June 12, 1962 E. B. WAGNER 3,038,619

LOADER FOR MINES

Filed July 17, 1959 3 Sheets-Sheet 1

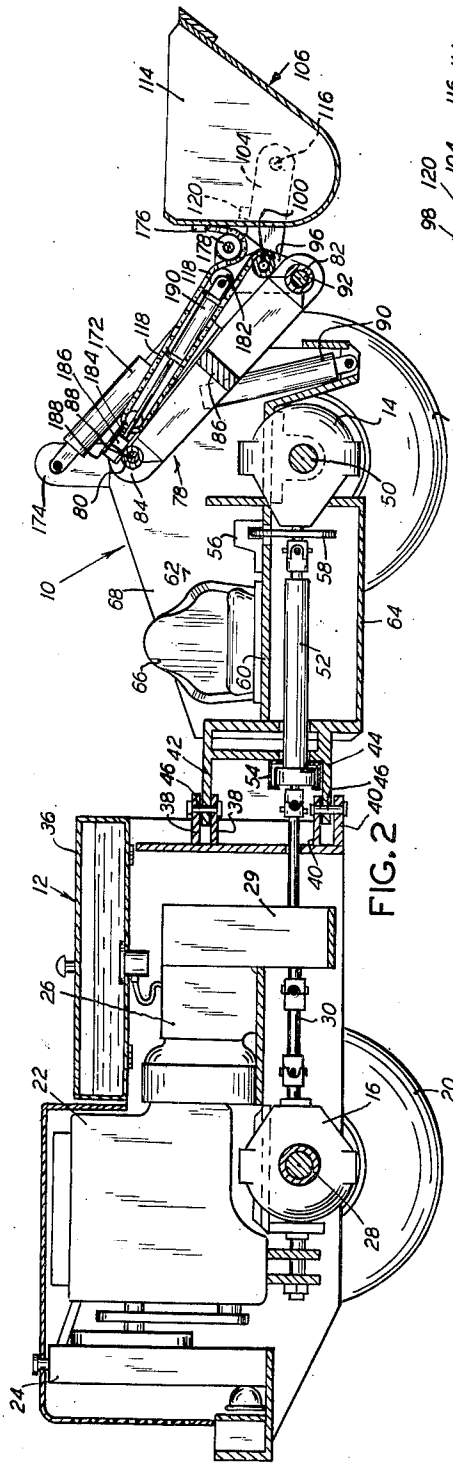


FIG. 2

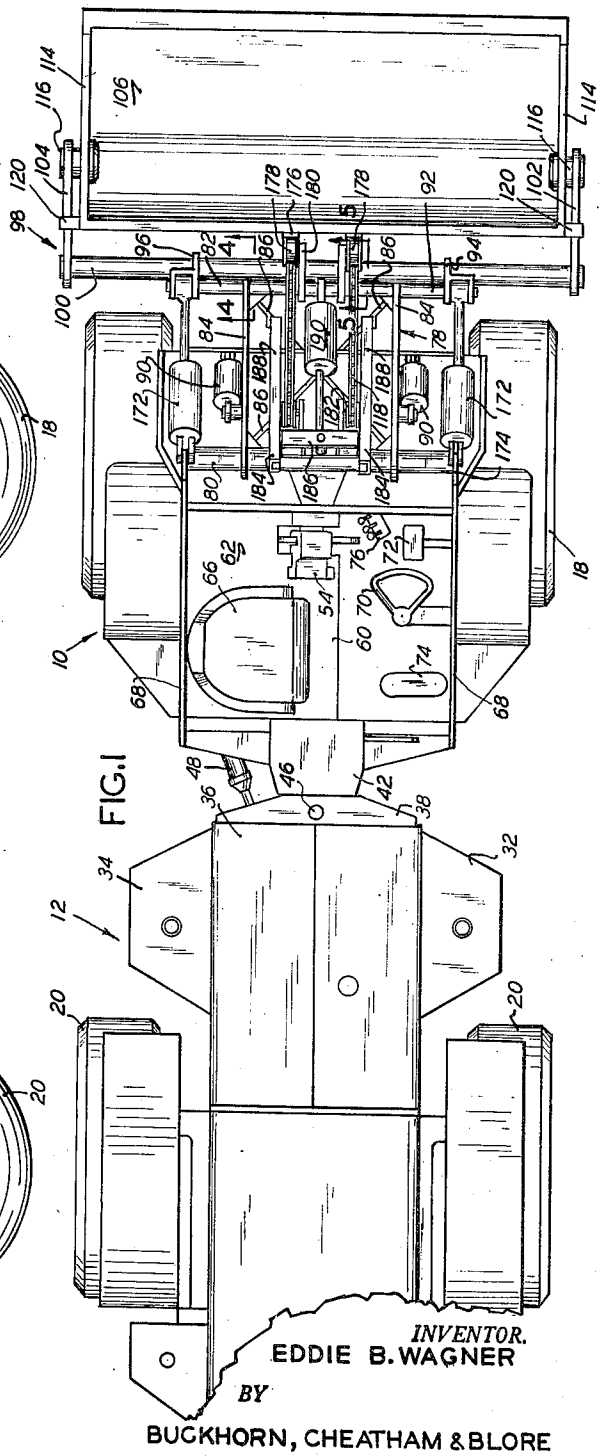


FIG. 1

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3 Sheets-Sheet 2

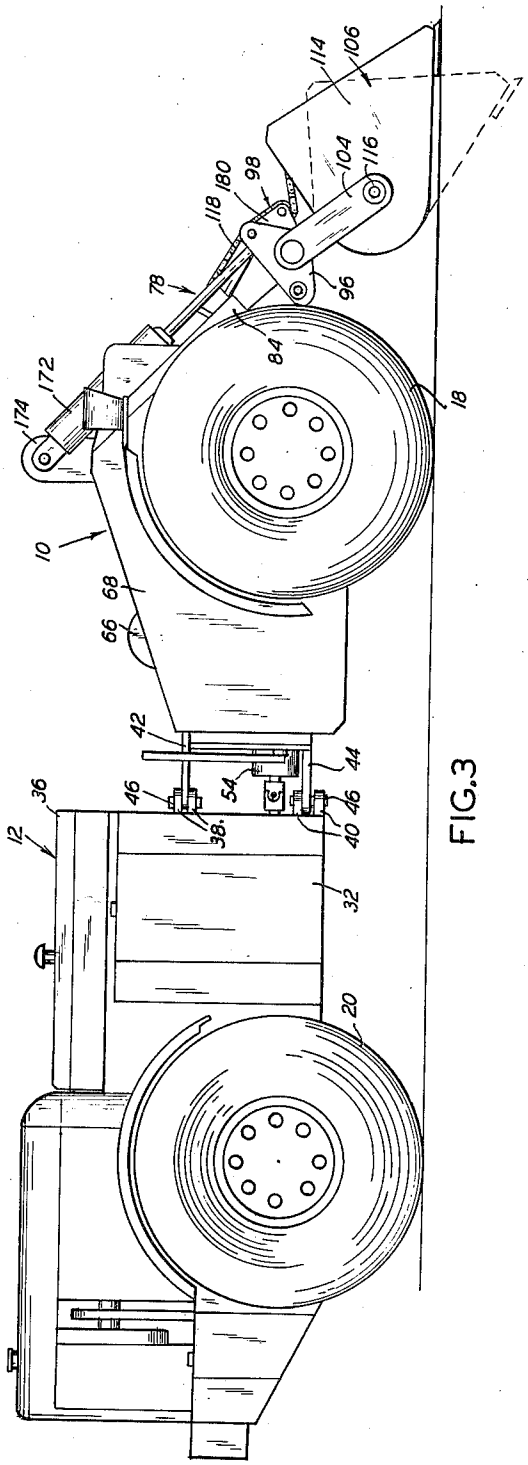


FIG.3

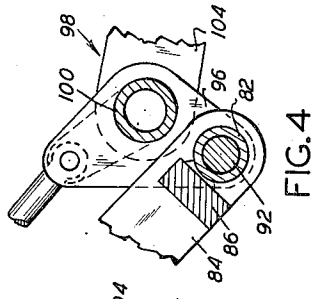


FIG.4

