March 5, 1963 K. W. RANDALL 3,080,076

LOADING MACHINE

Filed Oct. 21, 1959 5 Sheets-Sheet 1

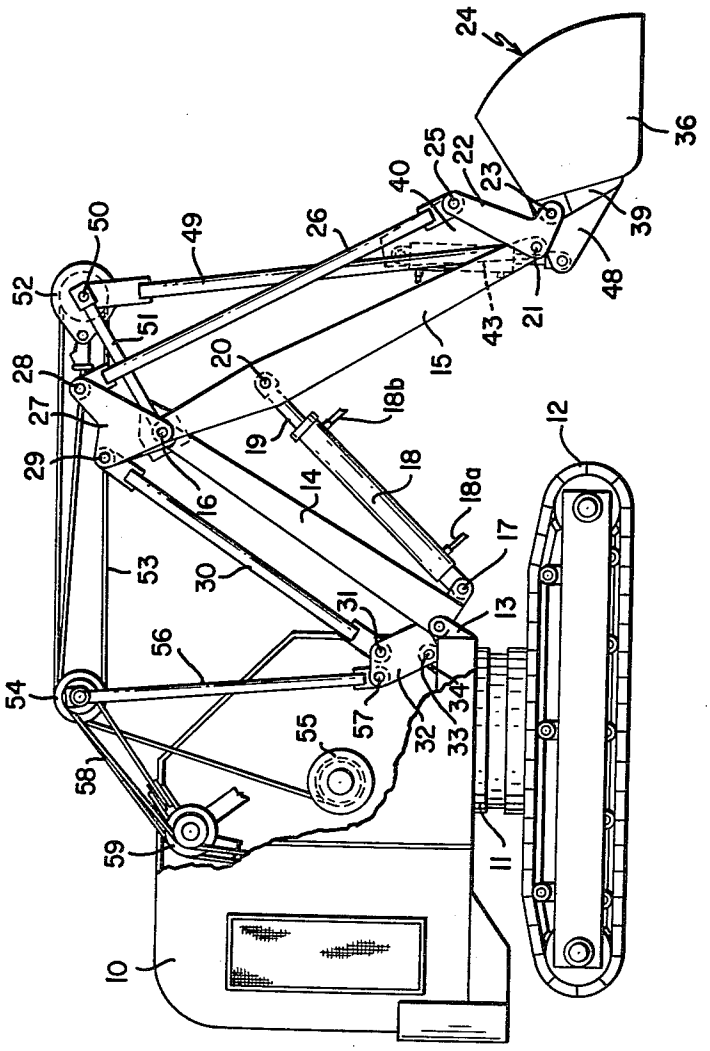


Fig. 1

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5 Sheets-Sheet 2

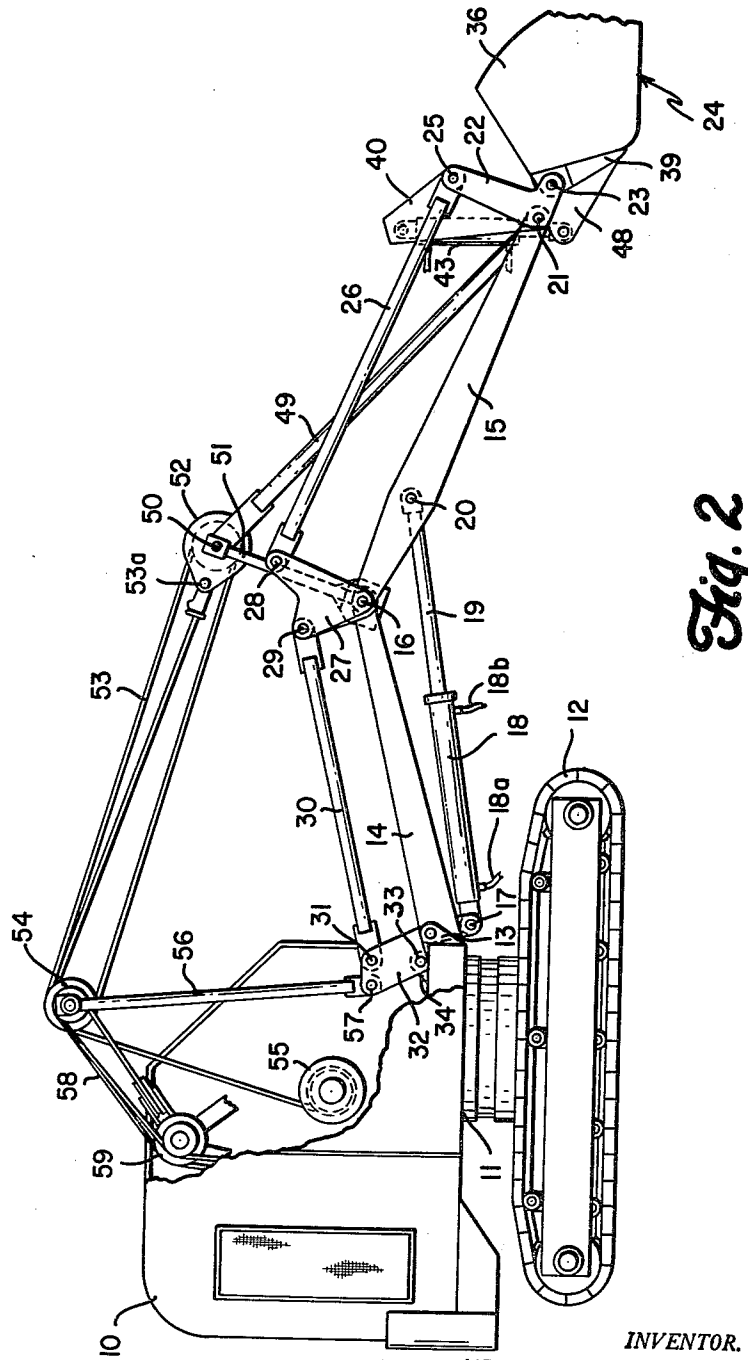


Fig. 2

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March 5, 1963 K. W. RANDALL 3,080,076

