Sept. 29, 1942. T. K. ANDERSEN ET AL 2,296,827

MATERIAL COLLECTING AND LOADING APPARATUS

Filed Jan. 2, 1941 3 Sheets-Sheet 1

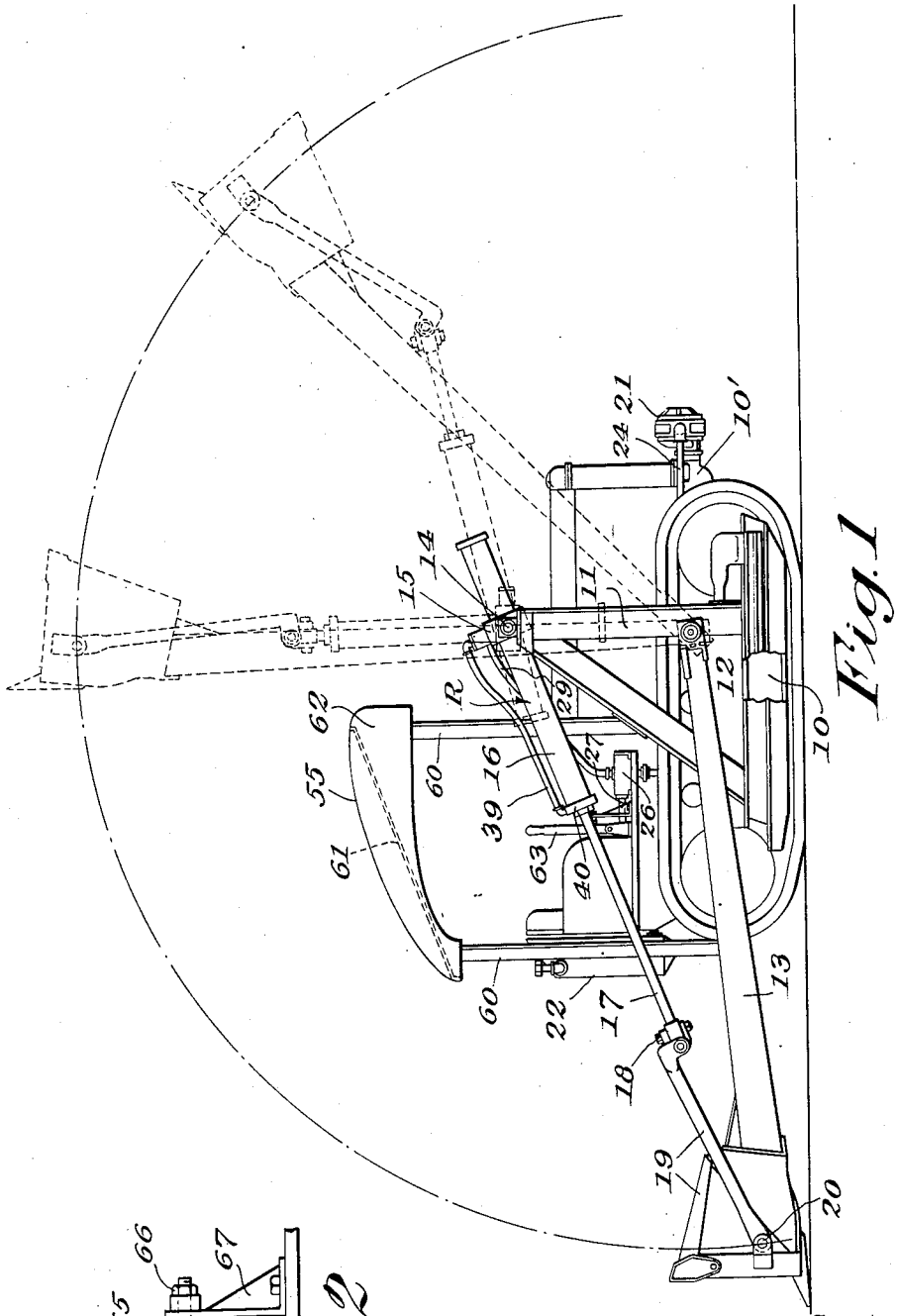


Fig. 1

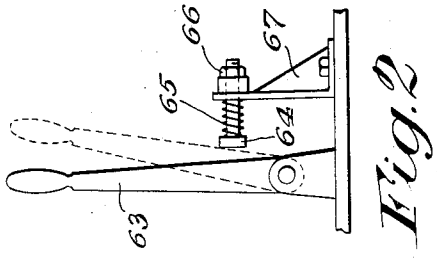


Fig. 2

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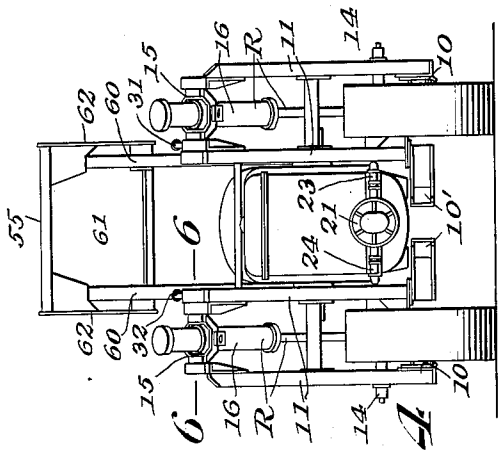