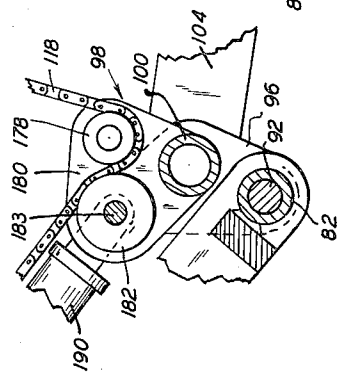


FIG.5

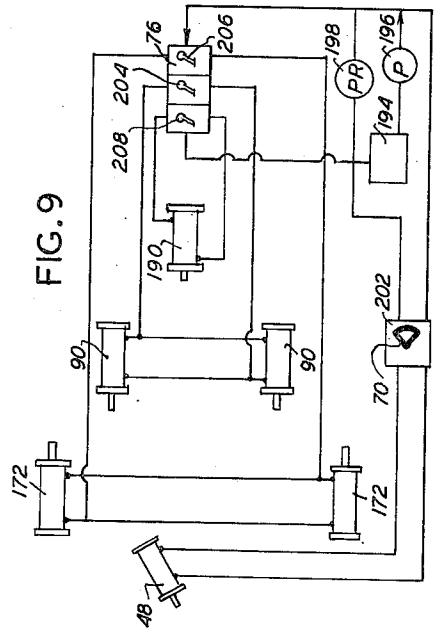


FIG. 9

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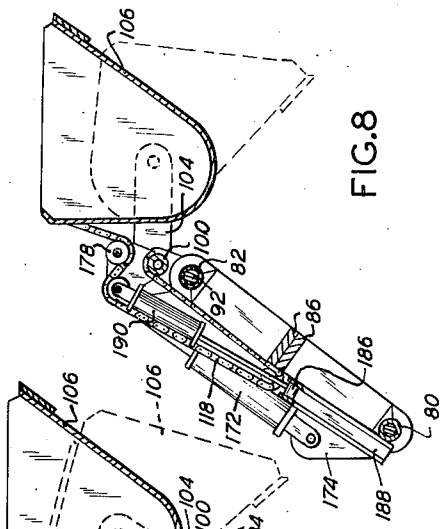


FIG.8

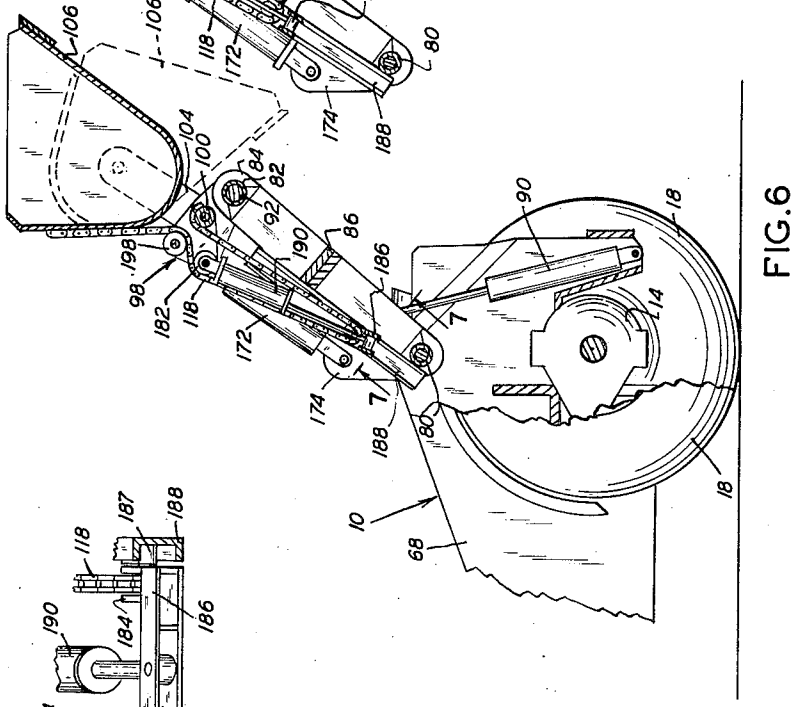


FIG.6

FIG.7

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3,038,619

LOADER FOR MINES

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Filed July 17, 1959, Ser. No. 827,879
5 Claims. (Cl. 214—140)

This invention relates to a loader for mines and more particularly to a loading machine which is particularly adapted for "mucking" in mines, i.e., as a power shovel or loader in mines where overhead clearance is low and material must be elevated and loaded into cars or trucks.

