June 5, 1945. J. A. HOFMEISTER 2,377,495

MUCKING AND LOADING MACHINE

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Fig. 1

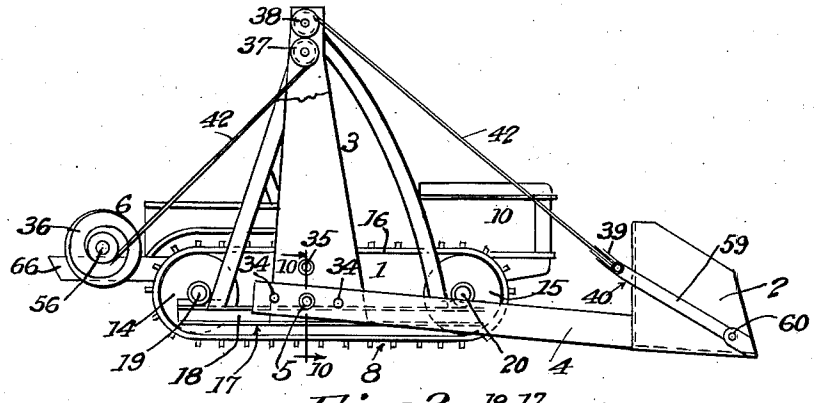


Fig. 2

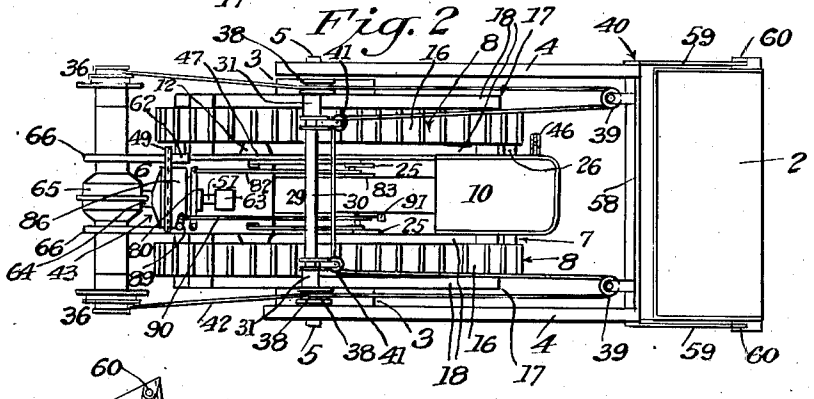


Fig. 3

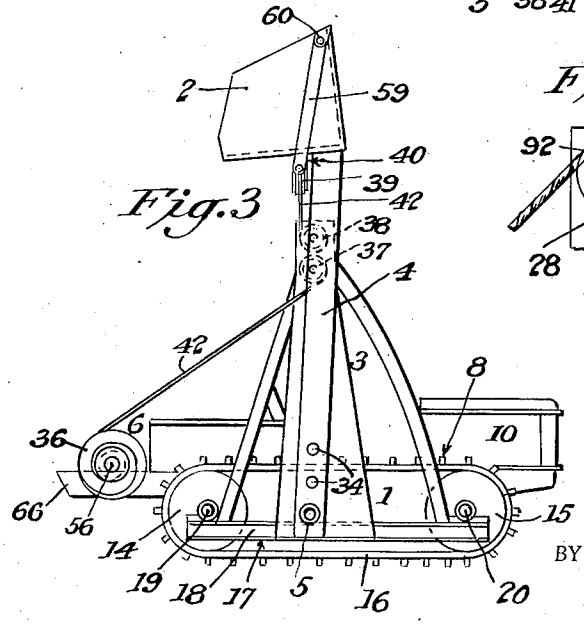


Fig. 13

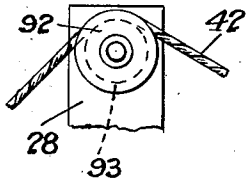
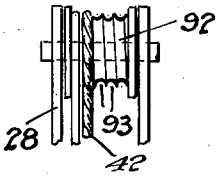