Fig. 4

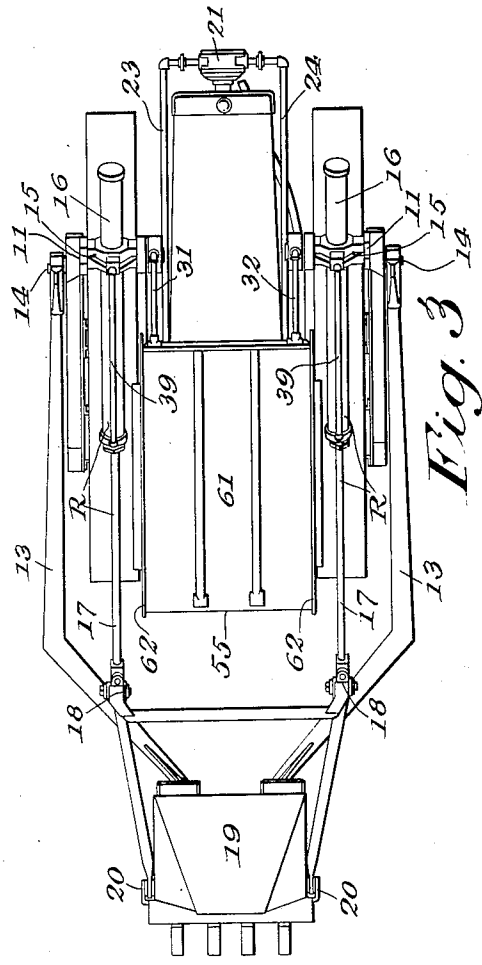


Fig. 3

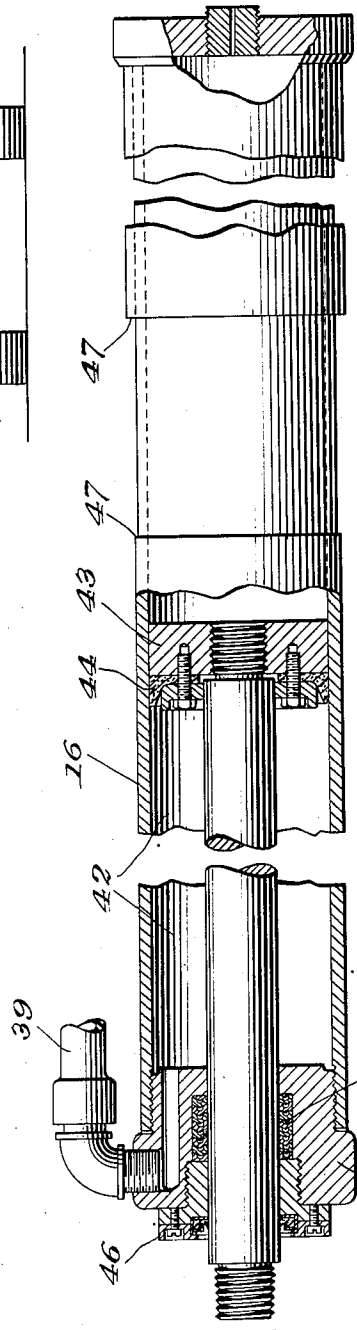


Fig. 5

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MATERIAL