COAL LOADING MACHINE
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This invention relates to coal loading machines of the character used for loading coal from narrow veins, and more particularly to a coal loading machine having a novel rotatable shovel provided with separate hydraulic mechanisms for effecting reciprocation and rotation of the shovel in connection with the loading and unloading operations. Additionally, the invention relates to improved power plants for self-contained coal loading machines incorporating holding jacks on a skid, or a Caterpillar-supported turntable, and the shovel and its actuating mechanism are tiltably supported on the turntable and rotatable therewith.

In my prior Patents 2,441,581 and 2,441,582, of May 18, 1948, I have disclosed and claimed coal loading machines of the vertically tiltable type having holding jacks, and unitary hydraulic mechanisms for reciprocating and rotating the shovels, together with special operating mechanisms for the selective control of the shovel reciprocating and rotating devices.

I have now found that a much more simple, compact, efficient, flexible and powerful coal loader can be obtained by providing a unitary motor drive for the power system comprising separate hydraulic power units for the shovel reciprocating and rotating mechanisms, as well as providing a novel, axially-supported shovel of improved design and increased capacity, and of improved maneuverability in both loaded and unloaded condition. Because of the improved distribution of the power loads and the reduction in size of the elements of the power equipment, the latter can be maintained at minimum size and distributed on a turntable to best advantage, whereby the capacity, efficiency and maneuverability of the coal loading machine is greatly increased, while, as noted, the overall size limitations are appreciably reduced. Additionally, the novel coal loader is susceptible of remote control operation from outside of narrow seams or workings, with consequent improvement in working conditions for the machine operator.

It is, therefore, among the objects of the present invention to provide an improved coal loading machine, which is movable under its own power, and which is characterized by increased load capacity and flexibility of operation.

It is also among the objects of the invention to provide a coal loading machine having dual power units in a single assembly and driven by a single motor, the whole being mounted on a skid or Caterpillar-supported turntable, together with tilttable power shovel operating mechanisms, the shovel operating mechanisms being self-balancing or equipped in retracted position, and the shovel being self-supporting in extended position, whereby no unbalanced loads are imposed on the tilting mechanisms.

The invention also comprises as features of novelty, an electric motor-driven, dual hydraulic power units and solenoid controls therefor, together with flexible power cables and machine-mounted, or remote control equipment.

Other and more detailed objects of the invention include a reciprocable top rod assembly for rotating the shovel, including a traveling manifold flexibly coupled to a separate hydraulic power unit; a power ram reciprocable in a fixed cylinder rigid with a fulcrum bearing guide and serving as a bearing for the traveling manifold; a shovel rotatably mounted at the end of the power ram; means in the top rod assembly cooperating with the power ram and shovel and effective to insure a predetermined forward travel of the shovel into the base of a pile of coal before rotation of the shovel on its axis is effected, whereby the pay load picked up by the shovel is practically doubled; the provision of a pivoted wheel support for the shovel, whereby the weight of the shovel and its contents is supported by the wheel in all forward positions of the power ram and associated guide rods, and no lever arm effect is imposed on the piston and guide rods; the provision of opposed, self-wedging grab jacks associated with the power piston crosshead and hydraulically coupled with the hold jack for selective operation; the provision of a tilt locking mechanism for the tiltable fulcrum guide and operable upon retraction of the ram, top rod piston and back support to fully retracted position, whereby the loaded shovel is counterbalanced and the turntable is movable to translate the shovel to any desired unloading position; and the provision of interlocking solenoid controls for the hydraulic units, whereby positive sequential operation of the equipment is assured.

The above and other desirable objects of the present invention will be more clearly understood by reference to the accompanying drawings, in which is illustrated a novel coal loading machine incorporating preferred embodiments of the invention, by way of example only, as other specific installations may incorporate the novel features herein without departing from the spirit and scope of the present invention.

In the drawings, like numerals refer to similar parts throughout the several views, in which:

Figure 1 is a schematic top plan view of the machine assembly with the shovel or scoop in completely retracted position, certain of the structures being shown in broken section, and the hydraulic lines and controls connected with the power units; 

Fig. 2 is a plan view of the turntable showing the mounting of the power units and control equipment the ram and shovel actuating equipment being shown in broken section; 

Fig. 3 is a vertical section through the hold jack and mounting skid with the teeter block shown in elevation and associated equipment in section; 

Fig. 4 is a side view partly in broken section of the assembly shown in Figs. 1 and 2, with portions of the hydraulic actuating mechanisms broken away and with the top rod in retracted position, showing the lip of the shovel at the beginning of the loading stroke, certain of the power elements being omitted to show the back bar-power cylinder mounting; 

Fig. 5 is a schematic view illustrating the travel of the scoop or shovel during loading; 

Fig. 6 is a rear elevation of the back support showing the side rods, or telescoping manifolds, cross-bar, ram, and top rod; 

Fig. 7 is a partial longitudinal section taken on line 7—7 of Fig. 6, and showing the details of the top rod hydraulic lock and the power ram locking means; 

Fig. 8 is a transverse section taken on line 8—8 of Fig. 7; 

Fig. 9 is an enlarged axial horizontal section taken on line 9—9 of Fig. 7; 

Fig. 10 is a fragmentary detailed plan view of the bucket mounting and teeter block;
Fig. 11 is a longitudinal section taken on line 11—11 of Fig. 10, showing the details of the grab jack mechanism, with the fixed mounting of the top rod, and ram housing in the teeter block, and the securing of the telescoping manifold side rods and the ram in the bucket cross-head;

Fig. 12 is a fragmentary vertical section through the teeter block, showing the details of the ram housing, ram cylinder, and ram piston mounting therein, the teeter block support and portion of the top rod and its mounting being shown in elevation;

Fig. 13 is a section taken on line 13—13 of Fig. 11, showing the details of the bucket mounting, and Figs. 14 and 15 are a plan and section view, respectively, of a modified hold-jack assembly.

The novel coal loader herein comprises a plurality of structural units and their component parts integrated into a unitary mechanism which is composed essentially of a leading head rotatively mounting a bucket or shovel, and dual, hydraulically controlled actuators, interconnected, both mechanically and hydraulically, and effective to reciprocate the leading head and rotate the shovel or scoop. Additionally, the loader assembly includes a traveling base and support for the assembly, mounting a fixed pivot or standard in its center, the standard incorporating a hold jack; a turntable mounted in alignment on the standard; a hydraulic turn motor, a tilting fulcrum standard, or trunnions, at the front of the turntable; a fulcrum guide or teeter block trunnioned in the standard, tiltably and reciprocably mounting the loader head actuators; and a motor-driven, dual hydraulic power unit mounted at one side of the turntable. The loader shovel, bucket, or scoop, extends across the entire front of the machine, and is movably supported on a cross-head having a pivoted caster so that there is no unbalanced or unsprung weight in any retracted or extended position of the leading head. The stability of the machine is considerably increased by lowering the centers of gravity of the component structural supporting and actuating units, which is accomplished by the design and use of relatively flat units, extending over a maximum of area, whereby the entire structure is relatively squat. By reason of this improved assembly, maximum stability is assured at all times. With the shovel using an axially suspended cylinder-drum structure, its height and vertical operating head room can be reduced to a minimum without sacrificing the increased load carrying capacity of the machine.