Fig. 14



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MUCKING AND LOADING MACHINE

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Fig. 4

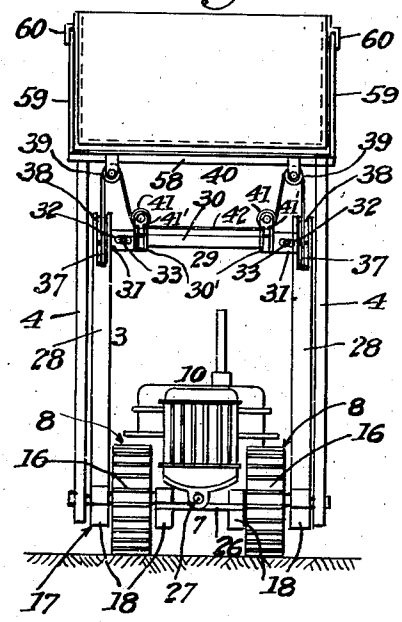


Fig. 5

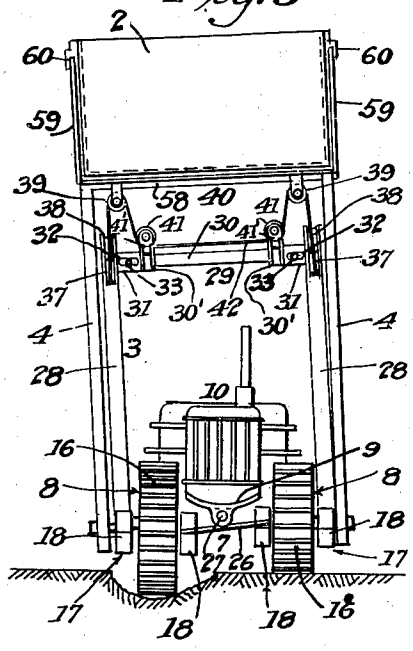
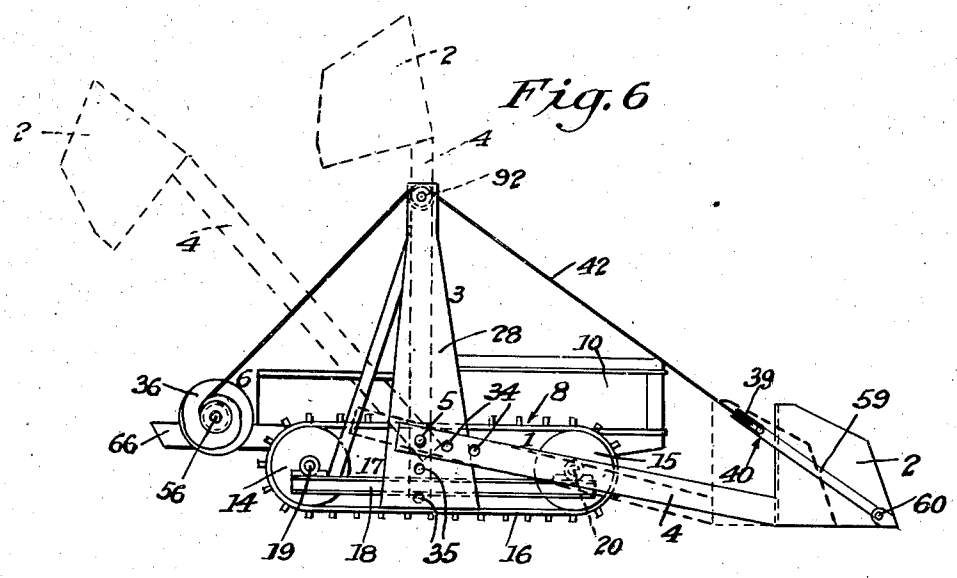