COLLECTING AND LOADING APPARATUS

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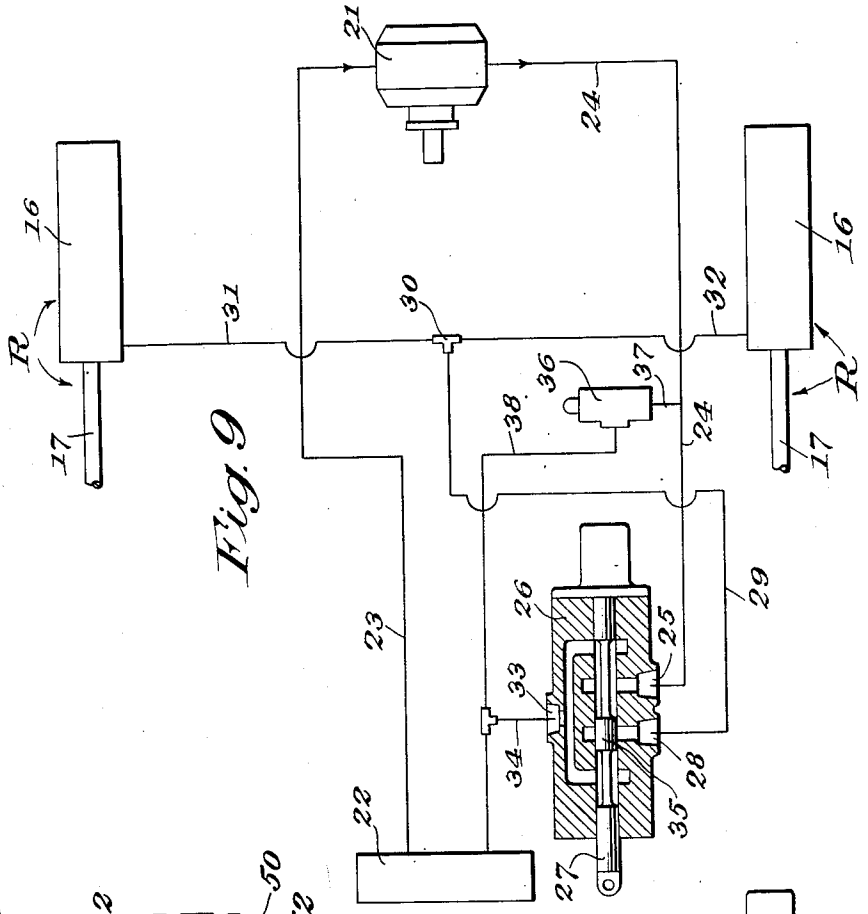