Considering the arrangement more in detail, and for the purpose of setting up the specific orientation of the component units and their mutual cooperation as a structural and mechanical entity, the novel machine, as shown in Figs. 1, 2, and 3, will be seen to comprise the following elements:

A. Skid base or support, mounting a vertical axis incorporating a hold jack;
B. Turntable rotatably mounted on the axis and including platform bases for units;
C. Dual, motor driven hydraulic unit on one side of the turntable;
D. Hydraulic turn motor and hydraulic tilting lock;
E. Teeter block for tiltably mounting the load gathering mechanism at the forward edge of the turntable and mounting the leading head actuators;
F. Loading head actuator;
G. Shovel rotator;
H. Shovel structure and supports, including grab jack and mounting therefore, and
I. Hydraulic connections and controls therefor.

Referring now to the drawings, the novel coal loader is seen to comprise a skid base, rotatably mounting a turntable, on which are mounted the fixed units comprising the fulcrum guide supports, tilting lock, hydraulic turn motor, hydraulic power units for the hydraulic actuators, and their common driving motor together with the necessary interlocking controls. Power is supplied to the motor by a power line from a control box, which is electrically connected, through slip rings on the vertical axis of the machine, with a main power cable having an entrant in the skid base.

The several units and their component elements will be separately described, after which the hydraulic connections will be detailed, followed by a specific description of the operation of the machine as an entity.

The use of electric push button controls for the hydraulic power units and valved hydraulic connections to the hydraulic actuators.

Skid base, hydraulic jack, and turntable assembly and mounting

Referring to the drawings, and more particularly to Figs. 2, 3 and 4, the mounting of the holding jack and the turntable on the skid base will be described.

The skid base comprises a sledge 1, having a skid plate or bottom 2 provided with a central annular boss 3, having a flat top bearing surface 4 and a lateral entrant 5 for the power cable. The sledge is provided further with tapering side walls 6 and an annular rim or top 7, and a cable entrant 8 in alignment with the entrant 5 in the boss 3. The sledge may be of any suitable configuration, either circular or polygonal.

The hydraulic jack and the turntable as shown in Figs. 2 and 3, are keyed or locked in operative position in a manner now to be described: A central shaft 10 has a bottom section 11 fitted into the boss 3 and secured in place as by screws 12, tapped around the annular joint of the shaft with the boss 3. The shaft 10 is Shouldered, as indicated at 13, to provide bearing engagement against the annular bearing surface 4. Immediately above the shouldering 13 the shaft forms a bearing surface 14 terminating in a recessed screw-threaded portion 15. The shaft is then reduced in diameter and continued upwardly as indicated at 16, the top portion being hollow, as indicated at 17, to provide a cylinder for the hydraulic jack.

The base portion of the shaft is centrally apertured, as indicated at 18, and is provided with a lateral opening at the bottom in alignment with cable entrant 5. A diametric transverse opening 19 connects the top of aperture 18 with the surface 16 of the shaft, and a collector ring support, as will be described more in detail hereinafter.

The hydraulic jack, designated generally by the numeral 20, includes a piston 21, having an axial duct 22 extending its entire length, and closed at the top section 23 by any suitable means, such as a top or machine screw 24.

The bottom of the piston is shouldered, as indicated at 25, and the piston reciprocates in the chamber 17 of the shaft 10. The flanged end of the piston is provided with a top limit stop, comprising washers 26, held in place by a lock ring 27. An oil entrant is tapped into the axial oil duct at an angle, desirably at 45°, and is connected to a suitable flexible conduit 28, as will be described more in detail hereinafter. The top jack, designated generally by the numeral 29, is secured to the top of the piston in any suitable manner, care being taken to insure the self-seating bearing engagement of the head under operative conditions.

As shown in Figs. 3 and 4, the turntable 30 is rotatably supported on the shaft 10 in the following manner: An annular ball bearing race 31 is fitted over shaft 10 in drive fit engagement with bearing surface 14 of the shaft, so that its bottom surface 32 has aligning engagement on the top surface 4 of the supporting boss 3 of the sledge or skid base 1. The top surface 33 of the annulus 31 is engaged by lock nut 34, which is turned up on the screw-threaded section 15 of shaft 10 and clamps the annular bearing member tightly in place.

A second, concentric annulus 35 serves with the outer annulus 31 as a race or cage for ball bearings 36. The turntable 30 is formed integral with an annular casting 37, serving as a hub for the turntable, and is secured.
The hub 37 incorporates a centrally aperture top 37, and is fitted on and over the outside ball race 35. An annular bearing plate 38 is secured to the bottom of member 37 by machine screws or bolts 39, and clamps the bottom surface of ball race 35, as shown. A grease seal 38' is provided between the outer surface of lock nut 34, and the edge of the aperture in the top 37.

The turntable is rotated about the shaft 10 in the following manner: A hydraulic turn motor 40 (Figs. 1 and 2), having a shaft coupling 41, is connected through gear box 42, to a depending pinion gear 43. The pinion gears meshes with ring gear 44 (Fig. 2), mounted in channel 45 formed in the upper surface of bottom plate 2 of the skid-base. The ring gear is secured in place by machine screws 46, or the like. The hydraulic turn motor and other auxiliary equipment are secured to the turntable. For rotation thereof, are desirably mounted on individual supporting plates which are secured to the turntable, as by welding, all as will be described more in detail hereinafter in connection with the description of the specific assemblies.

**Tilted support mounting.**

As noted hereinafter, the gathering mechanism must be mounted both for reciprocation and tilting, as well as being rotatable with the turntable.

Referring now to Figs. 1 to 5, and 7, the details of this mounting will be described:

A teeter block or guide fulcrum 70, tiltably and reciprocally mounting the gathering assembly, is tiltably mounted in guide bearings 60, 60', incorporated in spaced trunnion supports 50, 50' (Figs. 3 and 4). The supports are mounted on the turntable 30, in any suitable manner. The supports are symmetrical and comprised of the following elements: Spaced guide bearing supports 52, 52', having flanged base sections 53, 53', are secured in mutually parallel relation to the turntable 30, by machine screws 54. The supports 52, 52' are provided with top bearing sections 55, 55' having bearing shoulders 56 at both ends, and a top bearing surface 57, terminating in flanged ends 58, of the guide fulcrum 70. The guide fulcrum 70, 60, 60', and 66' are separably connected by lock nuts 69, 69', and removable secured over the outer ends of the bearings 66, 66' by screws 68, and permit access to the bearings for inspection and greasing.

The tiltable guide fulcrum 70, (Figs. 1-4, 10, and 11) as noted, is mounted in the guide bearings, and comprises a solid steel body having parallel, flat side bearing surfaces 71, 71', parallel back and front faces 72, 73, at right angles to the sides; bottom surface 74, top surface 75, with an integral, superjacent annular boss 76, and aligned aperture hubs 77, 77', for tiltably mounting the fulcrum in the teeter bearings. Spaced ears 78, 78' (Figs. 3 and 11), for the tilt lock 80, are formed integral with the bottom of the fulcrum body, and adjacent the front face 73. The aperture hubs 77, 77', are severably provided with offset ducts 77a and 77b, which communicate with the ram housing, as will be described more in detail hereinafter.