Fig. 6



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MUCKING AND LOADING MACHINE

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Fig. 7

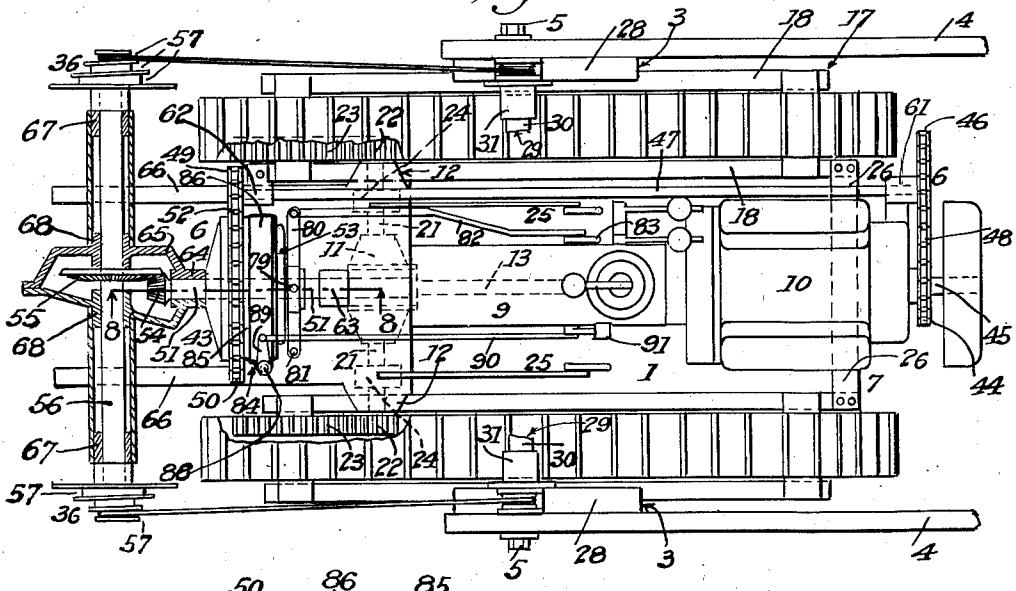


Fig. 8

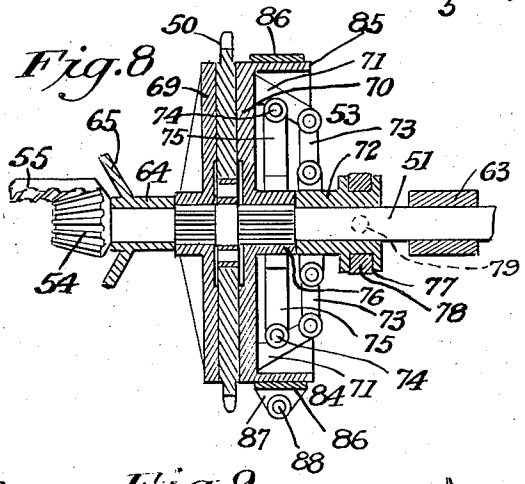


Fig. 10

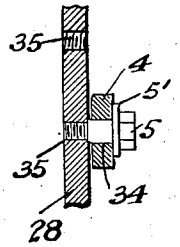


Fig. 11

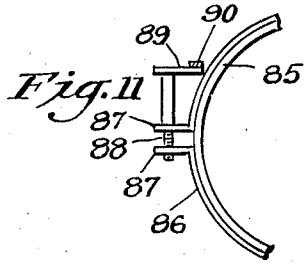


Fig. 9

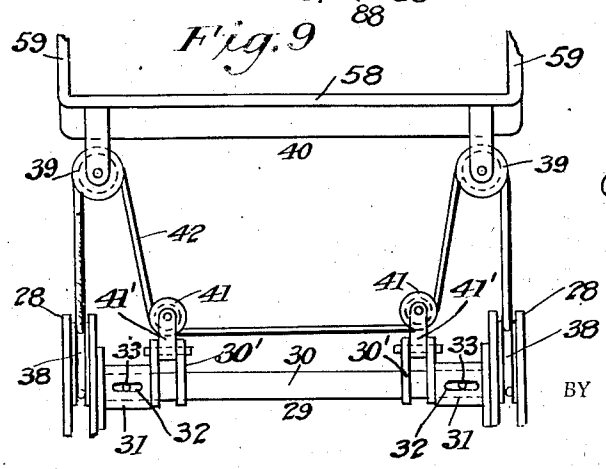
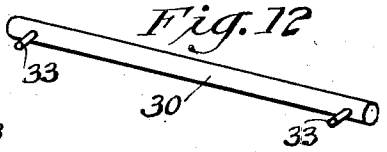


Fig. 12



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Patented June 5, 1945

2,377,495

UNITED STATES PATENT OFFICE

2,377,495

MUCKING AND LOADING MACHINE

Joseph A. Hofmeister, Los Angeles, Calif.

Application August 23, 1943, Serial No. 499,618

8 Claims. (Cl. 214—131)

This invention relates to excavating machines, and more particularly to a mucking and loading machine.

The general object of the invention is to provide a mucking and loading machine with means whereby the swinging movement of its shovel may be adjusted for loading trucks of different heights.

Another object is to provide an improved mucking and loading machine adjusted to travel smoothly over rough and irregular ground.

Other objects and advantages will appear hereinafter.

The invention is illustrated in the annexed drawings in which

Fig. 1 is a side elevation of my mucking and loading machine, with its shovel shown in its lowermost forward position.

