor 84 to advance or extend rectilinearly the boom 18 with respect to the main frame member for advancing the gathering head 23 into a pile of semi-compact or shattered coal which is to be loaded.

The operator may at any time, by means of the operating rod 57 seen in Fig. 13, cause the hydraulic piston motors 45 and 46 to swing the gathering head 23 about its horizontal mounting axis 40 and this adjustment may be relied upon by the operator for maintaining the forward edge of the gathering head 23 in engagement with the mine room floor as the boom 18 is advanced into the pile of coal being loaded. The operator may also, in combination with the adjustment of the gathering head about its horizontal mounting axis 40, utilize the adjustable features of the hydraulic motors 107 for elevating the mounting axis 40 of the gathering head 23 together with the boom 18 and main frame 10 with respect to the mine room floor. This particular combination of adjustments renders the loader highly versatile in gathering coal and particularly in operating over an uneven or rough mine room floor.

Assuming that the pile of coal to be loaded is a relatively large pile, it will be seen that the gathering head 23 will dig, cut or load out the coal lying in a path through the pile of coal and that the coal which is dug out is gathered by the flights 64 of the conveyer mechanisms on the gathering head and passed rearwardly between these gathering mechanisms and fed to the conveyer 17 which will scrape the coal rearwardly over the co-operating members of the conveyer 17 and discharge the coal from the conveyer at the rear end of the loader into a conveyer, hopper, mine car, shuttle car, or the like.

In order to load more coal from the same pile, the operator by operating the appropriate valve of the valve bank unit 167 will cause the hydraulic motor 84 to retract the boom 18 into the main frame of the loader. He will then cause the motors 98 of the traction wheel assemblies to swing the loader laterally about the axis of the jack 120 to a position wherein the gathering head, when advanced by the motor 84, will attack the pile of coal to be loaded adjacent the path previously cut therethrough. These operations may be repeated until all of the pile of coal has been loaded.

It is obvious that in view of the combined swinging of the loader and the rectilinear feeding of the gathering head 23, a wide area may be covered in which the coal is gathered. During this gathering operation the forces exerted upon the head 23 by the motor 84 to feed it into the loose or semi-compact coal may be adjusted between wide limits and the loader cannot slip or slide longitudinally of the axis of the conveyer 17 because of the fact that the discharge end of the loader is anchored to the mine room, thus providing an anchorage or abutment against which the loader can push.

The loader may be operated without being anchored to the mine room, if desired, that is, it may be operated in the manner previously described but while it is being supported by its steering wheel assemblies 133 and 134. The loader can also be operated to load coal by feeding the entire unit into a pile of loose or semi-compact coal and this can be supplemented by feeding the rectilinearly adjustable supplemental frame or boom 18 while the loader is unanchored or carried by all of its supporting wheel assemblies 92, 93, 133 and 134.

It will be seen that when the loader is operated while being supported by its supporting wheel assemblies 92, 93, 133 and 134, that it is more flexible for adjusting the elevation of the mounting axis 40 at the outer end of the boom 18 about which the gathering head 23 may be swung by piston motors 45 and 46, because the steering wheel assemblies 133 and 134 in combination with their hydraulic motors 144 operate as self-contained jack units for adjusting the elevation of the rear end of the loader with respect to the common axis of the stub axles 137 of the steering wheel units and consequently with respect to the mine room floor.

It will be seen that the elevation of the entire loader may be adjusted with respect to the mine room floor by causing the motors 107 of the trac-

tion wheel assemblies 92 and the motors 144 of the steering wheel assemblies 133 and 134 to operate simultaneously.

It will also be seen that the loader may be rotated as a unit about the common horizontal axis of the stub axles 96 of the traction wheel assemblies 92 and 93 by means of the steering wheel assemblies 133 and 134 acting as self-contained jacks or that the loader may be rotated as a unit about the common axis of the stub shafts 137 of the steering wheel assemblies 133 and 134 by the hydraulic motors 107 with the traction wheel assemblies 92, 93 acting as self-contained jacks at the front of the machine.