The tilt jack 80 (Figs. 3 and 11), comprises a cylinder body 81, having an offset pivotal mounting 82, a piston 83, and common oil inlet and outlet line 84. The piston 83 is secured at its forward end, in and between the lugs 78, of the teeter block 70, by means of a pin 79. Uni-

Directional flow of oil into the lock chamber from supply line 84 is permitted by a check valve in valve control 290, and return of oil is made to sump line 285.

**Gathering assembly.**

The gathering assembly of the improved coal-loading machine herein comprises a loading head, incorporating a rotatable shovel or scoop bucket, a caster, wheel-supported crosshead, mounting for the shovel, a power ram and associated traveling, or telescoping, manifold guide rods fixed to the crosshead and reciprocable therewith, and a top rod for effecting rotation of the advancing shovel.

The mounting, in the guide fulcrum, of the power ram together with its guide rods, and the power cylinder as well as the top rod, will now be considered with respect to the special structural features of the fulcrum appurtenant thereto.

The teeter block or guide fulcrum 70, Figs. 1, 2, 3, 4, 10, and 11, is provided with sectioned aperture 90-and lateral apertures 91, 91', having their centers lying in the plane of the central axis of the aligned hubs 77, 77', and at right angles thereto. The aperture 90 is formed with threaded sockets 92, 93, at the ends thereof, and the lateral apertures 91, 91', are severally provided with bronze bearings 94, 94'. The top boss 76 is centrally aperture at 76', in alignment with aperture 90, and is provided with a bronze bearing 95. The boss 76 and bearing 95 are transversely slotted at the front face to receive the forked rack.

Referring more particularly to Fig. 12, the aperture 90 and its threaded sockets serve to mount the forward end of the ram housing or boot 101, ram cylinder 120, and ram piston rod 128, in the following manner:

The socket 93 receives the forward end of boot 101 in threaded engagement. Staffing box 96 is threaded into socket 92. The central portion of the staffing box is threaded to receive the internally threaded forward end of ram cylinder 120. The staffing box is provided further with a slip ring 96' and a threaded journal 97, in which piston rod 128 reciprocates. A piston rod support 98 is threaded into aperture 92 in locking engagement with staffing box 96, and is permanently secured in locking position by machine screw 99.

The power ram or piston actuating mechanism, designated generally by the numeral 100, comprises an outer cylindrical housing or boot, an inner ram cylinder, and a piston or ram. The outer cylindrical housing or boot 101, has a lapped outer surface 102, and a lapped inner surface 103 with splines 104 extending therealong. The cylinder 101 is screw-threaded at both ends, and is provided at 105, 106. A ring 107, having an annular oil groove 108 on its forward face, is fitted on and over the surface 102 of the cylinder, with its grooved face flush with the root of the screw threads 105. The ring 107 is welded in place on the boot, and serves as a shouldered bearing or stop thereof, when its threaded end portion 105 is screwed up into threaded socket 93 of the teeter block or fulcrum guide 70, with its grooved face of the ring 107 jalled against the rear face 72 of the fulcrum guide. Desirably, a suitable gasket is fitted on and over the grooved face of the bearing ring to insure an oil-tight assembly.

At its rear end, the boot 101 is provided with a tubular extension or boot head 110, which is threaded up on the screw threads 106, or preferably welded to the boot, as shown at 110' (Figs. 1, 7, and 9), to form an integral extension thereof.

As shown in detail in Fig. 9, the section 110 is provided further with a transverse plate 111, having a central aperture 112, tapered at 113 to receive a clamping stud 130. The end 114 of the extension 110 is internally threaded at 115 to receive screw-threaded cap 116 in pressure-tight, hermetically sealed relation, whereby to form the closed end of boot 101. The chamber formed in section 110 by and between foraminous web 111, and cap 116 is designated generally by the
The cap 116 is desirably provided with a polygonal boss 118 to permit the use of a suitable wrench in screwing up and unscrewing the cap in its threaded seating and sealing engagement with the rear end section 110 of the power cylinder boot 101. While a boss sealing cap is shown, it will be understood that the outer face of the cap may be socketed to receive a socket wrench. A plurality of pairs of diametrically opposed, concentric, threaded tap holes or sockets 119, are formed in the outer face of cap 116, and serve to receive back bar securing and spacing studs, as will be described more in detail hereinafter. 

A boot secured in the boot or housing 101 is a ram cylinder 120. This cylinder is threaded at its front end 121, which is screwed up onto stuffing box 96 in teeter block 70 in advance of the boot 101. The rear end, 122, of the ram cylinder is closed by a cylinder head 123, desirably welded in place. The cylinder head is provided with a tapped central aperture which receives one end of a head clamping bolt 130, mounted in boot head 110, as will be described more in detail hereinafter. The cylinder head is provided with a plurality of concentric apertures 124 opening into the space 125 formed between it and the boot head, and serving as oil or hydraulic fluid entrants to the interior of the ram cylinder, behind the ram piston 126. The ram piston is comprised of a pair of leather cup washers mounted on a steel spacer and secured thereagainst by steel washers. The piston is secured on the threaded reduced end 127, of piston rod 128, by a suitable piston clamping nut 129. The forward end of the piston rod is journaled in a bushing 73, secured in the front face 73, of the teeter block.

It will be noted that the front end of the ram cylinder defines a piston chamber with the piston 126 and the front piston rod bushing. This chamber is in fluid communication with the "in" pump connection through duct 77. The forward end of the ram boot defines a second fluid chamber with the exterior of the ram cylinder, which chamber is in fluid communication with the rear end of the piston through splines 104 and cylinder head 123, and with the "out" pump connection through duct 77. As already noted, ducts 77, 77' are formed in the axis of the teeter block 70, and are severally provided with offset leads 77a, 77b, to the fluid chambers formed in the body of the teeter block, as above described.

Side rods and mounting thereof

As noted hereinabove, the front end of the ram piston rod 128 is fixedly secured to the front or loader crosshead 220. Telescoping, or collapsible manifolds are integrated with the front crosshead, the rear support, 180, and the back bar, 150, and are comprised of side rods reciprocably mounted on and over hollow fixed pistons serving as oil retrievers. The parallel hollow side rods 140, 140' are severally secured to the front crosshead 220, and are respectively mounted for reciprocation in the bushed bearings 94, 94' of the teeter block or guide fulcrum 70. The side rods are substantially co-extensive with the ram piston rod 128, and reciprocable therewith. The interiors of these hollow rods are severally designated by the numerals 141, 141'. The rear ends of the rods are fixedly secured to the rear support, 180, as will be described more in detail hereinafter, with their threads enterpers capped and packed to form stuffing boxes 142, 142', which serve as journal bearings for oil retrievers 143, 143'. The oil retrievers are hollow tubes threaded at their rear ends, and fitted into apertures 151, 151' at opposite ends of back bar 150. The tubes are shouldered, as shown, and are locked in place in the back bar by reverse clamping nuts 144, 144'. The back bar 150 is provided with a second set of spaced apertures 152, 152', adapted to register with threaded holes 119 in the boot cap, and be secured thereto by means of spacer rods 153, 153', having threaded spindle ends, one end of each rod being threaded into a tapped socket 119 in cap 116 of cylinder 101, and the other end passed through the cooperating aperture 152 or 152', the shoulder ends of the spindle sections serve as stops and provide bearing engagement against the inner face 154 of the back bar, positively securing the latter to the cylinder 101, which, as already noted, is itself positively secured in and to the teeter block or guide fulcrum 70. A third spindle 157 is threaded at both ends, and is tapped into cap 116, while its free end receives back bar clamping nut 158.