Fig. 2 is a plan view of Fig. 1.

Fig. 3 is a side elevation of my mucking and loading machine with its shovel swung up into its uppermost position, and in the act of swinging rearwardly over its dead center into its dumping position.

Fig. 4 is a front elevation of my mucking and loading machine shown traveling over smooth level ground.

Fig. 5 is a front elevation of my mucking and loading machine shown traveling over rough and irregular ground.

Fig. 6 is a side elevation of a modification of my mucking and loading machine with its shovel shown in full lines down in its forward and shoveling position, and shown in dotted lines swung upwardly and rearwardly into its dumping position.

Fig. 7 is a plan view, partly in horizontal section on an enlarged scale of my mucking and loading machine.

Fig. 8 is a vertical longitudinal section taken on line 8—8 of Fig. 7 showing the clutch for controlling the shovel operating mechanism.

Fig. 9 is a fragmentary rear elevation of a portion of the shovel operating mechanism.

Fig. 10 is a fragmentary vertical section taken on line 10—10 of Fig. 1 showing the pivot adjusting means for the shovel arms.

Fig. 11 is a fragmentary edge view of the brake for the clutch for controlling the shovel operating mechanism.

Fig. 12 is a perspective of the strut of transverse brace for the shovel supporting frame.

Fig. 13 is a side view of a modification of one of the sheaves mounted on the shovel supporting frame over which sheaves extends the shovel operating cable.

Fig. 14 is an edge view of the sheave shown in Fig. 13.

Referring more particularly to the annexed drawings, in which corresponding parts are designated by the same reference numerals in all of the figures, my invention includes generally a caterpillar tractor 1, a mucking shovel 2, a shovel supporting frame 3 mounted on said tractor and upstanding therefrom, a pair of shovel-carrying arms 4 adjustably pivoted to opposite sides of said supporting frame 3 by pivots 5, shovel-operating mechanism 6, and automatic adjusting means 7 for the forward ends of the caterpillar treads 8 of said tractor 1, whereby the forward ends of said treads may move up or down independently of each other to adapt themselves to irregular surfaces of the ground, so that my mucking and loading machine may travel smoothly over rough ground.

The caterpillar tractor 1 includes a main frame 9, the endless caterpillar treads mounted on oppoiste sides, respectively, of said main frame, an engine 10 mounted on the forward end of said main frame, and a differential 11 and a transmission 12 mounted on the rear part of said main frame whereby said caterpillar treads 8 are driven by said engine 10 through the main shaft 13 and said differential and said transmission. Each tread 8 comprises a rear end sprocket 14, a front end sprocket 15 and an endless traction chain 16 extending over said sprockets, and each tread is mounted at its ends in a tread frame 17 including a pair of side beams 18 extending longitudinally at opposite sides, respectively, of the tread, which beams are connected together at their rear ends by a rear end sprocket axle 19 and at their forward ends by a front end sprocket axle 20. The rear end of the main frame 9 is rigidly mounted on said rear sprocket axle 19. The rear sprockets 14 of the caterpillar treads 8 are journaled on the ends, respectively, of said rear sprocket axle 19. The front end sprockets 15 of said caterpillar treads are journaled on said front end sprocket axles 20, respectively. On the outer ends of the transmission shafts 21 extending from the differential 11, are secured pinions 22, respectively, in mesh with sprocket gears 23 secured on the inner sides of the rear end sprockets 14, respectively, of the treads 8 whereby said sprockets and said treads are driven from the transmission 12. Brakes 24 are mounted in said transmission to be applied to the differential shafts 21, respectively, by operating means 25, for causing the treads 8 to be driven at different speeds for steering the tractor 1. The automatic

adjusting means 7 for the tractor treads 8 comprises a cross bar 26, which rests at its ends upon the forward ends of the inner side beams 18 of the tractor tread frames 17, and the forward end of the main frame 9 is pivotally mounted on said cross bar 26, intermediate the ends of said bar, by a hinge 27, so that said cross bar may swing in a vertical plane in either direction on said hinge to permit relative vertical movement of the forward ends of the tractor treads 8 for enabling the tractor 1 to travel over rough ground, while the forward end of the main frame 9 of the tractor remains level or parallel to the rear axle 19 of the tractor.