LOADING MACHINE

Filed Oct. 21, 1959 5 Sheets-Sheet 3

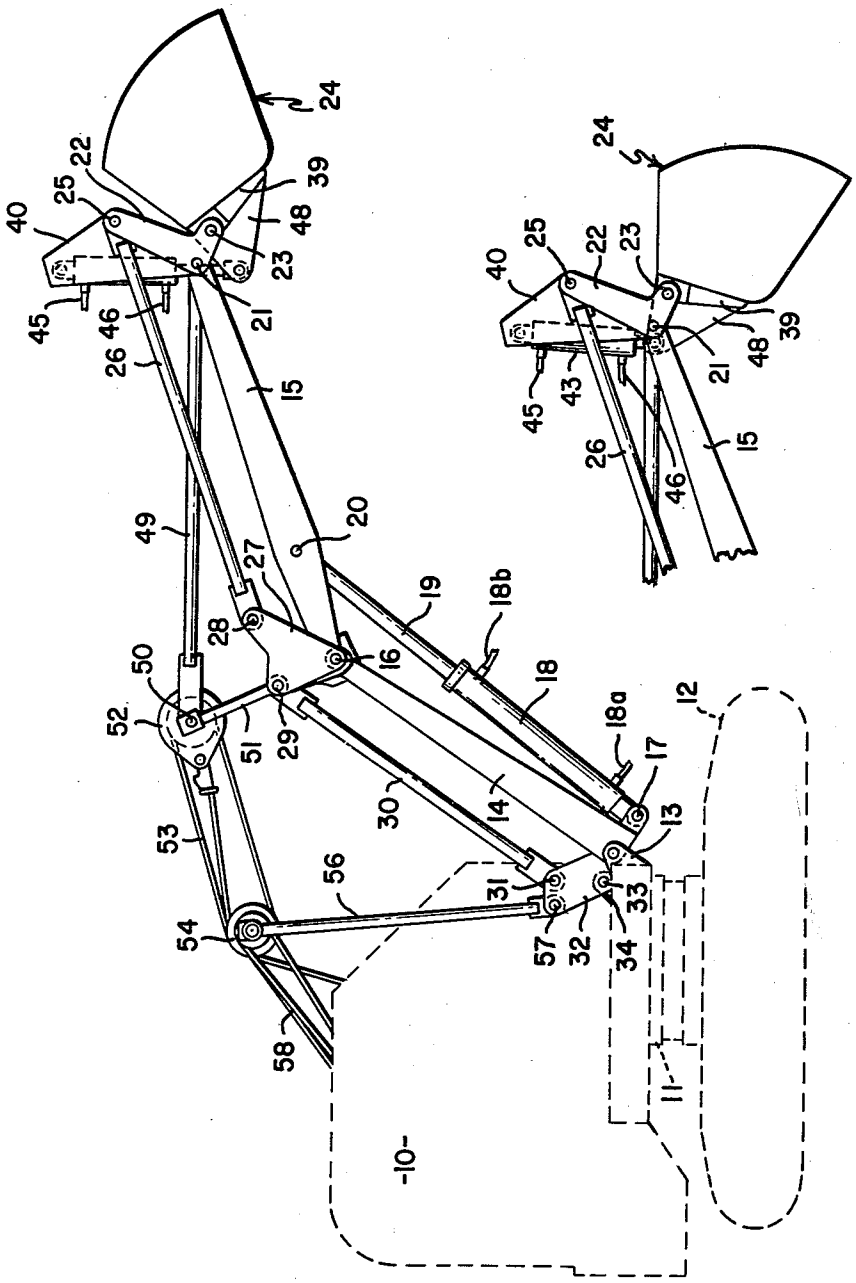


Fig. 3

Fig. 4

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March 5, 1963 K. W. RANDALL 3,080,076