In accordance with the present invention, a power driven loader vehicle is provided in which an operator's station is located at a low level between upstanding side walls of a front section of the vehicle and upon a floor, which floor is below the axles of the support wheels for the vehicle. The loader includes a boom at its front end having a bucket and carrier therefor as well as operating mechanism for the bucket and bucket carrier. The operator's position is immediately behind the loader boom, which boom is preferably of open cross braced construction so as to provide visibility for the operator. Also, the construction of the boom and the bucket supporting and operating structure carried by the boom is compact so as to provide a vehicle having low overall height while at the same time enabling the loaded bucket to be lifted and dumped a considerable distance above the top of the loader.

The loader has a rear power section containing a prime mover such as an internal combustion engine and such rear section is pivotally connected to the front section by a centrally located pivot structure so that steering can be accomplished by pivoting the front section relative to the rear section about a vertical axis. Both sections of the loader are supported by a pair of laterally spaced supporting wheels, all of which are power driven from the prime mover, the drive for the front wheels being through a drive shaft passing through the axis of the pivotal connection between the front and rear sections of the vehicle.

The loader is steered by a power actuator such as an actuator connected between the front and rear sections thereof and the boom is raised and lowered by one or more similar power actuators. The boom has its rear end pivoted to the upper front portion of the vehicle, such pivot being preferably directly above the front axles of the front drive wheels. A bucket carrier is mounted at the front end of the boom for pivotal movement about a horizontal axis and one or more power actuators, preferably hydraulic actuators, are connected between an upwardly extending portion of such bucket carrier and an upwardly extending portion of the front of the frame of the loader so as to provide a parallel linkage device with the boom and bucket carriage for one position of such power actuators.

The bucket is carried between a pair of laterally spaced forwardly extending arms forming part of the bucket carrier and is pivoted for pivotal movement about a horizontal axis spaced forwardly of the pivotal axis of the bucket carrier. A bucket tipping mechanism is provided including one or more flexible members having an end connected to the upper rear portion of the bucket and its other end connected to the bucket carrier and doubled back on itself so as to provide a bight for receiving a rotatable element which may be also reciprocated toward and away from the bucket carrier to tip the top of the bucket rearwardly and also allow it to tip forwardly about its pivotal axis. Such reciprocatory movement of the rotatable member is preferably accomplished by means of another power actuator, such as a hydraulic actuator, and the boom carries a guide for such reciprocatory movement of the rotary member.

The structure just described results in an extremely compact device which holds the bucket in upright position during raising and lowering of the boom after the bucket has been moved to such upright position, but also enables the bucket to be tipped forwardly for loading and for dumping in any position of the boom including the uppermost position or the lowermost position of the boom. The entire device is extremely maneuverable and may be used to move forwardly into confined spaces to load the bucket, after which it may be reversed so that the load is carried rearwardly to a position in which it can be dumped into a suitable vehicle or other receiver.

It is, therefore, an object of the invention to provide an improved loader particularly useful in mines.

Another object of the invention is to provide a loader in which the operator's station is located a low position in a front section of the loader and between protecting upwardly extending side walls and immediately to the rear of the loader boom and bucket mechanism.

Another object of the invention is to provide a more compact boom, bucket carrier and bucket tipping mechanism which maintains the bucket in upright position during raising and lowering of the boom after the bucket has been loaded and which enables the bucket to be tipped forwardly in any position of the boom to provide for loading of the bucket and for dumping of the bucket.

A further object of the invention is to provide an improved mine loader vehicle in which a flexible member having its ends connected to a loader bucket and a bucket carrier to provide a bight between the ends of such member is employed in conjunction with a power actuator for reciprocating a rotatable member in such bight to control the angular position of the bucket relative to the bucket carrier.

Other objects and advantages of the invention will appear in the following detailed description of a preferred embodiment of the invention shown in the attached drawings of which:

FIG. 1 is a top plan view of a loader in accordance with the present invention;

FIG. 2 is a vertical longitudinal section of the loader of FIG. 1 taken generally centrally through the loader but showing certain of the central parts in elevation;

FIG. 3 is a side elevation of the loader showing the bucket in loading position;

FIG. 4 is a fragmentary vertical section on an enlarged scale taken on the line 4—4 of FIG. 1;

FIG. 5 is a view similar to FIG. 4 taken on the line 5—5 of FIG. 1;

FIG. 6 is a fragmentary side elevation of the front portion of the loader with parts broken away to show interior structure and with the boom in its uppermost position;

FIG. 7 is a fragmentary section taken on the line 7—7 of FIG. 6;

FIG. 8 is a view similar to FIG. 6 showing the bucket carrier in a different position; and

FIG. 9 is a schematic diagram showing a suitable hydraulic system for the loader of the present invention.