The shovel-supporting frame 3 comprises a pair of upright side members 28 and an adjustable connecting equalizing brace 29 connecting the upper ends of said upright members, which members are secured at their lower ends to the outer side beams 18 of the tractor tread frames 17, respectively. The brace 29 comprises a strut 30 and two sockets 31, secured to the inner sides of the frame upright members 28, respectively, at the upper ends of said members, into which sockets the ends, respectively, of said strut are slidably fitted. The sockets 31 are provided with longitudinal slots 32 through which pins 33, respectively, extend radially from the end portions of the strut 30, so that said end portions of said strut may slide inwardly or outwardly in said sockets 31 to permit relative movement of the frame upright members 28, which movement is caused by the relative swinging movement of the tractor treads 8 on the rear axle 19 of the tractor 1 and said treads. The outward move- of the ends of the strut 30 in the sockets 31 is limited by the engagement of the pins 33 with the inner ends of the slots 32.

The shovel 2 is secured on the forward ends of the shovel arms 4, and the rear end portions of said arms extend over the outer sides of the frame upright side members 28, respectively, and are provided with a plurality of longitudinally-spaced pivot openings 34, while the frame upright side members 28 are provided in their lower portions with a plurality of threaded vertically-spaced pivot openings 35, so that the pivots 5 of said shovel arms may be extended through any one of the openings 34 in said arms and any one of the openings 35 in said upright frame members 28, for adjustably pivoting said shovel arms to said upright frame members, whereby the length and elevation of the swinging movement of the shovel 2 may be adjusted for loading trucks of different heights. The pivots 5 are bolts, and each thereof is threaded in an opening 35, in one of the frame upright members 28, and is turnably fitted in an opening 34 in one of the shovel arms 4, so that said arms may swing on said bolts, while a washer 5' is fitted on each of said bolts between the head of the bolt and the outer side of the shovel arm 4 through an opening 34 in which the bolt extends, whereby the shovel arms are held on said bolts in their operative swinging position.

The shovel operating means 6 includes a pair a spiral drums 36, two pairs of sheaves 37 and 38 journaled in the upper ends, respectively, of the upright frame members 28, a pair of sheaves 39 journaled on a bail 40 connected to the shovel 2, a pair of sheaves 41 journaled in arms 41' pivotally mounted in brackets 30' secured on the strut 30 of brace 29, a cable 42 secured at its ends to said drums 36, respectively, and extending over said sheaves, and driving means 43 whereby said drums 36 are rotated by the tractor engine 10 for winding said cables on said drums or unwinding said cables from said drums for swinging the shovel 2 on its pivots 5 in one direction or the other. Said driving means 43 includes a sprocket 44 secured on the shaft 45 of the tractor engine 10, a sprocket 46 secured on the forward end of a transmission shaft 47, over which sprockets extends a chain 48, a sprocket 49 secured on the rear end of said shaft 47, a sprocket 50 turnably mounted on a drive shaft 51, over which sprockets extends a chain 52, a clutch 53 for clutching said sprocket 50 to said drive shaft 51, or releasing said sprocket 50 from said drive shaft, a beveled pinion 54 secured on the rear end of said drive shaft, and a beveled gear 55 secured on a drum shaft 56 in mesh with said beveled pinion, the drums 36 being secured on the ends, respectively of said drum shaft. The drums 36 are formed, respectively, with spiral grooves 57 which increase progressively in diameter in which grooves the end portions, respectively, of the cable 42 are extended and wound around said drums, and the ends of said cable are secured to said drums at the innermost ends and smallest diameters of the spiral grooves 57 in said drums, respectively. The sheaves 37 and 38 are journaled in the upper ends of the upright frame members 28 with the sheaves 38 immediately above the sheaves 37, and the cable 42 is extended upwardly and forwardly from the drums 36 under the sheaves 37 and upwardly over the forward edges of said sheaves, and rearwardly and upwardly over the rear edges of the sheaves 38 and forwardly over the upper edges of said sheaves 38, from which last mentioned sheaves the cable 42 extends forwardly and downwardly over the sheaves 39 mounted on the shovel bail 40, and then rearwardly and upwardly over the sheaves 41 and transversely of the tractor 1 between said last-mentioned sheaves. The bail 40 is U-shape and comprises a transverse connecting member 58, and a pair of parallel arms 59 extending from the ends, respectively, of said connecting member at right angles thereto, and the ends of said arms are pivotally connected at 60 to the side walls of the shovel 2 near the lower forward corners of said shovel, with said connecting member 58 extending transversely of said shovel at the rear thereof. The sheaves 39 are mounted on the connecting member 58 of the bail 40, near the ends respectively, of said connecting members.