It may be mentioned that when the machine is to be swung in a horizontal plane as hereinbefore described while being supported at its rear end by the steering wheel assemblies 133 and 134 the vertical axis about which the machine will swing will not be the same as the axis of the jack 120 but it will shift to such a position that the machine can swing without dragging either of the wheels of the steering wheel assemblies 133, 134 directly laterally. When the loader is swung while being supported upon its steering wheels there will be some sliding or slipping of the wheels thereof upon the ground because the axes of the traction wheels when the wheels are swung to their tandem positions intersect at the axis of the jack 120. However, the sliding of the wheels with respect to the mine room floor is negligible and does not seriously interfere with the swinging of the loader.

Returning to a consideration of the showings in Figs. 1 and 2 of the drawings, certain important characteristics are to be noted. First of all, it is to be noted that the loader is of generally uniform overall height which may be, for example, approximately two feet. It is to be particularly noted that the main conveyer 17 extends longitudinally and rectilinearly between the two pairs of wheel assemblies including the traction wheel assemblies 92 and 93 and the steering wheel assemblies 133 and 134. Furthermore, it is to be noted that the overall height of the main frame 10 is less than the height or diameter of the wheels of the traction wheel assemblies 92, 93. In other words, the limiting factor on the height of this machine is the diameter of the traction wheels.

In Fig. 3 of the drawings certain of the hereinbefore described adjustments of the machine are indicated in dotted lines. In the dotted outline indicated at 168, for example, the main frame 10 is shown as being elevated with respect to the common axis of the stub shafts 96 of the traction wheel assemblies 92, 93 by the hydraulic motors 107. The outline indicated at 169 shows the boom 18 in its extended position and the outlines 170 and 171 indicate respectively the gathering head 23 in one of its elevated positions, i. e., a position in which it is swung clockwise by its piston motors 45 and 46, and a position in which it is swung or adjusted in a counter-clockwise direction to a position wherein its forward, leading or gathering edge is in engagement with the floor of the mine room.

From the foregoing description of the loader and its operation it is obvious that I have provided a very compact loader capable of self-transportation and self-loading, yet one which has a very high capacity since coal or other material is gathered by direct positive mechanically operated gathering mechanisms 38, 39 and is conveyed rearwardly over the loader to the receiving conveyer, hopper, mine car, shuttle car, or the like, by a direct continuously moving conveyer 17 which in the specific embodiment of my invention is a chain and flight scraper type conveyer. This combination of high capacity gathering mechanism and high capacity conveyer mechanism makes for a machine of very high capacity for the overall dimensions thereof. It also makes for a machine which is particularly adapted for use in very low seam coal though, of course, the machine may be used in high seam coal.

It will also be obvious that I have provided a machine which is highly flexible of adjustment by reason of the co-operation of its various features of adjustment, for example, the loader may be bodily elevated by operating all of its supporting wheel assemblies as jacks; it may be swung bodily about the plane in which the axes of the traction wheels 92 and 93 lie; or it may be swung about the axis of the wheels of the steering wheel assemblies 133 and 134.

As hereinbefore described, the gathering head 23 is adjustable about its horizontal mounting axis 40 and this adjustment or swinging of the gathering head 23 in combination with various adjustments of the elevation and the plane or planes in which the main frame may be caused to lie permit the gathering head 23 to be adjusted to substantially any necessary position or plane while it is attacking and loading coal. For example, the main frame 10 may be adjusted to a position in which it is horizontal or substantially parallel with respect to the mine room floor (Fig. 2) and, of course, when the boom 18 is extended it will be extended in a horizontal direction and the gathering head only may be adjusted about its horizontal mounting axis 40 for following the contour of the mine room floor. It will also be seen that the plane in which the main frame 10 lies may be adjusted to a position such as seen in full lines in Fig. 3 and therefore when the boom 18 is extended its forward end which carries the axis 40 about which the gathering head swings will approach the mine room floor as the boom advances, and that the gathering head may be swung counter-clockwise about its axis as the boom is extended, thereby premitting the gathering head to be advanced into a pile of coal without tending to lift the wheel assemblies 92 of the loading machine from the floor or, in other words, for permitting the leading edge of the gathering head 23 to follow the floor rather than to dig into it.

The foregoing illustrations of the operations and combinations of adjustments are to be considered as typical only of the many various combinations, adjustments and operations capable of being carried out by the mining machine both during transportation and while loading coal, other of its features of versatility being readily apparent from the foregoing description of the loader and the operation of the machine.

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

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

1. A loading machine including a frame formed of telescoping frame members one telescoping

within the other, endless traveling conveyer means for conveying material longitudinally over the telescoping members of said frame, a motor for driving said endless traveling conveyer means, steerable wheel means adjacent the rear end of one of said frame members, a pair of traction wheels adjacent the front end of said one frame member, motor means for driving said traction wheels, means mounting said traction wheels for swinging movement together about generally upright axes to positions for swinging said frame laterally, power means including hydraulic motors for raising and lowering each end of said frame both independently and simultaneously with respect to the wheel means supporting the respective ends of the frame, a gathering head pivotally mounted on a horizontal axis to the outer end of the other of said telescoping frame members, gathering means on said gathering head driven from said endless traveling conveyer means and adapted to gather material and deliver it to said endless traveling conveyer means, motor means for moving said telescoping frame members with respect to each other thereby feeding said gathering head forwardly and rearwardly, hydraulic power operated means for adjusting said gathering head on said horizontal axis including a hydraulic pump driven by said endless conveyer means and mounted on said gathering head, hydraulic motor means between said gathering head and said other frame member, and a control valve for controlling the flow of hydraulic fluid from said pump to said last named hydraulic motor means.

2. A loading machine including a frame formed of telescoping frame members one telescoping within the other, endless traveling conveyer means for conveying material longitudinally over the telescoping members of said frame, a motor for driving said endless traveling conveyer means, anchor means adjacent the rear end of one of said frame members, a pair of traction wheels adjacent the front end of said one frame member, motor means for driving said traction wheels, means mounting said traction wheels for swinging movement together about generally upright axes to positions for swinging said frame laterally about said anchor means, power means including a hydraulic motor for raising and lowering said frame with respect to said traction wheels, a gathering head pivotally mounted on a horizontal axis to the outer end of the other of said telescoping frame members, gathering means on said gathering head driven from said endless traveling conveyer means adapted to gather material and deliver it to said endless traveling conveyer means, hydraulic motor means for moving said telescoping frame members with respect to each other thereby feeding said gathering head forwardly and rearwardly, hydraulic power operated means for adjusting said gathering head on said horizontal axis including a hydraulic pump driven by said endless conveyer means and mounted on said gathering head, hydraulic motor means between said gathering head and said other frame member, and a control valve for controlling the flow of hydraulic fluid from said pump to said hydraulic motor means.

3. A loading machine including a frame formed of telescoping frame members one telescoping within the other, endless traveling conveyer means for conveying material longitudinally over the telescoping members of said frame, a motor for driving said endless traveling conveyer means, steerable wheel means adjacent the rear end of one of said frame members, anchor means also adjacent the rear end of said one frame member adapted to anchor and pivotally support it, a pair of traction wheels adjacent the front end of said one frame member, motor means for driving said traction wheels, means mounting said traction wheels for swinging movement together about generally upright axes to positions for swinging said frame laterally, power means including hydraulic motors for raising and lowering each end of said frame both independently and simultaneously with respect to the wheel means supporting the respective ends of the frame and for raising said steerable wheels when said frame is supported by said anchor means, a gathering head pivotally mounted on a horizontal axis to the outer end of the other of said telescoping frame members, gathering means on said gathering head driven from said endless traveling conveyer means adapted to gather material and deliver it to said endless traveling conveyer means, motor means for moving said telescoping frame members with respect to each other thereby feeding said gathering head forwardly and rearwardly, hydraulic power operated means for adjusting said gathering head on said horizontal axis including a hydraulic pump driven by said endless conveyer means and mounted on said gathering head, hydraulic motor means between said gathering head and said other frame member, and a control valve for controlling the flow of hydraulic fluid from said pump to said hydraulic motor means.

4. A loading machine including a frame formed of telescoping frame members one telescoping within the other, endless traveling conveyer means for conveying material longitudinally over the telescoping members of said frame, steerable wheel means adjacent the rear end of one of said frame members, anchor means also adjacent the rear end of said one frame member adapted to anchor and pivotally support it, a pair of traction wheels adjacent the front end of said one frame member, means mounting said traction wheels for swinging movement together about generally upright axes to positions for swinging said frame laterally, means for raising and lowering each end of said frame with respect to the wheel means supporting the respective ends of the frame and for raising said steerable wheels when said frame is supported by said anchor means, a gathering head pivotally mounted on a horizontal axis to the outer end of the other of said telescoping frame members, gathering means on said gathering head driven from said endless traveling conveyer means adapted to gather material and deliver it to said endless traveling conveyer means, means for moving said telescoping frame members with respect to each other thereby feeding said gathering head forwardly and rearwardly, hydraulic power operated means for adjusting said gathering head on said horizontal axis including a hydraulic pump driven by said endless conveyer means and mounted on said gathering head, hydraulic motor means between said gathering head and said other frame member, and a control valve for controlling the flow of hydraulic fluid from said pump to said hydraulic motor means.

5. A loading machine including a frame formed of telescoping frame members one telescoping within the other, endless traveling conveyer means for conveying material longitudinally over the telescoping members of said frame, steerable wheel means adjacent the rear end of one of said

frame members, a pair of traction wheels adjacent the front end of said outer frame member, means mounting said traction wheels for swinging movement together about generally upright axes to positions for swinging said frame laterally, means for raising and lowering each end of said frame with respect to the wheel means supporting the respective ends of the frame, a gathering head pivotally mounted on a horizontal axis to the outer end of the other of said telescoping frame members, gathering means on said gathering head driven from said endless traveling conveyer means adapted to gather material and deliver it to said endless traveling conveyer means, means for moving said telescoping frame members with respect to each other thereby feeding said gathering head forwardly and rearwardly, hydraulic power operated means for adjusting said gathering head on said horizontal axis including a hydraulic pump driven by said endless conveyer means and mounted on said gathering head, hydraulic motor means between said gathering head and said other frame member, and a control valve for controlling the flow of hydraulic fluid from said pump to said hydraulic motor means.

6. A loading machine including a frame formed of telescoping frame members one telescoping within the other, endless traveling conveyer means for conveying material longitudinally over the telescoping members of said frame, anchor means adjacent the rear end of one of said frame members adapted to anchor and pivotally support it, a pair of traction wheels adjacent the front end of said one frame member, means mounting said traction wheels for swinging movement together about generally upright axes to positions for swinging said frame laterally, means for raising and lowering said frame with respect to said traction wheels, a gathering head pivotally mounted on a horizontal axis to the outer end of the other of said telescoping frame members, gathering means on said gathering head driven from said endless traveling conveyer means adapted to gather material and deliver it to said endless traveling conveyer means, means for moving said telescoping frame members with respect to each other thereby feeding said gathering head forwardly and rearwardly, hydraulic power operated means for adjusting said gathering head on said horizontal axis including a hydraulic pump driven by said endless conveyer means and mounted on said gathering head, hydraulic motor means between said gathering head and said other frame member, and a control valve for controlling the flow of hydraulic fluid from said pump to said hydraulic motor means.

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