Referring more particularly to the drawings, the loader shown in FIGS. 1 2 and 3 includes a front section 10 and a rear section 12, both having frames made up of heavy sheet steel and supported on front and rear axle housings 14 and 16, respectively, in turn supported upon laterally spaced front and rear wheels 18 and 20, respectively.

The rear section 12, as shown most clearly in FIG. 2, contains a prime mover 22, which may be an internal combustion engine, and an associated radiator 24 and transmission 26. The rear wheeels 20 are driven from

axles 28 in turn driven from the internal combustion engine 22 through the transmission 26 and a depending gear box 29 and drive shaft 30 having suitable universal joints therein. Such rear section may also contain various supply tanks, such as a fuel tank 32 (FIG. 1), an oil tank 34 and a water tank 36, the latter tank being useful for supplying to water to a filter and gas treating device (not shown) for the exhaust gases of the internal combustion engine 22.

The front portion of the frame of the rear section 12 is provided with a pair of vertically spaced upper pivot plates 38 and a pair of vertically spaced lower pivot plates 40. The plates 38 are positioned a substantial distance above the plates 40 and the two pairs of plates provide vertically spaced pivot structures receiving between the plates thereof, vertically spaced pivot plates 42 and 44, respectively, forming part of the frame of the front section 10 of the loader. The plates 38 and 42 on the one hand and the plates 40 and 44 on the other hand are connected together for relatively pivotal motion about a vertical axis by axially aligned pivot pins 46. The front section 10 of the loader can thereby pivot about the vertical axis of the pivot pins 46 relative to the rear section 12. As shown in FIG. 1, such pivoting may be accomplished by the steering hydraulic actuator 48.

The front wheels 18 of the front section 10 are driven from the gear box 29 through axles 50 and through a drive shaft 52 including suitable universal and slide joints and passing through the axis of the pivot pins 46 between the upper and lower pivot pins 46. Such drive shaft may have a mechanical brake 54 shown in FIG. 2 and also a magnetic actuated brake 56 including a disc 58 on the drive shaft 52.

The drive shaft 52 has its forward portion positioned in a tunnel 60 in the floor of the rear portion 10 of the loader and extending through the driver's compartment 62 so as to extend above the floor 64 of such compartment. The floor 64 is positioned a substantial distance below the axles 20 and 50 and, in general, constitutes the lowest portion of the loader except the wheels, thereby determining the lowest clearance of such loader. The driver's compartment includes a seat 66 positioned at one side of the loader so as to face the other side of the loader so that the operator of the loader can easily see both forwardly and rearwardly. The operator's compartment is protected by upstanding side walls 68 forming part of the frame of the front section of the loader. Such operator's compartment may be provided with suitable controls, such as a steering handle 70, brake pedal 72, accelerator pedal 74 and a hydraulic actuator control valve block 76 provided with suitable control levers.

The front section 10 of the loader is provided with a boom indicated generally at 78. Such boom includes a rear tubular cross member 80 and a front tubular cross member 82 at its rear and front ends, respectively, secured together by longitudinally extending plates 84 laterally spaced from each other and spaced inwardly from the ends of the tubular members 80 and 82. The boom also has suitable angularly positioned bracing members 86, all of the members of the boom being welded together to form a rigid structure.

A cross shaft 88 (FIG. 2) is scured to and extends between the upper front portions of the two side plates 68 of the frame of the front section 10 of the loader and the rear tubular cross member 80 of the boom 78 is journaled thereon. A pair of hydraulic actuators 90 having their lower ends pivoted to a lower front extension of the frame of the front section 10 of the loader and their upper ends pivoted to the boom plates 84 approximately one-third the distance forwardly of the boom plates from their rear pivots serve to raise and lower the boom 78.