Fig. 9

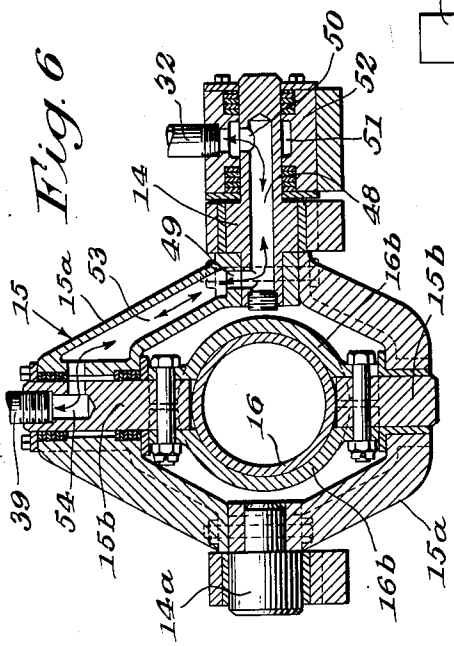


Fig. 6

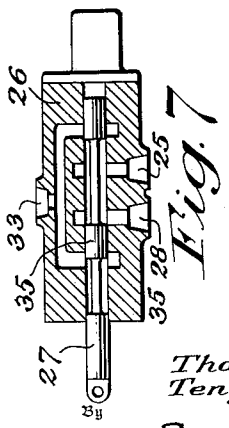


Fig. 7

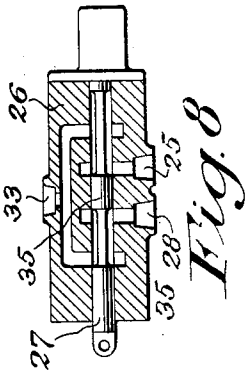


Fig. 8

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2,296,827

MATERIAL COLLECTING AND LOADING APPARATUS

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Application January 2, 1941, Serial No. 372,752

8 Claims. (Cl. 214—131)

This invention is an improvement upon the material collecting and loading apparatus shown in our prior Patent No. 2,182,781, of December 12, 1939, and consists in the novel construction, combination and relationship of parts whereby the power to revolve the material handling receptacle is applied from the sides of the vehicle without passing through the protective roof so that the roof may be both lightened to lower the center of gravity of the machine and shortened to improve the vision of the operator when dumping high loads.

We accomplish this result by establishing two ram pivot points adjacent the sides of the vehicle and above the pivot points of the receptacle arms and so located fore and aft of the vehicle that they are approximately under the balancing point of the receptacle as it passes over center. We connect these upper pivot points with appropriate pivot points on the arm and receptacle assembly by means of telescopic rams at the sides of the vehicle which rams shorten when power is applied but are of adequate length so that their stroke will lift the receptacle to its balancing point. When the receptacle has been lifted to its balancing point, it is permitted to continue its course by momentum and gravity on release of the lifting power. This construction permits complete operation of the receptacle by the use of a three-way valve with a single control lever which not only applies and releases the power but can stop and lock the receptacle at any position in its arc.

Other advantages which flow from our new construction may be briefly stated as follows:

(1) With the pump for circulating oil under pressure to the rams mounted on the front end of the vehicle and driven from the front end of the motor shaft we can by the use of flexible tubing allow for movement between the pump or driving member and the ram or driven member so that if desired the driving member can be mounted above the tractor springs and the motion between the two will not endanger the transmission of power from one to the other. In our patented machine there can be practically no motion between the driving member and the driven member, which fact limits its application to tractors which are either without spring action or on which the motor frame is strong enough to carry both the driving and driven members.

(2) By eliminating all cable sheaves and high speed bearings which wear rapidly in service and frequently have to be replaced, we can considerably reduce service expense and working delays.

(3) By eliminating the slap caused by the slacking of the cable as the receptacle passes over center, we can obtain smooth operation of the receptacle throughout its entire arc.

(4) By using a hydraulic valve which may be adjusted by a single operating lever to positions for lifting, lowering, stopping and locking the receptacle at any point in its arc, we simplify control so that one hand will do what previously required a hand and a foot in our patented machine.

(5) By using a safety valve set to release at a predetermined pressure, we can limit the proportion of the motor power of the tractor which can be thrown into the hoisting system. This enables us to design the machine strong enough to hoist its load without being forced to add strength to stand the full power of the tractors which is many times in excess of the power required for lifting the receptacle.