The transmission shaft 47 of the drum driving mechanism 43 is journaled at its forward end in a bearing 61 mounted on the tractor engine 10, while the rear end of said shaft is journaled in a bearing 62 mounted on the rear end of the main frame 9. The drive shaft 51 is journaled at its forward end in a bearing 63, mounted on the rear part of the main frame 9, and at its rear end in a bearing 64 formed in a housing 65 enclosing the bevel pinion 54, the bevel gear 55 and the drum shaft 56, which housing is mounted in brackets 66 secured on the rear end of the main frame 9 and extending rearwardly from said end of said frame. The drum shaft 56 is journaled near its ends in end bearings 67, in opposite ends of the housing 65, and between its ends in bearings 68 in said housing intermediate the ends thereof. The clutch 53 comprises a pair of clutch discs 69 and 70, a plurality of cams 71 for engaging said disc 70, an actuating sleeve 72 and a plurality of links 73 connecting said cams 71, respectively, and said actuating sleeve 72. The clutch disc 69 is keyed fast on the drive

shaft 51 at the rear side of the sprocket 50, while the clutch disc 70 is splined on said drive shaft at the forward side of said gear to be moved toward or away from said gear. The cams 71 are fulcrumed at 74 to the outer ends of a plurality of arms 75, respectively, secured on the hub 76 of the clutch disc 70 and outstanding from said hub. The actuating sleeve 72 is formed with an angular groove 77, in which is loosely fitted a collar 78 to which collar is pivotally connected at 79 an actuating arm 80 which is pivoted at one end at 81 to the main frame 9. To the other end of said actuating arm 80 is connected the rear end of a rod 82, which is connected at its forward end to a hand-operated lever 83 pivoted to the main frame 9 of the tractor 1 in position to be grasped by the driver of said tractor for swinging the same.

A brake 84 is mounted on the clutch 53, for braking the cable drums 36, whereby the shovel 2 may be held by the cable 42 against swinging movement on the fulcrum 5 in any position to which said shovel may be swung by said cable. Said brake 84 comprises a brake drum 85, formed on the clutch disc 70, and a split brake band 86 surrounding said drum, on the ends of which band are secured a pair of lugs 87, respectively, in which lugs is threaded a clamp screw 88 for clamping said brake band on said brake drum or for releasing said band from said drum. On one end of said clamp screw is secured an arm 89 to which is connected the rear end of a rod 90, which rod is connected at its forward end to a brake pedal 91 pivoted to the main frame 9 of the tractor 1 in position to be depressed by the foot of the driver of the tractor 1 for turning the clamp screw 88, through the medium of the link 90 and the arm 89, for operating the brake 84.

In Figs. 6, 10 and 11 are shown a single spirally grooved drum 92, one of which is journaled in the upper end of each of the upright members 28 of the frame 3, in place of the two sheaves 37 and 38, as shown in Figs. 1 to 5 inclusive, and the cable 42 extends over each of said drums 92 and around the same in the spiral groove 93 thereof, so that said cable will extend over said drums when the shovel 2 is swung upwardly and rearwardly over the pivot 5, as shown in dotted lines in Fig. 6.

The operation of my invention is as follows:

As my mucking and loading machine is driven over rough ground by the tractor 1 the caterpillar treads 8 swing up and down on the rear axle 19 of the tractor, so as to rest entirely upon the ground and support the machine firmly at all times, and as said treads rock up and down the cross bar 26 rocks alternately on its pivot 27 with its ends resting upon the inner beams 18 of the tread frames 17, whereby the front end of the tractor main frame 9 and the motor 10 are supported evenly on the general level of the tractor 1 and without rocking with said treads and the cable 42 is maintained under even tension at all times.