The front tubular cross member 82 of the boom has a cross shaft 92 (FIG. 2) journaled therein. Support plates 94 and 96 forming part of a bucket carrier indicated generally at 98 are secured to the ends of the shaft 92 and extend generally upwardly from such shaft. The plates 94 and 96 have a tubular member 100 passing through their center portions and rigidly secured thereto, for example, by welding. The tubular member 100 is spaced above and positioned slightly forward of the shaft 92 when the rear edges of the plates 94 and 96 are in a vertical position. The ends of the tubular member 100 extend laterally outwardly from the respective plates 94 and 96 and each have forwardly extending bucket supporting arms 102 and 104 secured to such ends, respectively. A laterally elongated bucket 106 having a substantially vertical rear wall, a rounded bottom wall and a forwardly inclined front wall and side walls 114 has such side walls pivoted to the bucket supporting arms 102 and 104 at 116 for movement of the bucket about a laterally extending axis below and to the rear of the center of gravity of the bucket or the bucket and its load. The bucket thus tends to pivot in a clockwise direction in FIG. 2 under the action of gravity. It is held in its counterclockwise direction by a pair of flexible elements, such as chains 118 more fully described below. The bucket has stops 120 engaging the side arms 102 and 104 to prevent rearward tipping of the bucket when the bucket is in the position shown in FIG. 2 relative to the bucket support arms 102 and 104.

The support plates 94 and 96 of the bucket carrier extend upwardly above the tubular member 100 and have the forward ends of a pair of hydraulic actuators 172 pivoted thereto. The rearward ends of such actuators are pivoted to side members 174 extending upwardly from the side plates 68 of the frame of the front section 10 of the loader. When the hydraulic actuator 172 is in the position shown in FIGS. 1 and 2, such actuators in conjunction with the boom 78, bucket carrier support plates 94 and 96 and the upstanding side members 174 form a parallel linkage, such that the bucket support arms 102, 104 retain the same angular position relative to the frame of the front section 10 of the loader during raising and lowering of the boom by the hydraulic actuators 90. That is to say, the bucket remains upright as the boom is raised from the position shown in FIG. 2 to the position shown in FIG. 8.

The bucket 106 is held from tipping forwardly from the position shown in FIG. 2 by a bucket actuating mechanism including the chains 108 referred to above. Such chains each have one end connected to the upper rear portion of the bucket at 176. Each chain then passes under a pulley 178 journaled on one of a pair of pulley support and bucket carrier actuating plates 180, shown most clearly in FIGS. 1 and 5. The plates 180 are rigidly secured to the tubular member 100 so as to be a rigid portion of the bucket carrier 98. The chains 118 then each pass over another pulley 182 journaled on a shaft 183 (FIG. 5) extending between and secured to the plates 180 and each chain then has an upper run extending rearwardly in a direction generally parallel to the boom 78. The chains then each pass around a pulley 184 journaled on one end of a shaft secured in a slide 186. The shafts of the pulleys 184 each has a roller 187 (FIG. 7) journaled on the other end and received in one of a pair of laterally spaced channel guides 188 secured to and extending in a direction generally parallel to the boom 78. The guides 188 are mounted above and are secured to the bracing plates 86 of the boom and have their rear ends secured to the tubular cross member 88 at the rear end of the boom. After passing around the pulleys 184, the chains 118 then have a lower run extending forwardly generally parallel to its upper run. The other ends of such chains are then secured to the tubular member 100. It will be apparent that the structure shown provides a loop or bight in each chain for one of the pulleys 184 on the slide 186.

Another hydraulic actuator 190 has its front end secured to a tubular member 192 journaled on the shaft

183 for the pulleys 182 so as to be pivotally connected to the plates 180 of the bucket carrier. The actuator 190 has its rear end connected to the slide 186. It will be apparent that movement of the slide 186 forwardly of the guides 188, i.e., to the right and downwardly in FIG. 2, will enable the bucket 106 to tip forwardly about its pivots 116. Also, movement of the slide 186 upwardly and to the left in such figure by the actuator 190 will return the bucket 106 to the position shown in FIG. 2. It will be further apparent that during raising of the boom, the chains 118 will wind onto the pulleys 182 but will simultaneously unwind from the pulleys 184. If the pulleys 182 and 184 are made of the same size, such chains will wind onto the pulleys 182 at the same rate that they unwind from the pulleys 184 so that there is no tendency to tip the bucket during raising and lowering of the boom between the position shown in FIG. 2 and the position shown in FIG. 8.