(6) The shock resulting from the free fall of the receptacle from an elevated position to a point where the tips of its teeth strike on a hard surface is far in excess of any legitimate working strain to which the tractor can subject it. By using oil as a power medium the friction of the pipe lines tend to cushion the free fall of the receptacle when dropping to loading position, thus obviating the necessity of designing it strong enough to stand the shock described above.

(7) The present machine is simpler in construction because less parts are required to make it, less weight is required to produce a given strength, the carrying load on the tractor is accordingly less and tractor life is prolonged thereby.

These, and other advantages which will appear as the description preceeds, are attained in the machine shown in the accompanying drawings, wherein

Fig. 1 is a side elevation of a tractor of conventional type equipped with our novel operating mechanism for the material handling receptacle, and showing the same in full and dotted lines in various operating positions.

Fig. 2 is a detail view of a choke device which may be used when desired.

Fig. 3 is a partial plan view of Fig. 1.

Fig. 4 is a front elevation of Fig. 1.

Fig. 5 is an elevation, partly in section, through a ram.

Fig. 6 is an enlarged section on approximately the line 6—6, of Fig. 4.

Figs. 7 and 8 are longitudinal sections through the three-way control valve for the hydraulic rams, Fig. 7 showing the position of the valve parts when the receptacle is raised, and Fig. 8 showing the position of the valve parts when the receptacle is lowered, and

Fig. 9 is a diagram of the fluid circuit and also showing the position of the valve parts when the receptacle is stopped and locked.

In accordance with our present invention we provide a driving member, preferably taking its

power from the motor of the tractor or other vehicle, and a pair of driven members connected with said driving member and with the arm and receptacle assembly. These driven members are pivoted at the sides of the vehicle above the pivot points of the receptacle arms and approximately under the balancing point of the receptacle as it passes over center, and are connected with appropriate pivot points on the arm and receptacle assembly so that on application of the lifting power the receptacle will be raised to its balancing point and on release of the lifting power the receptacle may continue its course by momentum and gravity. The driven members, so located and connected to the arm and receptacle assembly, may be of any desired construction, and as here shown are hydraulically operated rams.

We have indicated generally at 10 the sub-frame and at 10' the motor frame of the tractor. Attached to the sub-frame below the motor frame at each side thereof is an upright supporting structure 11. The structures 11 support in proper location the pivot points 12 for the receptacle arms 13 and the pivot points 14 which form a part of the universal joints 15 which support the cylinders 16 in which operate pistons 17 to form hydraulic rams R. The pistons 17 are connected by universal joints 18 to the receptacle assemly 19 at the pivot points 20.

Power to operate the telescopic rams is furnished by a pump 21 mounted on the motor frame and connected to and driven by the front end of the motor shaft. Oil is fed to the pump from reserve tank 22 through the pipe 23 (Fig. 9) and is pumped under pressure through the pipe 24 into the inlet 25 of valve 26.

When the valve stem 27 is moved by means of lever 63 (Fig. 1) to the position shown in Fig. 7, the oil under pressure from said pump is discharged through the outlet 28 into the pipe 29 to T 30 where the oil is divided and sent through branch pipes 31 and 32 to the rams R, causing the pistons 17 to be forced into the rams and the receptacle 19 to be lifted.

When the receptacle is lifted to approximately its vertical balancing point, the pistons 17 are released from oil presure by sliding the valve stem 27 to th eposition of Fig. 8. In this position the momentum of the receptacle 19 will exert back pressure on the oil in the rams R forcing the pistons 17 back out of the rams so that the oil flows in reverse direction through opening 28 in valve 26 and out through opening 33 into pipe 34 and thence back to the reserve tank 22. During this action the oil from the pump line 24 entering the valve at 25 is by-passed through the valve and back to reserve tank 22 through outlet 33.

When desired to stop the motion of the receptacle and lock it in any position in its arc, the valve stem 27 is moved to the position shown in Fig. 9. In this position the oil from the rams R is prevented from passing through the valve by a stop 35 across the opening 28 while the oil from the pump by-passes as in Fig. 8.