The forward ends of the oil retrievers 143, 143', open directly into the interior of the side rods 140, 140'. With this mounting the side rods are reciprocable in the teeter block 70, together with the ram piston rod, while the oil retrievers remain fixed and stationary with the ram housing assembly 100, which, as previously noted, is fixedly secured to the teeter block. The hydraulic controls for the several parts will be described in detail in the specific recital of the control features.

The remaining unit of the hydraulically controlled reciprocable members is a top rod 160 (Figs. 1, 2, 6, 7, 8, 10 and 11), mounted for reciprocation in bronze bearing 95 of the top aperture of the guide fulcrum 70. The top rod includes a tubular body section 161, having a forked steel gear rack 162 welded into the front end thereof. The forks of the gear rack are provided with depending gear teeth 163, operable to effect rotation of the loading bucket, the details of which operation will be discussed in connection with the assembly and operation of the loader head.

The tube 161 mounts a first steel slug 164, a compression spring 165, and a second, bronze slug 166. The rear passage of the top rod casing is shouldered to receive apertured steel cap 167 in screw-threaded engagement. A plurality of suitably spaced notches, designated generally by the numeral 169, are provided on the bottom surface of the top rod or tube 161, and are adapted to be engaged by solenoid controlled detent 169', which is mounted in the upper portion of teeter block 70, and rearwardly of the top rod journal 76. A fixed piston rod 170 comprising a hollow tube is secured in support 180, by clamping nut 171, and is journaled in bronze packing box 172, which is formed in the end of tube 161 by the end cap 167, cooperating with the threaded end of the top rod casing, and leather cup washers 173. The piston rod has a central passage 174 discharging through passageway 175' into chamber 168 in the rear end of the top rod housing. The piston rod is in fluid communication with the interior of telescoping manifold or side rod 140', through pressure line 170', as shown in Figs. 1, 4 and 7. The front end 176 of the fixed piston rod is threaded and mounts the piston comprised of leather cups set over steel washers 177, the assembly being secured in place on the piston by steel nut 178. The rear face of bronze slug 166 is recessed to receive the threaded forward end of the fixed piston.

The rear support (Figs. 1, 6 and 9), designated generally by the numeral 180, comprises a unitary casing having a central aperture 181, side apertures 182, horizontal axial alignment with the first said aperture, and an upper boss 183 mounting the fixed piston of the top rod. The central aperture is provided with a bushing 184 for bearing engagement with the lapped surface 102 of the ram boot 101. The lateral apertures mount the side rods 140, 140', of the telescoping manifolds, which, as noted, are provided with suitable journals or stuffing boxes 142, 142', to receive the oil retrievers 143, 143', which function as fixed pistons for the reciprocable side rods or oil delivery cylinders of the manifolds. As will appear more in detail hereinafter, the side rods and their fixed pistons, together with the flexible connections to the auxiliary oil pump, form continuously full, expandable reservoirs, providing instantly available oil pressure at all times.
Loading head

The loading head of the novel coal loader is designated generally by the numeral 201, and mounts a rotatable scoop bucket 202. The scoop is of special construction comprising a semi-cylindrical rear portion and a forwardly extending scoop portion, each mounted on a semi-cylindrical cross-section, with a toothed bucket lip. The developed surface of the novel cylindrical scoop bucket is that of a true cylinder, of which the semi-cylindrical rear bucket portion is a part.

The bucket is supported by a reciprocating semi-cylindrical rear portion and a transverse stiffening web joining the wall of the bucket to the inner or bucket face of the rear, the walls of the bucket being supported and stiffened by an integral U-shaped bracket on which the bucket is rotatably mounted.

Considering the bucket more in detail, and as shown in the drawings, the surface comprises a semi-cylindrical back section 202 and a forwardly extending curvilinear scoop section 203. The rear section has a top edge 204 lying in a diametrical plane of the semi-cylinder, whose axis or longitudinal center is designated by the numeral 205 (Fig. 4). The front edge 206 of the bucket is toothed. End plates 207, 207', are secured over and on the semi-cylindrical rear portion, being conformed thereto, and are formed of top edge 208, 208', severally joining the rear edge 204 with the front edge or lip 206. It will be noted that the radial distance from the axis 205 to the lip 206 is approximately equal to twice the distance between axis 205 and rear edge 204, or to the diameter of the semi-cylindrical back or body section of the bucket.

The bucket mounting means (Figs. 1, 4, 11 and 13) comprises a U-shaped bracket 210 secured to the walls of the bucket, the semi-cylindrical rear section of the bucket by rivets or other securing means, designated generally by the numeral 212. A web or stiffening plate 209, parallel to the end plates, is secured to the inside of the bucket and the forward surface of the recess.

The bracket 210, comprises a front wall section 212, of rectilinear shape, with side walls 213, 213'. The bracket wall sections are secured to the front and side walls of recesses 211 by machine screws 214. Dual quadrant gears 215, having gear teeth 216, are integral with or securely fixed to the back of front wall section 212. The bracket side walls and the quadrant gears are provided with axially aligned apertures to receive axis 217, which may be fixedly secured in place, or rotatably fitted therein. The axis 217 coincides with the axis 205 of the semi-cylindrical rear body section of the bucket. The bucket is divided into two parts by the mounting bracket recess 211 and the stiffening web 209, and the rear edge 204 is comprised of aligned and concentric portions 204a, 204b, of the concentric bucket portions 202a, 202b. The forked rack 162 is journaled in the guides or slide formed by bracket section 210 and cap plate 218, with the flat upper surface of the rack having reciprocating, bearing engagement with the under surface of the cap plate, and the rack gear teeth 163 being in mesh with the gear teeth 216 of quadrant gears 215, whereby reciprocation of the gear rack will effect rotation of the scoop bucket 201 about its axis. The bracket-supported scoop or scoop bucket 201 is mounted for rotation on crosshead 226, which, as noted, is fixedly secured to ram piston rod 128 and its cooperating side rods 140, 140'. The crosshead is diametrically a unitary casting having a front top section and a depending rear section, offset from the top section. The front section 221 is grooved, as shown at 222 to provide clearance for quadrant gears 215. A locking or cap plate 212: abuts the bracket elements 212, 213, 213', with its top surface flush with their upper surfaces. This plate is secured in place by the usual machine screws 214.

The loading head 220 is mounted generally for horizontal reciprocation by and with the actuators 128 and 160, and to prevent the empty or loaded scoop 'bucket' from imposing unsupported loads on its supporting members, when the bucket is extended, a swivel wheel 224 is mounted underneath the rear section 223 of crosshead 220, and in the central vertical axis about which the bucket rotates.

The support wheel mounting comprises an inverted bracket 225, having a top member 226 and depending legs 227 mounting axis 228 on which wheel 224 is secured. The member 226 is swiveled on the outer surface of the crosshead by axis 229. With this mounting, the weight of the bucket 201 is supported by the wheel 224 in all horizontally extended positions of the loading head.