LOADING MACHINE

Filed Oct. 21, 1959 5 Sheets-Sheet 4

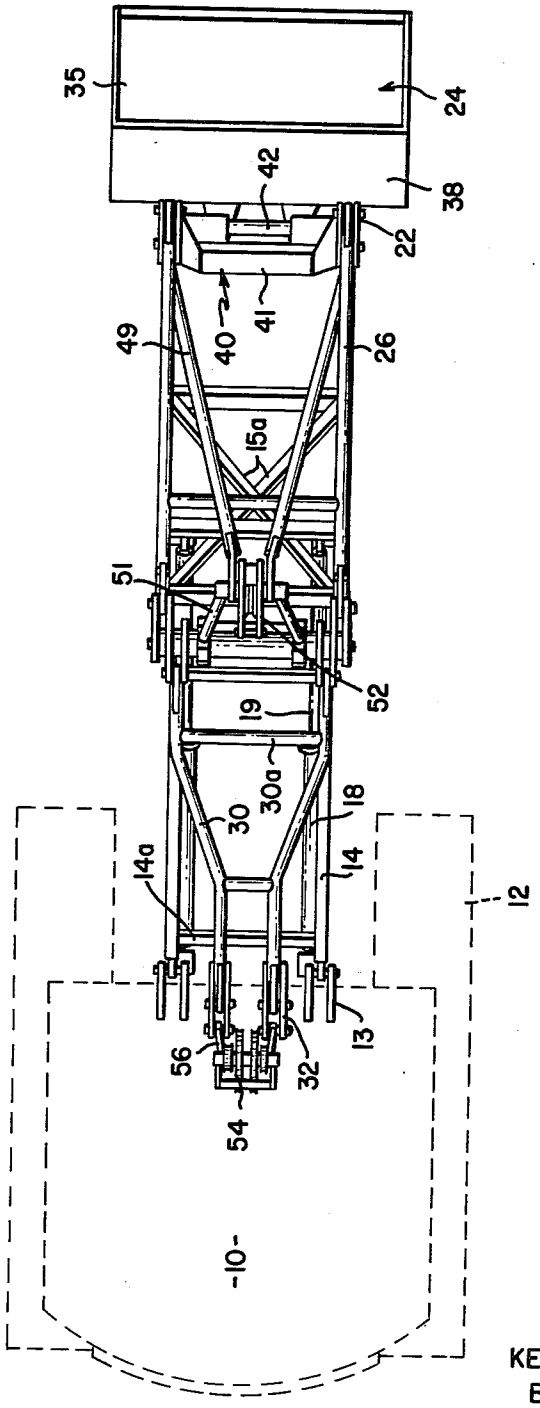


Fig. 5

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March 5, 1963 K. W. RANDALL 3,080,076