To limit the power that can be applied to the hoist, we preferably provide a conventional safety valve 36 connected by pipe 37 with the high pressure line 24 from the pump and discharging through the pipe 38 into the reserve tank 22.

The oil under pressure from the pump, having passed through the circuit as shown in Fig. 9, is passed through the universal joints 15 and thence to the driving ends of the cylinders 16 through pipe lines 39. These pipes each connect with a cylinder head 40. The oil thus admitted accumulates pressure in the piston chamber 42, operating against the piston head 43 and expanding the cup leather 44 thereof against the wall of the cylinder 16, thereby forcing the piston head 43 of the piston to withdraw inside of cylinder 16 and shorten the combined over-all length of the cylinder and piston.

The cylinder head is suitably packed as at 45 and is provided with a conventional wiper 46, and the outside diameter of each cylinder 16 is reduced between points 47 so that the universal joint 15 may be more securely clamped thereto.

Referring to Fig. 6, wherein we have detailed the method of mounting a cylinder 16 in its universal joint 15 and of circulating the oil therethrough, the numeral 15a designates the outer ring of the universal joint supported on the pivots 14 and 14a. The ring 15a supports the inner ring 15b of the universal joint to which are attached in any suitable manner the clamp sections 16b for the cylinder 16.

Conduits 32 and 39 are connected with each other through each universal joint as follows:

Pivot pin 14 has an axial bore 48 terminating adjacent each end in radial ports 49 and 50. The port 50 registers with an annular passage 51 in a bearing 52 into which conduit 32 connects. The port 49 connects in a similar manner with one end of a passage 53 within a section of the ring 15a. The other end of this passage 53 connects in a similar fashion with an axial passage 54 in the inner ring 15b into which the conduit 39 is fitted.

The roof 55 is supported by four posts 60 attached to the structure of the tractor independent of the ram supports 11 which take the hoisting strain. The roof has a downwardly and rearwardly slanting surface formed by the plate 61 which is enclosed by decorative sides 62.

In operation, as the pistons 17 are drawn into the cylinders 16 by oil pressure operating against the piston heads 43, the distance between the pivotal attachment points 14 and 20 is shortened until the receptacle arms 13 and the rams R approach a vertical and upwardly pointing position at or near the center of balance of the receptacle.

At this time, the hoisting power is released and the momentum of the receptacle 19 acquired during such lift carries the receptacle over vertical center whereupon gravity assists momentum in carrying the receptacle to the ground level on the opposite end of the vehicle, or to any point in its arc at which it may be desired to stop the receptacle, which is accomplished by shifting valve stem 27 into the position shown in Fig. 9.

If desired, we may introduce an adjustable choke to check gradually to any desired degree the momentum of the loaded receptacle as it falls towards and before it reaches its stopping position, and release this check so that it will not interfere with the speed of fall of the empty receptacle on its return trip towards loading position. A simple method of accomplishing this is illustrated in Fig. 2 wherein valve handle 63, when thrown ahead into dotted line position, is stopped before the flow of oil is fully released by the bolt head 64 and thereby chokes the flow of oil and checks the momentum of the loaded receptacle as it falls towards dumping position.

The bolt head 64 is held in the position shown by a compression spring 65 and nut 66 against the upright 67. If the proper choke for the

loaded bucket unduly slows down the fall of the empty bucket, the operator by pressing hard enough on valve handle 63 to compress the spring 65 can accomplish a complete release of the oil and an unchecked drop.

If desired, we may employ double acting rams instead of the single acting rams shown. In such case, it is only necessary to add to the release position, which now permits the receptacle to pass its balancing point, a reverse flow position to operate when the receptacle has passed dead center so that it will be positively forced down instead of dropping by gravity.

If desired, a larger ram at one side of the vehicle may be substituted for the two rams shown and its lifting power may be divided between the two sides of the receptacle assembly through any suitable rigging. In either case, the rams R may be attached to the side frames 11 at their ends or at some point along their length.