Front or pull jacks

A special feature of the invention herein is the incorporation of self-propulsion means in the coal-loader, whereby the machine may be self-propelled to any desired location, and solely by means of its own power plant. To secure this desirable effect, hydraulically actuated front or pull jacks—also known as grab or walking jacks—are mounted in the crosshead 220 in the following manner:

A pair of piston chambers 230, 231 are formed in the central vertical axis of cross head 220, between the bucket axis 217 and the clamping plate 129 which locks the front end of ram piston rod 128 to the cross head. These chambers are severally offset at a rearward angle, as shown, and are interconnected by a duct or opening 232, which is in fluid communication with side rod 140', through duct 233, as will be described more in detail hereinafter.

The bottom jack comprises the lower piston chamber 230, mounting a piston 235 having a pointed tip 236, a rear flange 237, and a central recess 238 extending from the rear end of the piston to the tip section thereof. The piston is journaled in a suitable bushing, designated generally by the numeral 239. The top jack, comprises a telescoping piston 240, mounted for reciprocal movement in upper piston chamber 231. This device includes an outer sleeve piston 241 having a bottom flange 242 in bearing engagement with the wall of chamber 231, the upper end of which is closed by bushing 243 in which piston 241 is journaled. A second, hollow piston 244, has a central recess 245, a pointed tip 246, and a bottom flange 247 in bearing engagement with the inner wall of sleeve piston 241. Piston 244 is journaled in bushing 248 at the inside of the upper end of sleeve piston 241. The pistons are normally biased into retracted position (see Fig. 11) by tension spring 250, which is fitted in the piston recesses 238 and 245, extending through central opening 232. Spring 250 is secured to the opposed pistons by transverse pins 251, 252 in pistons 235, 240. The pin sockets are sealed from the piston centers by sunken machine-screws, designated generally by the numeral 253.

It will be noted that when hydraulic actuating fluid is forced through duct 233 into the inter-chamber space 232, the lower and upper pistons 235, 240 are driven outwardly against the bias of tension spring 250. Because of the supporting wheel 224, insuring the normal horizontal positioning of the ram assembly 100, lower grab jack piston 235 has a limited, fixed trajectory, to the floor of the working, while, owing to varying roof heights of different workings, the telescoping upper grab jack can be extended to any required height, and a uniform hydraulic pressure is applied to both jacks.

The specific functioning of the pull jacks as elements of the self-propulsion system of the coal loader will be discussed more fully in connection with the detailed description of the hydraulic actuating system and its interlocking solenoid valve controls. At this point, it is to be noted, the front jacks are self-anchoring, due to their rearward tilt severally imparted by the respective piston chambers.

Hydraulic actuating mechanism

An important feature of the invention herein is the improved actuating system, which insures positive, live hydraulic control of the bucket operating mechanism by
providing a continuously pressurized hydraulic actuating pump system therefor, so that the main hydraulic unit is not subjected to varying operative loads, but is concentrated on its main job of powering the ram piston.

It will be appreciated that the power requirements of the loading head reciprocating system are of an entirely different order from the power requirements of the oil lock for the top rod in its bucket-rotating, locked position, and the power required to actuate the hold jack and the front, grab, or walking jacks. The invention herein comprehends the utilization of a motor-driven, dual unit, hydraulic power system, of differential power capacity and pressure, whereby greater flexibility of control is secured, without uneconomical spread in the operative range of a single power plant. Additionally, by means of the improvements herein, the operative characteristics of the basic operating units of my coal loader are greatly improved.

Referring to the drawings, and particularly to Figs. 1 and 2, the details of the dual power plant will be considered.

The power plant for energizing the hydraulic actuating mechanism comprises a pump unit 260, driven by motor 271; an electrical control cabinet 279 mounting the push button controls, and a valve enclosure 280, mounting the solenoid valves 310, 315, and 320.

The pump unit comprises an enclosed casing 261, divided by an inner wall member 262 into a main pump chamber 263, and a corner reservoir 264, of generally triangular cross-section, and in fluid communication with the main pump chamber. A pair of outlet ports 265, 266, and a pair of inlet ports 267, 268, are formed in one wall of the casing, as shown. The pump 270, is powered by motor 271 through shaft 272, the motor being mounted outside the pump casing 261. Pump 270 is a dual unit having a high pressure and a low pressure end, with inlet connections 273, 274, respectively, and a pair of outlet ports 265, 266, and a pair of inlet ports 267, 268, are formed in one wall of the casing, as shown. The high pressure end of the pump discharges through line 275 and relief valve 277 to outlet 265. The low pressure end of the pump discharges through line 276 and relief valve 275 to outlet 266. The dual pump unit 270 and its inlet and outlet connections are submersed in and by the hydraulic fluid in the pump chamber 263.

The valves are mounted in a valve enclosure 280, and the electrical controls in a cabinet 279, appropriate connections being provided to the pump elements and the loader. The valves and their connections are as follows: Valve 280 is a double solenoid controlling the "in" and "out" motion of the ram piston 128. It is provided with inlet and outlet ports 282, 283, severally connected to high pressure pump outlet 265 and reservoir inlet 267, through lines 284, 285, respectively. A pressure relief valve 286 is mounted across lines 284, 285. Valve 281 is provided further with outlet ports 287, 288, severally connected through flexible lines 77c and 77d to the ram "out" and ram "in" connections 77 and 77 in the teeter block axis. When the control button for the "out" motion of the ram piston is pressed, the flow of hydraulic fluid is from port 282 to port 287, thence through line 77c, duct 77, and splines 104, to the back of the piston 126, applying pressure to the same. Simultaneously, port 288—which is on the free side of the piston—is connected through exhaust port 283 to the pump tank return 285, thus relieving back pressure on the piston. When the "in" button is depressed the procedure is reversed. The "in" and "out" solenoids are mechanically interconnected, so that both ports 282, 287, 288, cannot receive pressure simultaneously. With the pump running, and neither "in" nor "out" motion is desired, the valve springs back to neutral, diverting the flow of hydraulic fluid from inlet port 282 to return port 283, and trapping the fluid on both sides of the ram piston, so that the ram piston rod—and attached loader head—can neither move in nor out, and the loader head is locked in place.

The tilt lock control valve 290 has an inlet port 291, connected through check valve 292 to high pressure fluid line 284. The valve is provided further with an outlet port 293 in fluid communication with tilt lock port 294, and a return port 294, connected through line 295 to the pump return line 285. This valve is a 3-way single solenoid spring offset valve, and controls the tilt lock 80 which holds the bucket assembly in a tilted position after the bucket has been loaded, retracted, and is ready for the outward stroke to dump. The supply of hydraulic fluid is from high pressure feed line 284 to inlet port 291, and, when the valve is in the "in" position, the oil returns to outlet port 293. With dual pump 270 operating, there is a supply of oil available to flood the tilt lock as the bucket assembly tilts upwardly, when retracted. The check valve 292 traps the oil that is drawn into the tilt lock 80. When the bucket is to be dropped to a horizontal position, the tilt unlock button is actuated, energizing the solenoid that moves the valve, so that the trapped oil returns to the pump tank through ports 293, 294, and return lines 295, 295.