With the shovel 2 resting upon the ground in its lowermost forward position, as shown in Figs. 1, 2 and in full lines in Fig. 6 my mucking and loading machine is driven forwardly by the tractor 1 to cause the shovel to dig and shovel dirt until the shovel is filled with dirt, whereupon the machine is brought to rest by the driver thereof, and the driver, upon grasping the operating lever 83 operates the clutch 53 to clutch the sprocket 50 to the drive shaft 51, so that the drums 36 are rotated by the tractor engine 10, through the medium of the sprockets 44 and 46 and chain 48, transmission shaft 47, sprockets 49 and 50, and chain 52, clutch 53, drive shaft 51, bevel pinion 54, and bevel gear 55 and drum shaft 56, and the cable 42 is wound on the drums 36, causing said cable to travel over the sheaves 37 and 38, 39 and 41 and to swing the shovel 2 and its arms 4 upwardly on their pivots 5 into a position with the shovel slightly rearwardly over its dead center or over said pivots, whereupon said shovel and its arms assisted by the downward and rearward movement of the dirt in the shovels swing down rearwardly by gravity, until the shovel reaches its dumping position over the rear end of the machine, as shown in dotted lines in Fig. 6, in which position the shovel dumps its load of dirt into a truck which may be driven into position under the shovel to receive the dirt dumped from the shovel. When the shovel swings rearwardly over its pivots 5 or over its dead center the cable 42 leaves the sheaves 38 at the rear thereof and extends only around and over the rear of the sheaves 37, and said cable continues to extend around and over said sheaves 37 while the shovel is in its position over the rear of the pivots 5 and in any of its dumping positions.

The shovel 2 may be arrested by the driver of my machine in any of its elevated positions, and particularly in any of its dumping positions at different elevations corresponding to the heights of the trucks into which the shovel dumps its load of dirt upon releasing the clutch 53 from the drive sprocket 50, by swinging the clutch-operating lever 83 and applying the drum brake 84 to the drive shaft 51, by swinging the brake-operating lever 89, upon depressing the brake pedal 91, whereby the brake drums 36 are prevented from rotating.

The length and elevation of the swinging movement of the shovel 2 may be adjusted for enabling the shovel to dump its load of dirt into trucks of different heights, by inserting the pivot bolts 5 through different openings 34 in the shovel arms 4 and threading said pivot bolts into different openings 35 in the upright members 28 of the shovel supporting frame 3.

When the shovel 2 is in its lowermost forward position for shoveling dirt, as shown in Fig. 1 of the drawings, the cable 42 is unwound from the drums 36 with the exception of the ends, respectively, of the cable, which are secured to the drums in the inner ends and smallest diameters of the spiral grooves 57 of the drums, so that when said drums are rotated to swing the shovel upwardly and rearwardly from its shoveling position where the greatest power is needed to swing them the greatest leverage of the drums, at said points of connection of the ends of the cable 42 to said drums, is applied through the cable to the shovel for swinging the same as aforesaid, and as the shovel is swung upwardly and rearwardly, and the power necessary to swing the shovel is progressively decreased, the cable 42 is wound on the drums 36 in the grooves 57, increasing progressively in diameter, and the speed of said upward and rearward swinging movement of said shovel is accelerated.

In the modification of my invention shown in Figs. 6, 13 and 14, each strand of the cable 42 extends around the single sheave 92 in a spiral groove 93 therein, in all positions of the shovel 2, in view of the fact that said cable is coiled spirally several times around said sheave and cannot leave the sheave in any position of the shovel.

I claim:

1. A mucking and loading machine including a tractor with caterpillar treads pivotally mounted at their rear ends on the tractor frame, whereby said treads may swing independently up or down on their pivot, means for operatively mounting the forward end of the tractor frame upon the forward ends of said caterpillar treads, a shovel mounted on said tractor to be swung down forwardly of said tractor into position for shoveling dirt as the tractor is driven forwardly, and to be swung rearwardly over the rear of said tractor for dumping a load of dirt, and means for swinging said shovel into shoveling or dumping position.

2. A mucking and loading machine including a tractor, a shovel supporting frame constructed with a pair of upright members mounted on said tractor at the sides, respectively, of said tractor, a shovel, a pair of arms, on one end of which said shovel is mounted, said arms extending from said shovel over said frame upright members and each of said arms being provided with a plurality of longitudinally spaced pivot openings in its rear end portion remote from said shovel, said frame upright members being each provided with a plurality of vertically spaced pivot openings, a pair of pivots constructed and arranged to be inserted through any of said pivot openings in said shovel carrying arms, respectively, and secured in any of said pivot openings in said frame upright members, respectively, whereby said shovel and said arms are adjustably pivoted in operative position on said frame upright members, and means for swinging said shovel forwardly and downwardly in front of said tractor into shoveling position, or upwardly and downwardly over the rear end of said tractor into dumping position.