LOADING MACHINE

Filed Oct. 21, 1959 5 Sheets-Sheet 5

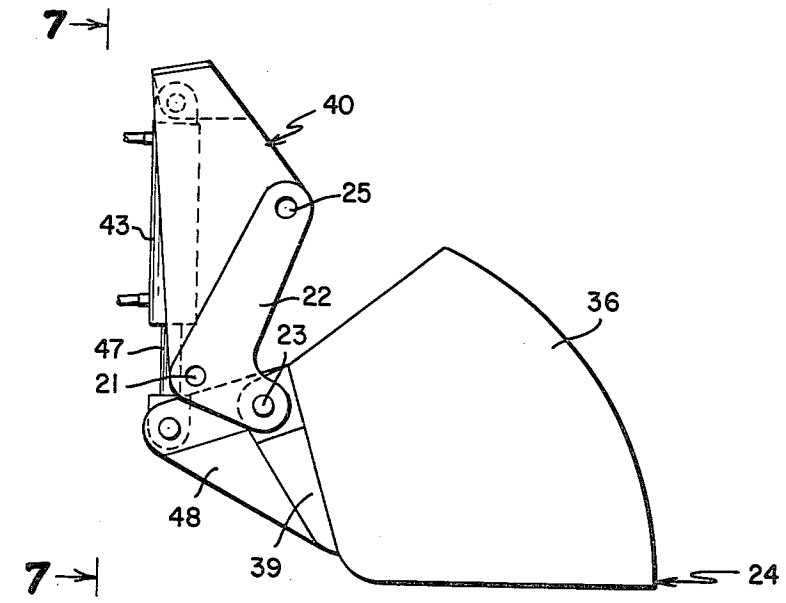


Fig. 6

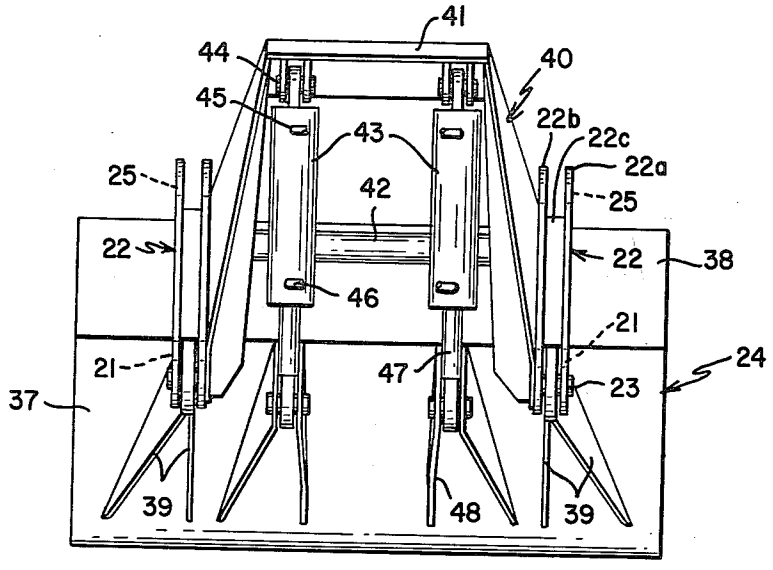


Fig. 7

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United States Patent Office 3,080,076 Patented Mar. 5, 1963

3,080,076

LOADING MACHINE

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Filed Oct. 21, 1959, Ser. No. 847,724
4 Claims. (Cl. 214—138)

This invention relates to loading machines, but more particularly to machines having a bucket at the front which is advanced or crowded relative to the material and thereafter, after being filled, the bucket is elevated and swung to the desired place for dumping, such for example as into a truck.

An object is to produce a new and improved front end loader which embodies toggle mechanism for establishing an exceedingly powerful crowding action and is so constructed and arranged that the bucket remains in a predetermined position relative to the ground surface, thereby to effect a smooth and uniform grade at almost any selected angle.

Another object is to produce a front end loader in which the bucket is carried at the outer ends of toggle arms which are hydraulically actuated to and from crowded position by hydraulic piston and cylinder assemblies in an unique manner by which hydraulic power concomitantly straightens the toggle arms and depresses the toggle joint.