The low pressure side of pump 270 supplies hydraulic fluid for the actuation of the center jack, front jacks, top rod fluid lock, and the two-way turn motor. Valve unit 280 controls the hold jack and pull jacks. This valve is a 4-way double solenoid spring centered valve having the operative, solenoids mechanically interlocked, so that pressure cannot be simultaneously applied to both sides. Low pressure feed line 300 connects pump outlet 260 to valve inlet port 311 through reducing valve 301. Outlet port 312 is connected to the front jacks through line 143a with oil retainer 143; outlet port 313 is connected through line 20a with the center or holding jack 20; and discharge port 314 is connected to sump 264 through return line 306 and port 268.

When the center or hold jack 20 is to be actuated, the center jack control button is pressed, and hydraulic fluid flows from port 311 to port 313, and thence to the jack. Simultaneously, port 312 is interconnected with exhaust port 314 and return line 306, discharging the hydraulic fluid from the front jacks which is forced through oil retainer 143 by the bias of tension spring 250 acting on the jack pistons. When the center jack is to be collapsed the solenoid is deenergized, and ports 311, 312 are connected with discharge port 314, and thence to the tank 264.

When the front or pull jacks are to be actuated, the front jack control button is pressed, energizing the solenoid, whereby ports 311 and 312 are interconnected. Hydraulic fluid is driven through side rod 140 into the front jack cylinders, and the jacks are extended and anchor themselves in the floor and roof of the working. With the front jacks extended and anchored, and the hold jack automatically retracted, the loader head is in its extended position. Ram control valve 281 is then actuated to the ram "in" position, whereby hydraulic fluid is forced between the front face of the ram piston and the associated teeter block chamber, forcing the teeter block—and the turntable and skid base—forwardly to approximate the loader head in its anchored position. As the loading machine moves forward under its own power the retriever rods are telescoped in the side rods, building up a back pressure in the latter. This pressure is relieved by pressure relief valve 278 in pump line 276. With the machine in its new, advanced position, the hold jack is actuated, thereby automatically releasing the front jacks from their grab or hold position, and freeing the loader assembly for normal reciprocation in loading and unloading.

Valve 315 is a 3-way double spring centered solenoid valve which controls the flow of hydraulic fluid to the fluid lock in the rear of the top rod 160. After the bucket has been oscillated and loaded, this lock maintains it in its "up" position. The valve includes inlet
When the coal loader is to be operated, it is brought into position at the face of the chosen working, which has been previously provided with an endless belt conveyor or other suitable means for conveying the coal to the main arteries of the workings. The coal loader, being set in its original, desired, operating location, the power lines, either electric or hydraulic, are coupled to the power supply, and the operator takes over at the controls. As explained hereinabove, the operator and the controls may be on the coal loader itself, or stationed at a distance from the machine, and connected thereto by suitable control leads.

The hold-jack control is first energized, opening up, the valve controlling the admission of pressure fluid to the hold-jack piston cylinder, whereby the jack is moved into roof-engaging contact with the roof of the working, and the jack cylinder, with its supporting turntable and skid base, is forced downward, whereby the bucket is finally seated on the floor of the working, with the machine pivoted about the hold-jack as an axis of rotation. A check valve in the pressure fluid feed line locks the hold-jack in place. When the hold-jack is energized, the pressure fluid feed line to the grab or traveling jacks, mounted in the loader head support, is coupled to the return line to the pump sump, and the grab-jack pistons are retracted by their retractable biasing spring, with a concomitant forcing of any pressure fluid in the grab-jack cylinders back into the return line.

Usually, the coal loading head is carried at its fully retracted position, when the machine is not actually engaged in coal loading. In this position, the side rods and ram supporting the loading head are retracted, and the bucket or scoop is supported out and by a swivel wheel having bearing engagement with the floor of the working. The serrated lip of the bucket is carried atop the floor of the working. The ram "out" control is now actuated, and pressure fluid, from the high pressure side of the power unit, is introduced behind the ram piston, forcing the ram and attached loading head forward until the lip of the bucket engages the bottom of the coal pile at the face of the working. In this forward travel, the side rods are carried forward, as is the top rod. The top rod is provided with suitable detents which are engaged by a solenoid-controlled stop member when the lip of the shovel has contacted the bottom of the face of the coal pile which is to be loaded. As the ram continues its forward travel, the lip of the bucket is forced into the coal pile, and scoops up a bucket load of coal. The scooping-up action of the bucket is effected by the engagement of the quadrant gears of the loading head with the now stationary racks carried at the front of the top rod, whereby the forward travel of the loading head carries the quadrant gears forwardly, and, being restrained by the stationary racks, they are forced, causing the arcuate or scooping movement of the bucket about its axis. The scooping movement of the bucket is accentuated by the continuing forward travel of the loader head, so that a fifty (50) percent increase in loading capacity is effected.

When the top rod is being carried forward by the loader head and the traveling support, pressure fluid is aspirated into the top rod locking cylinder through its fixed piston rod, which is fixedly secured to and carried by the traveling support. The pressure fluid line supplying the top rod locking cylinder is provided with a check valve, whereby fluid in the cylinder is immobilized, effectively locking the top rod against forward motion, after it has been initially stopped by the detents. With the scoop in its turned-up, fully loaded position, and locked against rotation about its own axis by the interengagement of the quadrant gears with the racks on the forward end of the now locked top rod, the ram "in" control is actuated. Pressure fluid is forced into the ram cylinder forcing the ram back with the loader head and its contained load.
The retraction of the ram forces pressure fluid from its "out" side back into the pump sump, and the excess weight of the teeter-block-mounted ram cylinder housing, or boot, the trailing support, and the top rod, will overbalance the loaded scoop, raising it off of the ground. The raised, loaded scoop is rotated to a suitable discharge or unloading position by actuating the turn motor in the desired direction. When the unloading point is reached, the top rod locking cylinder feed line is coupled to the sump return line, whereby the unbalanced load of coal in the loading bucket causes the bucket to rotate about its axis, and discharge the coal. The rotation of the bucket to its coal-discharging position is accompanied by the advance of the top rod in response to the pull of its forward end by the rotating quadrant gears of the loader head. The advance or forward movement of the top rod is accompanied by the forcing out of pressure fluid from the locking cylinder back into the pump sump. The turn motor is now actuated to return the loading head to its coal loading position, the ram:"out" control is actuated, and the loading cycle is repeated as often as desired.

When a given working is exhausted, the machine is moved to a new loading position in the following manner:

The loading head is advanced to its forward, loading position, and the grab-jack control actuated. Pressure fluid is forced into the grab-jack cylinder, forcing the upper and lower pistons, against the bias of the retracting spring, into gripping engagement with the roof and floor of the working, respectively. When the grab jack is actuated, the hold jack is simultaneously connected to the sump line, the hold-jack piston sinks under its own weight, because of the release of pressure, and the pressure fluid in the hold jack is forced out into the sump line.

With the grab jacks anchored in place, the ram "in" control is actuated. The ram being anchored in its forward, extended position, by the grab jacks, the pressure fluid will exert pressure on the stuffing box in which the ram is journaled, and the teeter block will be forced forward, carrying the turntable and its skid support with it. Upon completion of the forward travel of the skid support to its new location, the hold-jack control is actuated, automatically anchoring the hold jack and skid in place, and simultaneously releasing the grab jacks from theirram-anchoring position.

The coal loading and unloading operations are then continued in the manner described above.