Although the rams R are shown as mounted in universal joints 15 and universally jointed at their other ends at 18 to the receptacle assembly, it is obvious that they could be constructed with horizontal pivots at 14 and either with pivots or without joints at 18. However, the universals are introduced to lengthen the life of the piston head packing.

By raising the height of side frames 11 and moving the attachment points 20 to some point on the arms 13 nearer the pivot points 12 and by also substituting shorter and more powerful rams R, the same cycle could be accomplished by having the rams turn down during the cycle instead of turning up as shown.

Although we have described the oil pump as driven from the tractor motor, it is obvious that it could be driven from an independent motor.

Although we have shown our invention as applied to a crawler tractor of conventional type, it will be understood, however, that the invention is capable of application to other self-propelled vehicles, as wheel tractors, trucks or the like.

Various other modifications in the construction, arrangement and operation may obviously be resorted to within the spirit and scope of our invention as defined by the appended claims.

What we therefore claim and desire to secure by Letters Patent is:

1. In earth moving equipment for use with a self-propelling tractive vehicle, a pair of supporting arms pivoted adjacent the sides of said vehicle, a receptacle mounted adjacent the outer ends of said arms, said arms being of a shape and length to carry said receptacle in a vertical arc from loading position at one end of the vehicle along its fore and aft center line and past the pivot points of said arms to dumping position, a second set of pivot points located adjacent the sides of the vehicle above and substantially in vertical line with the arm pivot points and in fore and aft location approximately under the balancing point of the receptacle as it passes over center, power means operating from said second set of pivot points and acting on said arm and receptacle assembly to cause said assembly to be lifted when power is applied, and a manual control for applying said power, for terminating said power application and concurrently releasing said power means so that either the weight of the receptacle or its momentum as it passes over center will be sufficient to reverse the direction of travel of said power means, and for arresting the movement of the receptacle at any point by stopping the travel of said power means.

2. The combination of claim 1, the power means being telescopic rams pivotally connected to said second set of pivot points and to said arm and receptacle assembly.

3. The combination of claim 1, the power means being telescopic rams, and said rams being equipped with universal joints, one joint being adjacent said second set of pivot points and the other joint being between the end of the piston and the receptacle assembly.

4. The combination of claim 1, the power means being telescopic rams pivotally connected to said second set of pivot points and to said arm and receptacle assembly, the fluid for operating the rams being introduced into them through said second set of pivot points.

5. The combination of claim 1, the power means being telescopic rams pivotally connected to said second set of pivot points and to said arm and receptacle assembly, and a choke associated with said manual control for optionally increasing to a predetermined amount the frictional resistance between the fluid line and the fluid and for decreasing such resistance at will.

6. The combination of claim 1, and a protective roof sloping rearwardly with elevated sides to discharge rearwardly and prevent side spillage of overflow material falling from the elevated receptacle.

7. In earth moving equipment for use with a self-propelling tractive vehicle, a pair of supporting arms pivoted adjacent the sides of said vehicle, a receptacle mounted adjacent the outer ends of said arms, said arms being of a shape and length to carry said receptacle in a vertical arc from loading position at one end of the vehicle along its fore and after center line and past the pivot points of said arms to dumping position, a pair of ram supports attached adjacent the sides of the vehicle and extending upwardly therefrom and containing a second set of pivot points located above and substantially in vertical line with the arm pivot points and in fore and aft location approximately under the balancing point of the receptacle as it passes over center, telescopic rams carried by said ram supports and pivotally connected to said second set of pivot points and to said arm and receptacle assembly and acting on said arm and receptacle assembly to cause said assembly to be lifted when power is applied, and a manual control for applying said power, for terminating said power application and concurrently releasing said power means so that either the weight of the receptacle or its momentum as it passes over center will be sufficient to reverse the direction of travel of said power means, and for arresting the movement of the receptacle at any point by stopping the travel of said power means.

8. The combination of claim 7, the ram supports being attached below the motor frame of the vehicle and the rams being driven by a pump mounted on the motor frame of the vehicle.

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