A further object is to produce a loader machine in which the bucket is carried by a toggle arm arrangement which itself forms part of a modified and variable parallelogram, the arrangement being such that crowding action is effected by straightening out the toggle and due to the parallelogram, the bucket is maintained at the desired pitch during working operation.

A still further object is to produce a front end loader in which the bucket is carried by a boom made up of toggle arms which are power actuated to advance or retract the bucket, cable means being associated with the toggle for controlling the vertical position of the bucket.

A still further object is to actuate by fluid power and through toggle means the bucket during the crowding action and to control the pitch or tilt of the bucket by fluid pressure means.

A still further object is to produce a simple and efficient front end loader having the novel features of construction and operation hereinafter described.

Other objects and advantages of the invention will hereinafter appear and for purposes of illustration but not of limitation, an embodiment of the invention is shown on the accompanying drawings in which:

FIGURE 1 is a side elevation of a front end loader machine showing the bucket at ground level and in retracted position;

FIGURE 2 is a side elevation of the machine shown in FIGURE 1 with the bucket in its advanced position;

FIGURE 3 is a view somewhat similar to that of FIGURES 1 and 2 but showing the cab and crawler structures by broken lines, and showing the bucket in elevated position;

FIGURE 4 is a fragmentary elevation of the bucket and adjacent parts showing the bucket in its downwardly tilted or discharge position;

FIGURE 5 is a top plan view of the mechanism shown in FIGURE 3, the cables being omitted for purposes of clarity;

FIGURE 6 is an enlarged side elevation of the bucket assembly; and

FIGURE 7 is a rear end elevation of the bucket assembly shown in FIGURE 6 and taken substantially on the line 7—7 of FIGURE 6.

The illustrated embodiment of the invention comprises a cab 10 which is mounted on a revolving platform 11 carried by the usual crawler units 12, although manifestly instead of crawler units, rubber-tired wheels may be employed. It will be understood that contained within the cab 10 is the usual engine (not shown) for imparting motive power to various drive mechanisms including a hydraulic pump. Since the particular construction and arrangement of these mechanisms form no part of the present invention, detail illustration and description thereof are not regarded as being necessary.

On the forward end of the cab 10 are two pairs of brackets 13 arranged at opposite sides thereof and connected to each pair is one end of a toggle arm 14 which extends forwardly of the cab. The pairs of laterally spaced arms 14 are connected together for purposes of strength and rigidity by one or more cross braces 14*a*. Pivotally connected on a cross shaft 16 to the front end of each toggle arm 14 are the rear ends of forward toggle arms 15. As shown in FIGURE 5, the pair of toggle arms 15 are connected by a series of cross and diagonal strengthening braces 15*a*.

Depending from and secured to each of the rearward toggle arms 14 adjacent the rear end thereof is a rigid bracket 17 to which is pivotally connected the rear end of a hydraulic cylinder 18 in which reciprocates a piston rod 19, the front end of which is pivotally connected to the respective forward toggle arm 15 at a point 20 located near the rear end thereof or at a point about one-third of the length thereof measured from the rear end of same. The cylinder and piston arrangement 18–19 is double acting and hoses 18*a* and 18*b* lead to opposite ends thereof from a suitable hydraulic pump in the cab 10, thereby to enable liquid under pressure to be introduced selectively at one end or the other for driving the piston in the desired direction for spreading apart the toggle arms as in FIGURE 3 or drawing these arms toward each other as in FIGURE 1.

The forward end of each of the forward toggle arms 15 is pivoted at 21 to the apex portion of a respective bell crank 22. As indicated on FIGURE 7, the bell cranks 22 are laterally spaced and each comprises a pair of spaced parts 22*a* and 22*b* which are connected by an integral web 22*c*.

The short horizontal arm of each bell crank assembly 22 is pivotally secured by a pin 23 to the rear face of a bucket 24. The long vertically disposed arm of each bell crank 22 is pivotally secured at 25 to an arm 26 which is generally parallel to the respective toggle arm 15. The rear end of each arm 26 is pivotally connected at 28 to a generally triangular rock bracket 27. The lower or apex portion of the bracket 27 is pivoted to the shaft 16. Pivotally connected at 29 to the rearwardly disposed upper end of each bracket 27 is the front end of a rod 30 which is generally parallel to the arm 14 and has its rear end pivoted at 31 to a rock bracket 32. The lower end of the rock bracket 32 is pivoted at 33 to a bracket 34 fixed to the cab 10. As shown in FIGURE 5, the two rods 30 are integrally connected by cross braces 30*a* and converge for a portion of their length so that the rear ends are disposed between and spaced from the toggle arms 14. It will thus be apparent that the arm assembly 30 is an integral fabricated unit.

The bucket 24 has a front open mouth and is formed with a bottom wall 35 and vertically disposed side wings 36. Integral with a portion of the upper ends of the side wings 36 is an upwardly and rearwardly inclined back wall 37 and closing a portion of the top of the bucket is an upwardly and forwardly inclined short top wall 38. Suitably secured as by welding on opposite ends of the rear wall 37 are pairs of converging wing-like brackets 39 and straddling the upper ends of these pairs

of brackets are the parts 22*b* and 22*c* of the bell cranks 22, a pin 23 serving as the pivotal connection between the respective bell cranks and the brackets.

The inner portion 22*b* of each of the bell cranks 22 is welded to the vertical arm portions of an inverted U-shaped supporting structure 40 which is formed with a horizontally disposed cross member 41. A tubular brace member 42 is rigid with the legs of the U structure 40 for strengthening the same.

Hydraulic mechanism is provided for effecting tilting of the bucket 24 to and from discharging position and, as shown, a pair of double acting hydraulic cylinders 43 are arranged between the legs of the inverted U structure 40. The upper ends of these cylinders are pivotally secured to brackets 44 which are rigid with the underside of the horizontal cross member 41. Adjacent opposite end portions of each of the cylinders 43 are hose connections 45 at the top 46 and adjacent the bottom, the hoses secured thereto lead to the cab 10 where they are suitably connected to a pump and suitable controls so that liquid under pressure may be admitted to one end or the other of the cylinders for effecting the desired movement of the pistons disposed therein. Connected to these pistons are piston rods 47, the lower ends of which are pivotally connected to brackets 48 which are rigid with and project outwardly from the back wall 37 of the bucket. As particularly shown in FIGURE 6, the brackets 48 project outwardly a considerable distance beyond the brackets 39 to which the bell crank structures 22 are pivoted.

Welded to or otherwise securely fixed to the outer end portions of the toggle arms 15 are rods 49 respectively which, as shown in FIGURE 5, converge at their inner ends which are pivotally connected to a cross shaft 50. Depending from the shaft 50 and disposed on opposite sides of the end portions of the arms 49 are hanger arms 51, the lower ends of which are pivotally mounted on the cross shaft 16. Disposed between the inner ends of the rods 49 is a pulley 52 about which is passed a cable 53 which also passes about a sheave assembly 54, with one end of the cable anchored at 53*a* to the pulley 52 and the other end wound about a power driven hoist drum 55 within the cab 10.

The sheave assembly 54 is supported by a jack frame 56 which is vertically disposed and has its lower end pivoted to the rock bracket 32 at 57. Also passing around a portion of the sheave assembly 54 is a cable 58 which is suitably passed over a sheave arrangement 59 within the cab and extends to a power driven boom hoist (not shown).

In operation and, assuming the parts are in the position shown in FIGURE 1 and it is desired to advance the scoop bucket 24 to grade a surface, etc., liquid under pressure is delivered to the cylinders 18 through the connection 18*a* for advancing the piston rods 19 thereby to straighten out the toggle arms 14 and 15. The action of the piston and cylinder assemblies 18 and 19 is such that the toggle arms 14 are forced downwardly due to the connection between the cylinders 18 and the depending brackets 17. At the same time the forward toggle arms 15 are forced outwardly by the action of the piston rods 19. This effects forward or crowding movement to the bucket 24 but in order to maintain the latter at ground level, the cable 53 is payed out in order to enable the sheave 52 and adjacent parts, including the arms 49, to move downwardly. At the same time the arms 30 and 26 which are disposed parallel to the toggle arms 15 and 14 respectively similarly move downwardly. Thus as the piston rods 19 are extended, the toggle formed by the arms 14 and 15 is moved closer into horizontally aligned position. During such crowding movement of the bucket, it may be necessary to alter the disposition of the bucket relative to ground level by introducing liquid under pressure to the cylinders 43 for effecting the desired bucket movement. The cable mechanism embodying the cable 53 controls the lowering or raising of the assembly and as well as creating a downward pressure and assisting in the crowd action of the bucket itself.

After the bucket 24 has been filled, the entire assembly may be elevated by operation of the hoist drum 55, taking up on the cable 53 and rocking the toggle arms 14 and 15 about their pivots on the brackets 13. To retain the contents within the bucket 24, liquid under pressure may be introduced to the cylinders 43 through the connections 45 to extend the piston rods 47 for moving the bucket substantially to the position shown in FIGURE 3, in which tilted position the contents will remain within the bucket.

The cab 10 may then be swung to a suitable position where it is desired to dump the bucket 24. If desired, the machine may be advanced on the crawlers 12 if the load is to be dumped or discharged at a more remote place. When the bucket has been moved to the desired place where the contents are to be discharged, the operator within the cab 10 introduces liquid under pressure to the cylinders 43 and particularly through the hoses 46 for retracting the piston rods 47, thereby to tilt the bucket 24 downwardly substantially to the position shown in FIGURE 4 for discharging the load. After the load has been discharged, the bucket through the above described hydraulic connections will be rocked to a position approaching that of FIGURE 1 so that the boom made up of the various parts above described, including the toggle arms 14 and 15, can be lowered to the position of FIGURE 1 by retraction of the piston rods 19 due to introduction of liquid under pressure to the hose connections 18*b*. This brings the parts to the position shown in FIGURE 1 preparatory for another bucket loading operation. It will be understood that in carrying out the loading, the cable 53 is payed out at the same time the toggle arms 14 and 15 are extended.

By maintaining the parallelogram arrangement made up of the arms 14, 15 and 30 and 26, it will be manifest that when the parts are lifted, a substantially parallelogram boom is formed, the lifting taking place through the agency of the hoist cable 53 in the region of the joint between the toggle arms 14 and 15, the arms 30 and 26 maintaining their parallel spaced relation due to the manner in which they are mounted at their opposite ends. An important feature of the invention resides in disposing the bucket at a predetermined position or pitch, unless the operator desires to raise or lower the lip of the bucket, this enabling the operator to make a perfectly smooth grade at practically any angle he desires. This is achieved by the double parallelogram arrangement of arms above described.

Although this is not shown, it will be understood that a conventional automatic pressure release may be provided to relieve the pressure in the bucket operating cylinders, should the bucket encounter an immovable object which would otherwise damage the components of the hydraulic system.

The boom hoist acting through the cable 58 and associated sheaves is employed only to control the position of the jack frame 56. In the normal operation of the machine, the jack frame is maintained in the position substantially as indicated on the drawings.

Numerous changes in details of construction, arrangement and operation may be effected without departing from the spirit of the invention, especially as defined in the appended claims.

What I claim is:

1. A loading machine comprising an ambulatory and revoluble supporting platform, a bracket on said platform, an inner toggle arm having one end pivoted to said bracket, a forward toggle arm having one end thereof pivoted to the other end of said first toggle arm forming a toggle joint, a bell crank having its apex pivoted to the other end of said forward toggle arm, a scoop bucket, a pivotal connection between one arm of said bell crank

and the rear end portion of said bucket, an arm pivoted to the other arm of said bell crank and disposed generally parallel to said forward toggle arm, a rock bracket mounted on the pivotal connection between said inner and forward toggle arms and upstanding therefrom, a pivotal connection between the adjacent end of said parallel arm and said rock bracket, an arm parallel to said inner toggle arm and pivoted to said rock bracket at one end, an upstanding rock bracket on said platform to the upper portion of which said last parallel arm is pivoted, a double acting linear motor for extending and retracting the toggle arms, a bracket depending generally downwardly from the inner toggle arm adjacent the inner end thereof to which one end of said linear motor is pivoted, a pivotal connection between the other end of said linear motor and an intermediate portion of the forward toggle arm, and hoist means including a pulley, a first rigid arm having one end pivotally connected to the toggle joint between said inner and forward toggle arms and its other end pivotally connected to said pulley, a second rigid arm having one end pivotally connected to said pulley and having its other end pivotally connected to said bell crank, a hoist drum mounted adjacent said platform, and cable means extending from said drum and reeved about said pulley.

2. A loading machine comprising an ambulatory and revoluble supporting platform, a bracket on said platform, an inner toggle arm having one end pivoted to said bracket, a forward toggle arm pivoted to the other end of said first toggle arm forming a toggle joint, a bell crank having its apex pivoted to said forward toggle arm, a scoop bucket, a pivotal connection between one arm of said bell crank and the rear end portion of said bucket, an arm pivoted to the other arm of said bell crank and disposed generally parallel to the forward toggle arm, a rock bracket mounted on the pivotal connection between the toggle arms and upstanding therefrom, a pivotal connection between the adjacent end of said parallel arm and said rock bracket, an arm parallel to said inner toggle arm and pivoted to said rock bracket at one end, an upstanding rock bracket on said platform to the upper portion of which said last parallel arm is pivoted, a double acting linear motor for extending and retracting the toggle arms, a bracket depending from the inner toggle arm adjacent the inner end thereof to which one end of the linear motor is pivoted, a pivotal connection between the other end of the linear motor and an intermediate portion of the forward toggle arm, and hoist means extending from said platform to the pivotal connection between the toggle arms, said hoist means including pulley means, rigid arm means extending downwardly from the pulley means to the toggle joint, a rigid arm extending from the pulley means to the front end of the forward toggle arm, a hoist drum on the supporting platform, and cable means reeved from the pulley means to the hoist drum.

3. A loading machine comprising an ambulatory and revoluble supporting platform, a bracket on said platform, an inner toggle arm having one end pivoted to said bracket, a forward toggle arm pivoted to the other end of said first toggle arm forming a toggle joint, a bell crank having its apex pivoted to said forward toggle arm, a scoop bucket, a pivotal connection between one arm of said

bell crank and the rear end portion of said bucket, an arm pivoted to the other arm of said bell crank and disposed generally parallel to the forward toggle arm, a rock bracket mounted on the pivotal connection between the toggle arms and upstanding therefrom, a pivotal connection between the adjacent end of said parallel arm and said rock bracket, an arm parallel to said inner toggle arm and pivoted to said rock bracket at one end, an upstanding rock bracket on said platform to the upper portion of which said last parallel arm is pivoted, a double acting linear motor for extending and retracting the toggle arms, a bracket depending from the inner toggle arm adjacent the inner end thereof to which one end of the linear motor is pivoted, a pivotal connection between the other end of the linear motor and an intermediate portion of the forward toggle arm, hoist means extending from said platform to the pivotal connection between the toggle arms, said hoist means including pulley means, rigid arm means extending downwardly from the pulley means to the toggle joint, a rigid arm extending from the pulley means to the front end of the forward toggle arm, a hoist drum on the supporting platform, and cable means reeved from the pulley means to the hoist drum, an upright jack frame pivoted to said upstanding rock bracket, a sheave assembly on said jack frame, and means for controlling the position of the jack frame and including a cable passing about said last sheave assembly.

4. A loading machine comprising a supporting platform; toggle mechanism having pivotally connected inner and forward toggle arms; a pivotal connection between the inner end of said inner arm and said platform to afford vertical swinging movement of said arms; a scoop bucket; means providing an operative connection between said forward toggle arm and said bucket; a double acting linear motor for actuating said toggle arms; a mounting for opposite ends of said linear motor, said mounting including a bracket extending generally downwardly from the inner end of said inner arm and adjacent to said pivotal connection between the inner end of said inner arm and said platform, a pivotal connection between one end of said linear motor and said bracket, and a pivotal connection between the opposite end of said linear motor and said forward toggle arm, whereby upon actuation of said linear motor in one direction concomitant rocking of said inner arm and extension of said forward arm of said toggle mechanism toward a position where said toggle arms align is effected and the opposite action is effected upon actuation of said linear motor in the opposite direction; and hoist means from said platform to the joint of said toggle arms for controlling the raising and lowering of said toggle arms and thereby said bucket.

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