3. A mucking and loading machine including a tractor, a shovel supporting frame mounted on said tractor, a shovel, a pair of arms on one end of which said shovel is mounted, means for adjustably pivoting said shovel carrying arms on said frame whereby said arms may be adjusted as to elevation on said frame, and adjusted as to length, and means for swinging said arms to swing said shovel down in front of said tractor into shoveling position, or to swing said shovel upwardly and downwardly over the rear end of said tractor into dumping position.

4. A mucking and loading machine including a tractor constructed with a main frame and a pair of caterpillar treads pivotally mounted at their rear ends on the rear part of said frame at the sides, respectively, of said frame, whereby said treads may swing independently up or down on their pivots, means for operatively mounting the forward end of said frame upon the forward ends of said treads, a shovel supporting frame comprising a pair of upright members mounted at their lower ends upon said treads, respectively, and an equalizing brace connecting the upper ends of said upright members, so that said members may move relatively to each other with the relative movement of said treads, a shovel, a pair of arms on one end of which said shovel is mounted with the other end portions of said arms extending over said upright frame members and pivoted to said upright members respectively, and means for swinging said shovel on said pivots forwardly and downwardly in front of said tractor into shoveling position or upwardly and downwardly over the rear end of said tractor into dumping position.

5. A mucking and loading machine as claimed in claim 4 in which the equalizing brace of the shovel supporting frame comprises a strut and a pair of sockets secured to the upper ends of the upright frame members, respectively, into which sockets the ends of said strut are slidably fitted.

6. A mucking and loading machine including a tractor constructed with a main frame and a pair of caterpillar treads pivotally mounted at their rear ends on the rear part of said frame at the sides, respectively, of said frame whereby said treads may swing independently up or down on their pivots, means for operatively mounting the forward end of said frame upon the forward ends of said treads, a shovel supporting frame comprising a pair of upright members mounted at their lower ends upon said treads, respectively, and an equalizing brace connecting the upper ends of said upright members, so that said members may move relatively to each other with the relative movement of said treads, a shovel, a pair of arms on one end of which said shovel is mounted with the other end portions of said arms extending over said upright frame members and pivoted to said upright members, respectively, a pair of drums mounted on said tractor frame, a cable having its ends secured to said drums, respectively, to be wound on said drums, sheaves mounted on the upper ends of the upright frame members, a bail secured to the shovel, a pair of sheaves mounted on said bail and a pair of sheaves mounted on the equalizing brace of the shovel supporting frame, over which sheaves said cable extends from said drums, and means for rotating said drums for winding said cable thereon or unwinding said cable therefrom, for swinging the shovel forwardly and downwardly in front of the tractor into shoveling position, or upwardly and downwardly over the rear of the tractor into dumping position.

7. A mucking and loading machine including a tractor, a shovel, a pair of shovel-carrying arms, pivotally mounted on said tractor whereby said shovel may be swung down in front of said tractor into shoveling position, or swung upwardly and rearwardly into dumping position, a pair of uprights mounted on said tractor at the sides thereof, respectively, a pair of sheaves mounted on each of said uprights, one sheave of each pair above the other, a pair of drums mounted on said tractor, a cable connected at its ends to said drums, respectively, and extending upwardly and forwardly over the lower sheaves of said pairs of sheaves, respectively, and extending upwardly, rearwardly, and forwardly over the upper sheaves of said pairs of sheaves, respectively, to said shovel in its shoveling position, means for operatively connecting said cable to said shovel, and means for rotating said drums for winding said cable thereon or unwinding said cable therefrom, whereby said shovel may be swung forwardly and downwardly in front of said tractor into shoveling position, or upwardly, and rearwardly over said sheaves into dumping position.

8. A mucking and loading machine including a tractor, a shovel, a pair of shovel-carrying arms pivotally mounted on said tractor, whereby said shovel may be swung down in front of said tractor into shoveling position or swung upwardly and rearwardly into dumping position, a pair of uprights mounted on said tractor at the sides there-

of, respectively, a sheave journaled on each of said uprights, a pair of drums mounted on said tractor, a cable mounted at its ends to said drums, respectively, and extending upwardly and coiled around said sheaves and extended forwardly to said shovel in its shoveling position, means for operatively connecting said cable to said shovel, and means for rotating said drums for winding said cable thereon or unwinding said cable therefrom, whereby said shovel may be swung forwardly and downwardly in front of said tractor into shoveling position, or swung upwardly and rearwardly over said sheaves into dumping position.

JOSEPH A. HOFMEISTER.