Turning now to Figs. 14, 15, there is shown a modified hold-jack assembly which is particularly adapted for use with low pressure hydraulic actuating fluid. The assembly, designated generally by the numeral 350, comprises a pair of hydraulic jacks 354, 355, fixedly mounted, in opposed relation, on annular castings 37 which, as previously noted, serves as the hub for turn-table 30. The central post 10 is specially fitted with a hollow piston 21a which reciprocates in the chamber 17 formed in member 18. The top of the piston 21a secured in a yoke 353 and moves therewith. Member 353 is provided with sockets 354, at opposite ends thereof, and with a circular, shouldered aperture 356 adapted to receive a conforming plug member 357 having socketed bearing engagement with the bearing plate 29. A tension spring 358 is secured between the member 357 and a shackle 359 made fast to the bottom of piston chamber 17.

The hydraulic jacks 351, 352 are of identical construction, and comprise base elements 360 fixedly secured to or integral with hub 37 of the turntable. The members 360 are circular and are channelled as indicated at 361 to receive the cylindrical casings 362 of the jacks. Caps bases 363 are mounted on the casings 362 and receive pistons 364. These pistons are provided with stub shafts 365 on the top thereof, which shafts are received in the sockets 354, 355 of the yoke member 353. Entrants 366, connected to a manifold, not shown, are provided at the bottom of casings 362 to permit hydraulic fluid, supplied thereto from supply line 20a, to be forced into the piston chambers against the bias of spring 358.

The improved hold jack construction is characterized by positive function with the expenditure of minimum energy in pressure fluid. When pressure fluid is supplied to line 20a, the pistons 364 are forced upwardly in the jack cylinders or casings, and carry the yoke or plate 353 therewith, against the bias of tension spring 358 mounted in the central piston channel 17. With the bearing plate or head 29 of the jack in clamping bearing engagement with the roof of a working, the coal loader is secured about member 29 and is fixed pivot. When the grab-jack assembly is actuated, the entrant 20a is automatically connected to the sump of the hydraulic power unit, and the tension spring 358 acts on plate 353, through member 357, to retract the plate and the attached pistons 364, whereby the hydraulic fluid in the piston cylinders is forced out through inlets 366 to the supply header and thence through line 20a to the sump.

It will now be appreciated that there has been provided a novel coal loading machine of simple design, and greatly increased loading capacity, which can be jacked into any selected working position, under its own power, and which is actuated by hydraulic pressure fluid delivered to the operating mechanisms through interlocking controls, the fluid being pressurized in a unitary pump assembly. It will also be appreciated that the novel coal loader herein is of compact, yet rugged construction, and, while designed primarily for operation by hydraulic pressure fluid, can be operated by suitable electrical or mechanical actuating equipment.

While I have shown and described the preferred embodiment of my invention, I wish to be understood that I do not confine myself to the precise details of construction herein set forth by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention or exceeding the scope of the appended claims.

What is claimed is:

1. In a coal loading machine of the character described, telescoping manifolds comprising reciprocable tubular side rods fixedly secured at both ends in a swivel wheel-supported loader head and a back support, said loader head, back support and side rods forming a structural entity; a combination tilting and rotating support mechanism comprising a teeter block including means for receiving the said side rods in sliding bearing engagement; a pair of tubular pistons telescopically fitted in said rods and in fluid communication therewith, hermetic bushings in the rear support member forming pressure tight fluid seals for said pistons, a back bar fixedly mounting the rear ends of said pistons; hydraulic fluid supply means to the rear ends of said pistons, and means to control the fluid pressure therein, whereby the said rods and the pistons of the telescopic manifolds are kept filled with hydraulic fluid.

2. In a coal loading machine of the character described, telescoping manifolds comprising reciprocable tubular side rods fixedly secured at both ends in front and rear support members, said support members and side rods forming a structural entity; a combination tilting and rotating support mechanism including means for receiving the said side rods in sliding bearing engagement; a pair of tubular pistons telescopically fitted in said side rods and in fluid communication therewith, hermetic bushings in the rear support member forming pressure tight fluid seals for said pistons; a back bar fixedly mounting the rear ends of said pistons, whereby the side rods are reciprocable thereon and theretofore; and valved hydraulic fluid supply means connected to the said rear ends of said pistons.

3. In a coal loading machine of the character described, telescoping manifolds comprising reciprocable tubular side rods fixedly secured at both ends in front and rear...
support members, said support members and side rods forming a structural entity; a fixedly mounted combination tilting and rotating support mechanism including means for receiving the said side rods in sliding bearing engagement; the front support comprising a loader crosshead mounting a grab-jack assembly and the rear support member comprising a traveling top rod support; a pair of tubular pistons telescopically fitted in said side rods and in fluid communication therewith; hermetic bushings in the rear support member forming pressure tight fluid seals for said pistons; valved hydraulic fluid conduit means connecting the rear ends of said side rods whereby fluid connection is established in and between the said side rods, the top rod and the grab-jack assembly; a back bar fixedly mounting the rear ends of said pistons, and spacedly secured to the combination tilting and support mechanism and hydraulic fluid supply means connected to the said rear ends of said pistons.

4. In a coal loading machine of the character described, telescoping manifolds comprising a pair of tubular side rods fixedly secured at both ends in a swivel wheel-supported loader head and a back support, said loader head, back support and side rods forming a structural entity; a combination tilting and rotating support mechanism comprising a teeter block including means for receiving the said side rods in sliding bearing engagement; a pair of tubular pistons telescopically fitted in said side rods and in fluid communication therewith, hermetic bushings in the rear support member forming pressure tight fluid seals for said pistons, a back bar fixedly mounting the rear ends of said pistons; hydraulic fluid supply means to the rear ends of said pistons; a ram piston housing fixedly secured in and between said teeter block and said back bar; a ram piston reciprocably mounted in said housing and fixedly secured to and supported by the loader head; a percussive top rod journaled in said teeter block and normally movable with the loader head; and hydraulic check means for arresting forward movement of the top rod, whereby on continuing forward movement of the loader head, a percussive impact is imparted thereto by the top rod.

5. In a coal loading machine of the character described, telescoping manifolds comprising a pair of tubular side rods fixedly secured at both ends in a swivel wheel-supported loader head and a back support; a combination tilting and rotating support mechanism comprising a teeter block including means for receiving the said side rods in sliding bearing engagement; a grab jack header in the loader head in fluid communication with one of the side rods; a pair of tubular fluidic members telescopically fitted in said tubular side rods in fluid communication therewith; hermetic bushings in the back support forming pressure tight fluid seals for said side rods, said loader head, back support and side rods forming a structural entity; a back bar fixedly mounting the rear ends of said fluidic members; a ram cylinder fixedly mounted in and between said teeter block and said back bar; a ram piston rod in said ram cylinder and having sliding bearing engagement in said teeter block, said power piston rod fixed to said loader head and reciprocably mounted therewith; a first hydraulic supply means operatively connected to said power cylinder, whereby to reciprocate the ram piston rod, and a second hydraulic supply means connected to the rear ends of said fluidic members and partially establishing fluid communication therewith.

6. In a coal loading machine of the character described, a crosshead, means for supporting the crosshead, a ram piston rod for projecting the crosshead and retracting the same; a quadrant gear; a shaft integral with the gear and journaled in the crosshead; a loading scoop pivoting on the axis and having a rearreart portion defining a semi-cylinders whose axes coincide with the axis, said semi-cylinders lying on either side of the rearreart portion; a rack cooperating with the gear; a percussive top rod connected to the rack; said rod being normally movable with the crosshead, and hydraulic control means for selectively limiting the travel of the top rod, whereby on continued movement of the crosshead, a percussive impact is imparted thereto by the top rod.

7. In a loader, a crosshead, swivel wheel means for supporting the crosshead, a ram piston rod for projecting the crosshead forward and retracting the same; a quadrant gear; a shaft integral with the gear and journaled in the crosshead; a loading bucket pivoting on the shaft and having a rearreart portion defining semi-cylinders whose axes coincide with the axis, said semi-cylinders lying on either side of the rearreart portion; a forked rack in mesh with the gear; a percussive top rod connected to the rack, said rod being normally movable with the crosshead, and hydraulic check means for securing the top rod against forward movement with respect to the ram piston rod, whereby on continued movement of the crosshead, a percussive impact is imparted thereto by the top rod.

8. A loader shovel having a generally cylindrical rear portion, a forwardly extending scoop portion terminating in a lip and conforming end walls, said lip extending substantially one cylinder diameter radially out from the axis of the cylinder, a shaft pivotally supporting the loader shovel in the central axis of the cylinder, a segment gear on said shaft, a re-entrant rear portion fixedly mounting said shaft, a cross-head supporting means in said re-entrant portion and rotatably mounting said shaft and gear, a rack operatively engaging with said gear, a percussive top rod secured to said rack, means for moving the bucket forwardly and rotating about its axis during such forward movement, the said shovel being axially movable in a forward direction with the lip initially percussively engaging and then continuously engaging the material to be loaded during the course of the forward movement while the shovel is rotated on its axis, whereby to bring the lip horizontally forward a determined distance and thence from a depending position, substantially through 180° to its top loaded position, the contour of the loader being such that the material picked up is continuously disposed in the vertical axis of the loader.

9. A shovel particularly adapted for use with coal loading machines, comprising a bucket having a semi-cylindrical body section with a forwardly extending scoop section terminating in a lip, and conforming end plates, a shaft coincident with the axis of the semi-cylindrical body, a rearreart portion fixedly mounting said shaft, a segment gear on the said shaft, a swivel wheel-supported crosshead supporting means in said rearreart portion and rotatably mounting said shaft and gear, a rack operatively engaging with said gear, a rack restraining plate secured to said crosshead, said crosshead and rack being movable to effect initial percussive engagement and conjoint forward movement of the rack and the shaft, the movement of the bucket from unloaded to loaded position.

10. A self-propelling coal loader, including a loading head mounting a rotatable bucket; a rearreart portion in the bucket; a shaft secured transversely of said rearreart portion and mounting spaced quadrant gear segments, a swivel wheel-supported crosshead supporting means in the rearreart portion and rotatably mounting said shaft and gear, a rack operatively engaged with said gear, a rack restraining plate secured to said crosshead, crosshead and rack being movable to effect initial and self-propelling engagement, and rearreart movement of the rack and the shaft, the movement of the bucket from unloaded to loaded position.

11. A coal loading machine of the character described, comprising a base; a turntable mounted on said base; a holding jack mounted in the axis of the turntable; a tiltable coal gathering assembly mounted on the turntable at one side of the axis and including a gathering head
comprising a bucket; means for supporting the bucket and means for rotating the bucket, said bucket supporting means comprising a swivel-wheel-supported crosshead; a ram piston rod and telescopic manifolds including tubular side rods secured to the crosshead; a tiltable fulcrum guide mounting the said ram piston rod and side rods in sliding bearing engagement; a ram cylinder and a housing therefor fixedly secured to the fulcrum guide and housing the said ram piston; fluid receivers telescoped in said side rods and secured at one end to a back bar; means for fixedly securing the ram cylinder and its housing to the back bar; a back support reciprocably mounted on the ram cylinder housing, the rear ends of said side rods being secured to said back support and receiving the fluid receivers in sliding bearing engagement, the side rods, crosshead, ram piston rod, and back support forming a reciprocating unit; a fixed hollow piston secured to said back support, a top rod cylinder disposed about the said fixed piston and reciprocably mounted in the guide fulcrum; a quadrant gear-actuating rack secured in the forward end of said top rod cylinder, and engageable with said bucket rotating means; a separate hydraulic actuator for the ram cylinder and a separate hydraulic locking means for the reciprocable top rod cylinder; and percussion means comprising spring biased inertia members in the top rod.

12. In a mining loader, a ram piston rod and dual tubular side rods; a crosshead carried by the said piston rod and side rods; a quadrant gear rotatably supported in the crosshead, a scoop shovel rigid with the gear; a cylindrical top rod movable with the ram piston rod and side rods, said top rod incorporating spring-balanced percussion hammer means comprising inertia members; a guide for the top rod comprising a back support fixedly mounting the side rods and movable therewith; a rack at the forward end of the top rod in mesh with the quadrant gear; hydraulic fluid control means for limiting movement of the top rod; and a tilt lock for holding the shovel in tilted position and operable by retractive movement of the crosshead to its rearmost position.

13. A self-propelling coal loader, including a swivel wheel-supported loading head mounting a rotatable bucket; a reentrant rear portion in the bucket; a shaft secured transversely of said reentrant portion and mounting spaced quadrant gear segments, a crosshead mounting the shaft; a ram piston rod and lateral side rods secured to the crosshead; a forked rack adapted for engagement with the gear segments; a percussive top rod secured to said rack; means for moving the bucket forwardly and rotating it about its axis during said forward movement, whereby to engage with and load coal; self-propelling means for the coal loader comprising self-anchoring, hydraulically operated, opposed grab jacks mounted on the loading head; a duplex holding jack mounted rearwardly of the loading head; and interlocking hydraulic control means for selectively actuating the jacks.

14. A self-propelling coal loader, including a loading head mounting a rotatable bucket; a reentrant rear portion in the bucket; a shaft secured transversely of said reentrant portion and mounting spaced quadrant gear segments, a swivel wheel-mounted crosshead mounting the shaft; a ram piston rod and lateral side rods of telescopic manifolds secured to the crosshead; a forked rack adapted for engagement with the gear segments; a percussive top rod secured to said rack; means for moving the bucket forwardly and rotating it about its axis during said forward movement, whereby to engage with and load coal; self-propelling means for the coal loader comprising self-anchoring, hydraulically operated, opposed grab jacks mounted on the loading head; a duplex holding jack mounted rearwardly of the loading head; a swivel wheel-mounted crosshead mounting the shaft; a ram piston rod and lateral side rods of telescopic manifolds secured to the crosshead; a forked rack adapted for engagement with the gear segments; a percussive top rod secured to said rack; means for moving the bucket forwardly and rotating it about its axis during said forward movement, whereby to engage with and load coal; self-propelling means for the coal loader comprising self-anchoring, hydraulically operated, opposed grab jacks mounted on the loading head; a duplex holding jack mounted rearwardly of the loading head; and interlocking hydraulic control means for selectively actuating the jacks.

15. Coal loader according to claim 14, characterized by a tension spring in the hold jack, secured to and between the bearing member and the hold jack support, and normally biasing the bearing member in retracted position.

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