In all ordinary loading operations, the position shown in FIG. 8 is a sufficiently high dumping position for the bucket but if desired, the structure shown has the capability that the bucket may be elevated to a higher dumping position shown in FIG. 6. This is accomplished by rotating the bucket carrier 98 in a counterclockwise direction in the figures from the position shown in FIG. 8 to that shown in FIG. 6 by means of the actuators 172 and at the same time causing the actuator 190 to move the slide 186 toward the front end of the boom. This will allow the bucket to remain in upright position even though the bucket carrier 98 has been tipped backwardly to raise the bucket. Thereafter, controlling the actuator 190 to move the slide 186 further toward the front or free end of the boom 78 will allow the bucket to tip forwardly in FIG. 6 to dump the bucket. When the boom is lowered, the full line position of the bucket shown in FIG. 3 is obtained by tilting the bucket carrier 98 in clockwise direction in FIG. 3 by the actuators 172 while the slide 186 is in its rearward position relative to the boom. A movement of the slide 186 toward the front end of the boom by the actuator 190 will allow the bucket to assume the dotted line loading position shown in FIG. 3.

A suitable hydraulic control system for the actuators 48, 90, 172 and 190 is shown diagrammatically in FIG. 9 as including a storage tank 194 for hydraulic fluid, a pump 196 and a pressure regulator 198. The pump supplies hydraulic fluid under pressure to both the control valve block 76 for the actuators 90, 172 and 190 and the steering control valve block 202. The control valve block 76 may have individual valve control levers 204, 206 and 208 for the actuators 90, 172 and 190, respectively. The steering control valve block 202 may contain a valve actuated by the steering member 74 for actuating the steering actuator 48. It will be understood that the valve blocks contain conventional double acting four-way valves for control of the hydraulic fluid in order to operate the various actuators and that the various parts of the hydraulic system including suitable conduits for the fluid will be mounted upon the loader in any convenient position.

In operation of the device, the operator controls the internal combustion engine 22 in the usual manner by the accelerator pedal 74 and also controls the direction and travel of the loader by the automatic transmission 26 through standard controls (not shown), and the brakes including the brake pedals 72. The operator sits sideways in the seat 66 so as to be able to easily see both forwardly and rearwardly of the loader while being protected by the side plates 68 of the frame of the front section 10 of the loader. The various actuators are controlled by the levers 204, 206 and 208 and by moving such levers, the boom can be raised and lowered, the bucket carrier 98 can be moved in either direction about the shaft 92 by the actuators 172 and the bucket may be allowed to tip forward and be returned to upright position by the actuator 190. The bucket may be loaded at any level of the front end of the boom including loading by a digging operation below the level of the wheels of the vehicle and the bucket may be returned to upright position by the actuators 172 and 190 at any time desired. Moving the front end of the boom up and down by the actuators 90 will not change the angular position of the bucket relative to the frame of the loader unless one or the other or both of the actuators 188 and 190 are also operated. The entire vehicle can be readily driven into close quarters with low clearance and a load gathered in the bucket after which the vehicle can be backed and the bucket elevated and dumped into a truck, car or other receiver.

I claim:

1. A loader comprising a wheeled vehicle having a rear power section containing a prime mover and a front loading section, said sections each having a pair of supporting power driven wheels and being connected together for steering pivotal movement about a vertical axis positioned between said sections, said front section having its supporting wheels journaled for rotation about horizontal axes adjacent its front end and having at its rear portion a floor positioned below said horizontal axes and upstanding side walls defining an operator's station, a cross member extending laterally of said front section between the upper front portions of said side walls forwardly of said station, a forwardly extending loader boom having its rear end mounted for pivoted movement about a horizontal axis provided by said cross member, a loader bucket carried by the forward end of said boom for pivotal movement about a horizontal axis and power means controlled from said station for raising and lowering said boom and for pivoting said bucket about the last mentioned axis.

2. A loader comprising a wheeled vehicle having a rear power section containing a prime mover and a front loading section, said sections each having a pair of supporting power driven wheels and being connected together for steering pivotal movement about a vertical axis positioned between said sections, said front section having its supporting wheels journaled for rotation about horizontal axes adjacent its front end and having at its rear portion a floor positioned below said horizontal axes and upstanding side walls defining an operator's station, a shaft secured to and extending laterally between the upper front portions of said side walls forwardly of said station, a forwardly extending loader boom having a rear tubular member at its rear end journaled for pivoted movement on said shaft and a laterally extending front tubular member at its front end, said boom including laterally spaced plates extending longitudinally of said boom and having their ends secured to said tubular member, a shaft journaled in said front tubular member, a carrier secured to the ends of said shaft for pivotal movement about a horizontal axis relative to said boom, a bucket pivoted in said carrier and power means controlled from said station for raising and lowering said boom and for pivoting said bucket carrier and said bucket relative to each other and said boom.

3. A loader for mines comprising a wheeled vehicle having a rear power section containing a prime mover and a front loading section, said sections each having a pair of supporting power driven wheels and being connected together for steering pivotal movement about a vertical axis positioned between said sections, said front section having its supporting wheels journaled for rotation about horizontal axes adjacent its front end and having at its rear portion a floor below said horizontal axes and upstanding side walls defining an operator's station, a forwardly extending boom having its rear end journaled about a first horizontal axis at the forward upper portion of said vehicle for pivotal movement between a downwardly inclined position and an upwardly inclined position, a bucket carrier mounted for pivotal movement about a second

horizontal axis at the forward end of said bottom and having a pair of laterally spaced arms extending forwardly from said boom, a bucket mounted between said arms for pivotal movement about a third horizontal axis at the forward end of said arms, said third axis being to the rear and below the center of gravity of said bucket, said bucket carrier having an upwardly extending portion, power means between said upwardly extending portion and said upper portion of said vehicle for pivotally moving said bucket carrier about said second axis and forming a parallel linkage means with said boom and carrier in one position of said power means, a flexible means having one end secured to said bucket adjacent the upper edge thereof and another end secured to said bucket carrier and providing a bight, a rotatable member positioned in said bight, and movable longitudinally of said boom, a power means between said carrier and said rotatable member for longitudinally moving said rotatable member to pivot said bucket toward a rearward position, and slide means carried by said boom for guiding the longitudinal movement of said rotatable member.

4. A loader structure comprising a vehicle, a forwardly extending boom having its rear end journaled about a first horizontal axis at the forward upper portion of said vehicle for pivotal movement between a downwardly inclined position and an upwardly inclined position, a bucket carrier mounted for pivotal movement about a second horizontal axis at the forward end of said boom and having a pair of laterally spaced arms extending forwardly from said boom, a bucket mounted between said arms for pivotal movement about a third horizontal axis at the forward end of said arms, said third axis being to the rear and below the center of gravity of said bucket, said bucket carrier having an upwardly extending portion, power means between said upwardly extending portion and said upper portion of said vehicle for pivotally moving said bucket carrier about said second axis and forming a parallel linkage means with said boom and carrier in one position of said power means, a flexible means having one end secured to said bucket adjacent the upper edge thereof and another end secured to said bucket carrier and providing a bight, a rotatable member positioned in said bight, and movable longitudinally of said boom, a power means between said carrier and said rotatable member for longitudinally moving said rotatable member to pivot said bucket toward a rearward position, and slide means carried by said boom for guiding the longitudinal movement of said rotatable member.

5. A loader structure comprising a vehicle having upstanding side walls providing an operator's station between said walls, a shaft extending between the upper portions of said walls forwardly of said station, a forwardly extending boom having a laterally extending rear tubular member at its rear end journaled for pivotal movement of said boom about said shaft between a downwardly inclined position and upwardly inclined position, a laterally extending front tubular member at the front end of said boom, a shaft journaled in said front tubular member, a bucket carrier supported by said shaft for pivotal movement about a second horizontal axis at the forward end of said boom and having a pair of laterally spaced arms extending forwardly from said boom, a bucket mounted between said arms for pivotal movement about a third horizontal axis at the forward end of said arms, said third axis being to the rear and below the center of gravity of said bucket, said bucket carrier having an upwardly extending portion, power means between said upwardly extending portion and the upper front portions of said side walls for pivotally moving said bucket carrier about said second axis and forming a parallel linkage means with said boom and carrier in one position of said power means, a flexible means having one end secured to the upper rear portion of said bucket and another end secured to said bucket carrier and providing a bight extending rearwardly along said boom, a rotatable member positioned in said bight, and movable longitudinally of said boom, power means between said carrier and said rotatable member for longitudinally moving said rotatable member to pivot said bucket toward a rearward position, and slide means carried by said boom for guiding the longitudinal movement of said rotatable member.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,038,619 June 12, 1962

Eddie B. Wagner

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 7, line 1, for "bottom" read -- boom --.

Signed and sealed this 9th day of October 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents