April 20, 1943. T. K. ANDERSEN ET AL 2,316,760

MATERIAL COLLECTING AND LOADING APPARATUS

Filed Sept. 26, 1941 4 Sheets-Sheet 1

Fig. 1

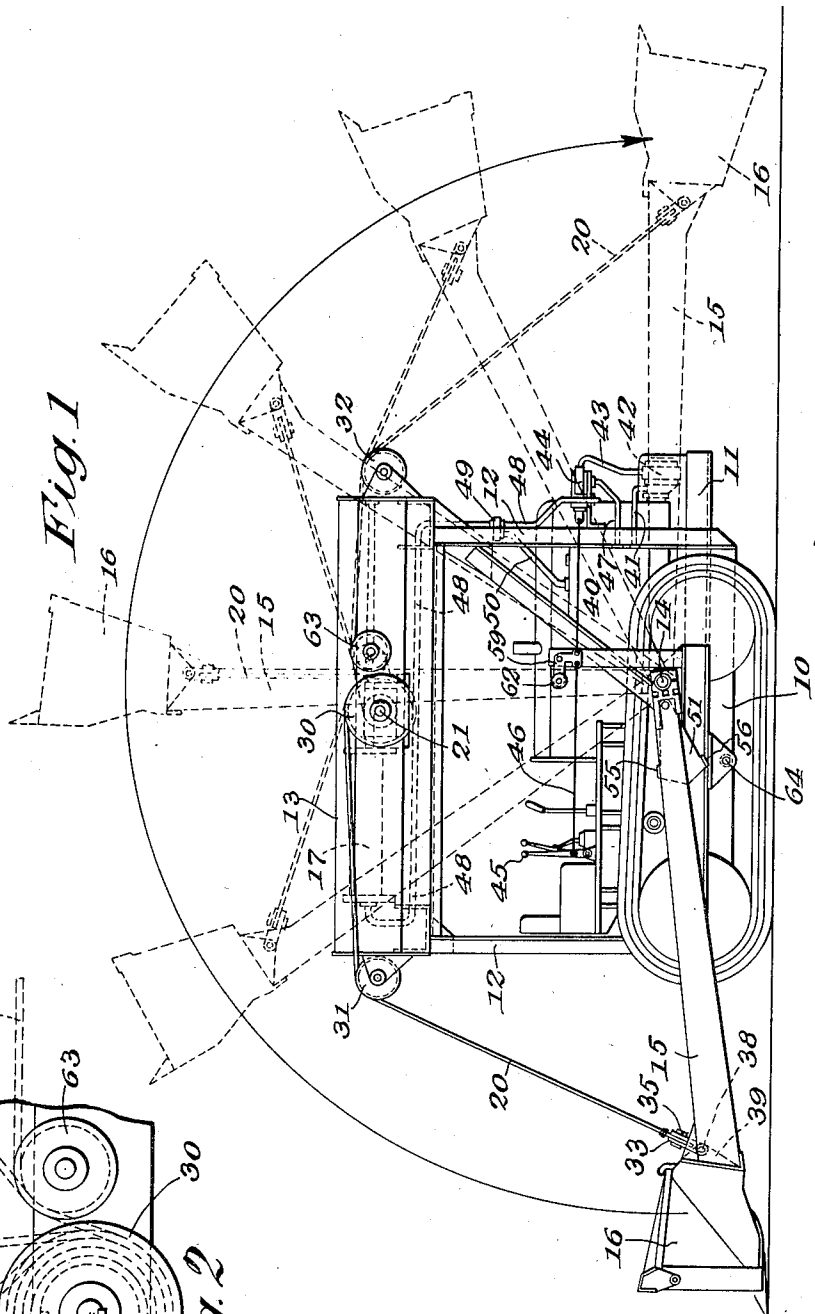
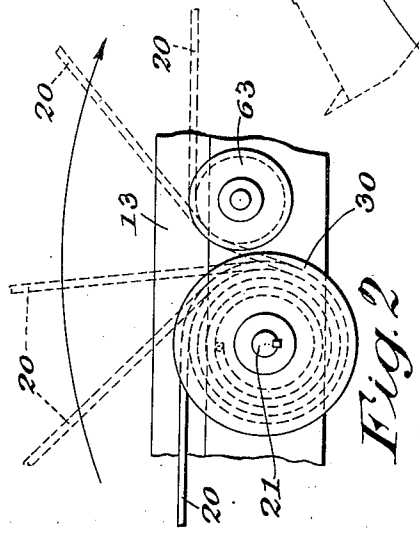


Fig. 2



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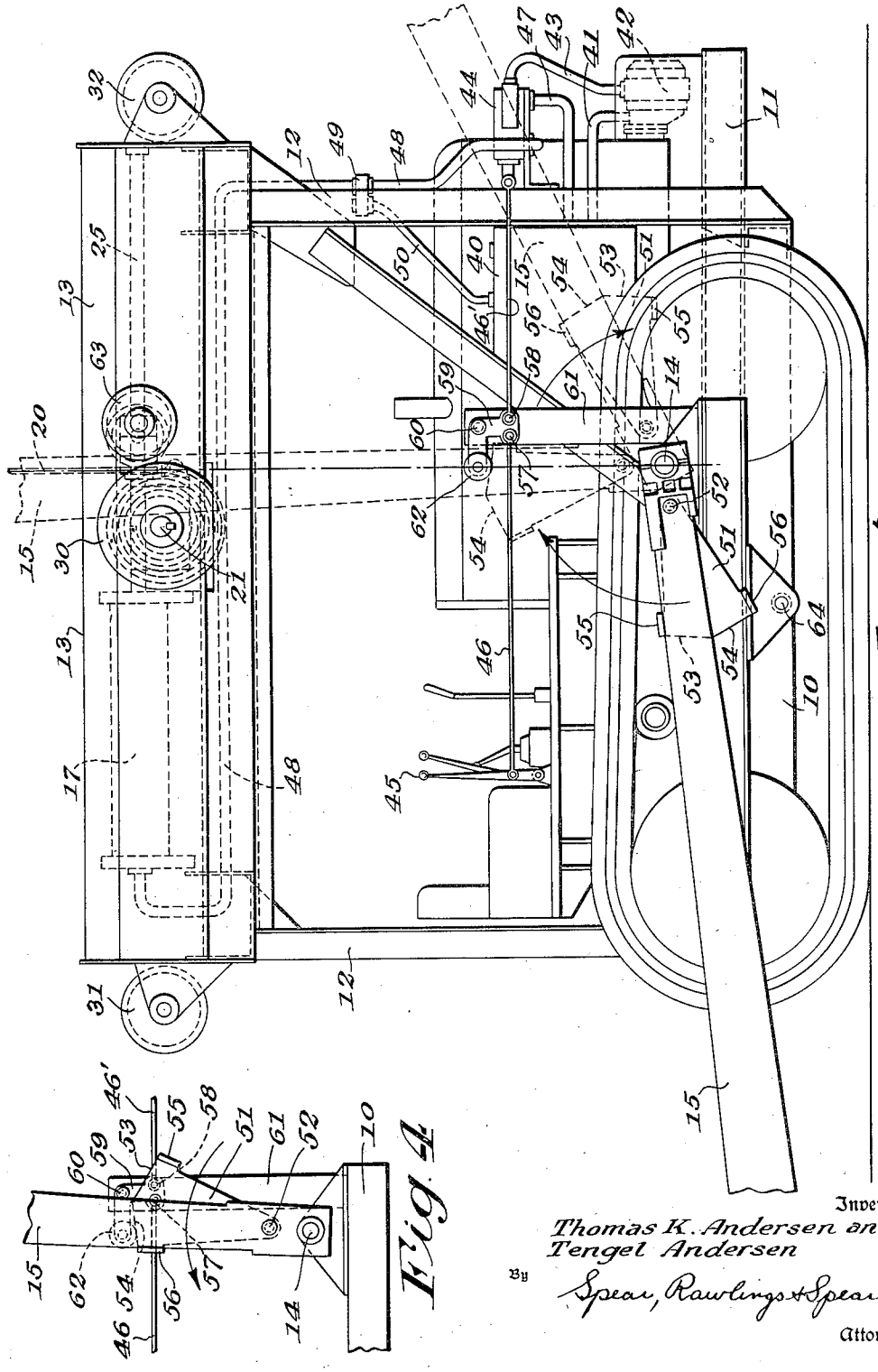

Fig. 3

Fig. 4

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MATERIAL COLLECTING AND LOADING APPARATUS

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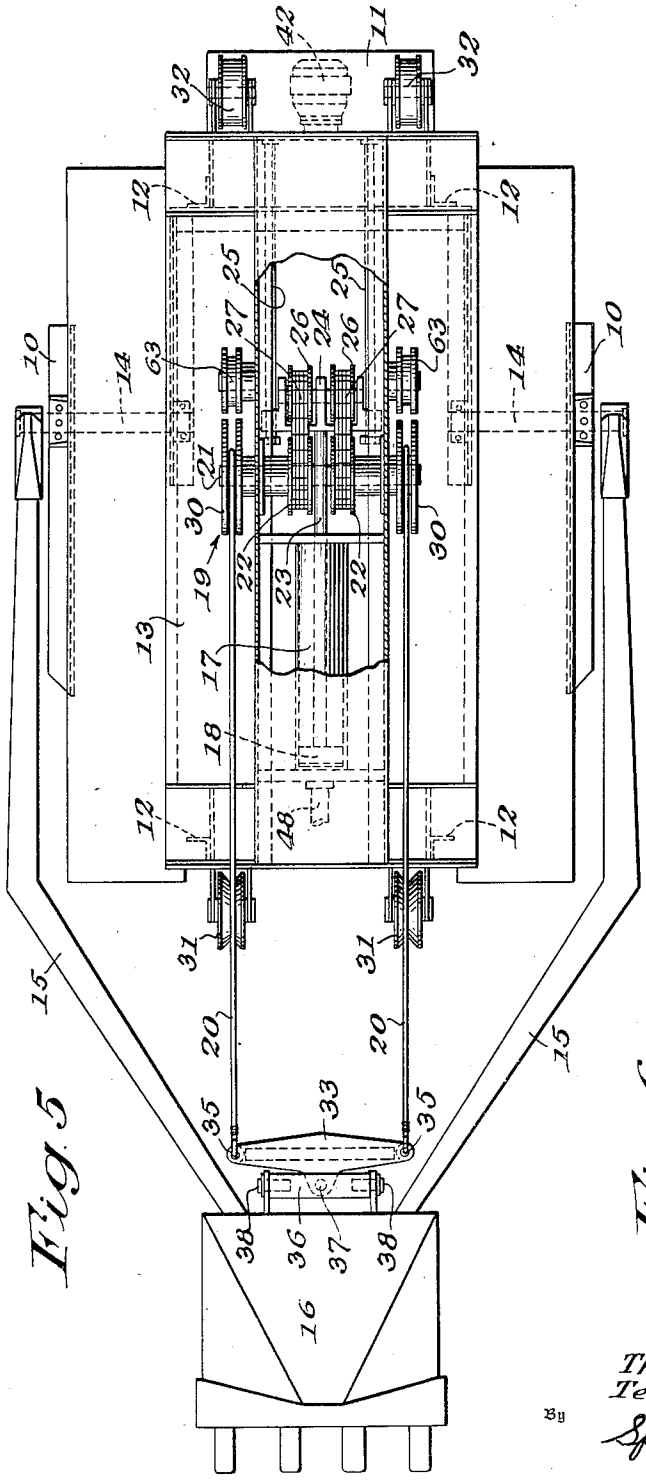

Fig. 5

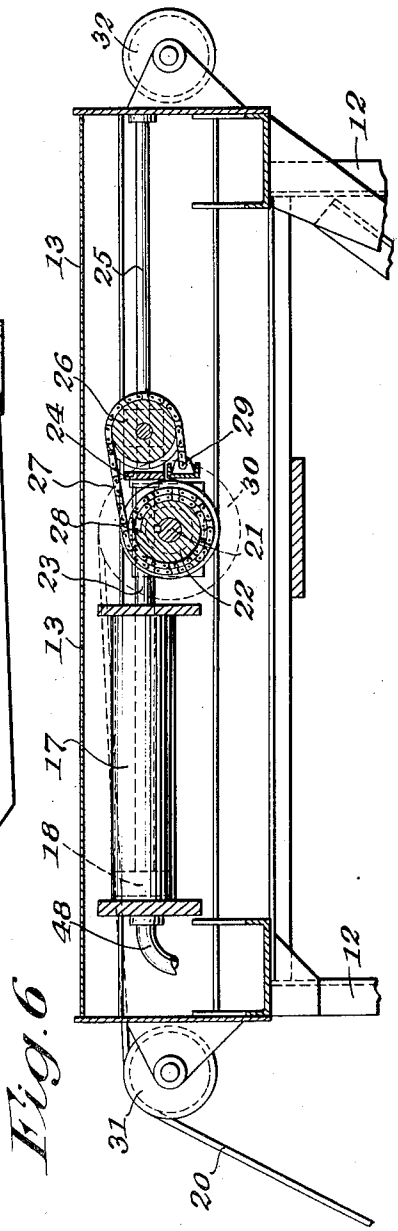

Fig. 6

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MATERIAL COLLECTING AND LOADING APPARATUS

Filed Sept. 26, 1941 4 Sheets-Sheet 4

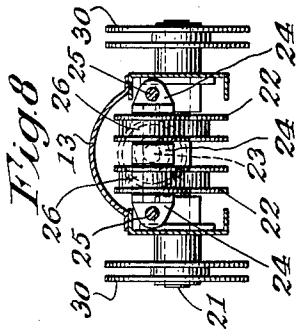

Fig. 8

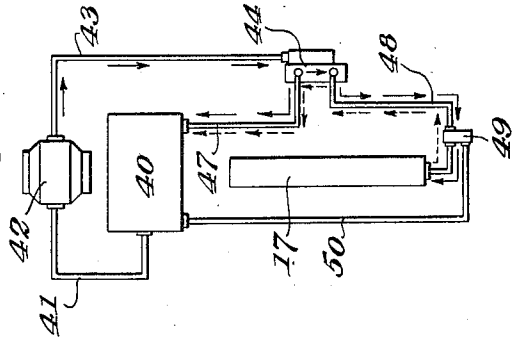

Fig. 11

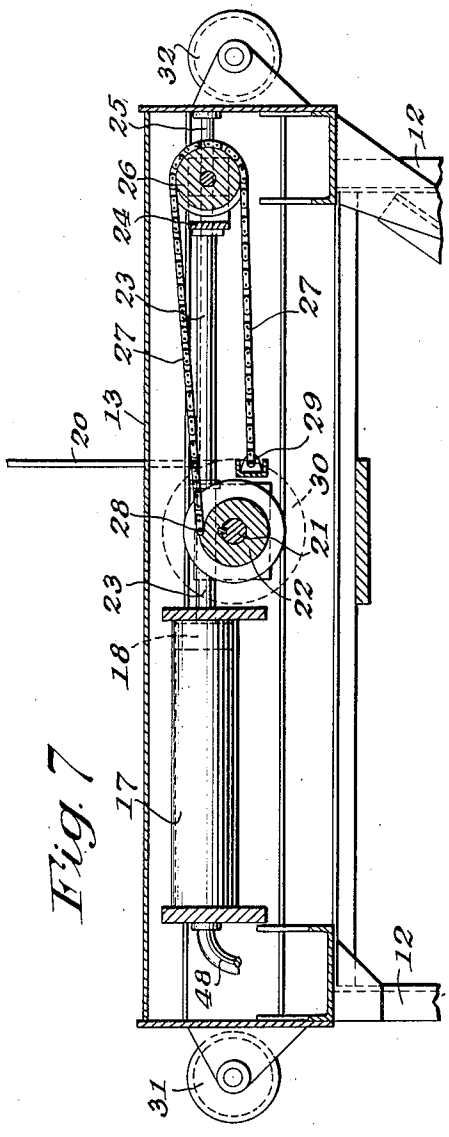

Fig. 7

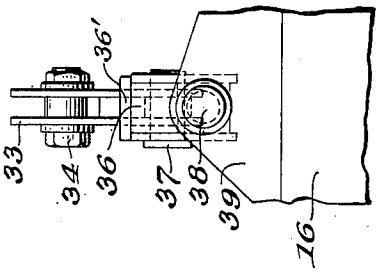

Fig. 10

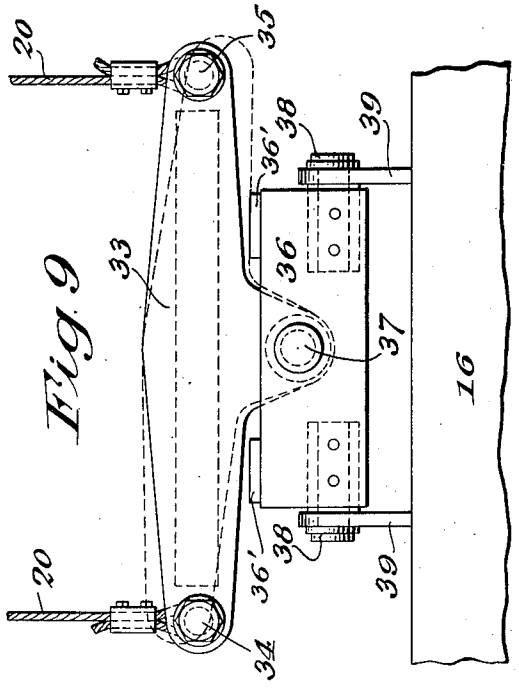

Fig. 9

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Patented Apr. 20, 1943

2,316,760

UNITED STATES PATENT OFFICE

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MATERIAL COLLECTING AND LOADING APPARATUS

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Application September 26, 1941, Serial No. 412,442

10 Claims. (Cl. 214—131)

This invention relates to material loading and collecting machines of the type disclosed in our prior Patents Nos. 2,182,781, and 2,233,237, and has for its general object to improve the construction and operation of our patented machine.

In attaining this object, we have substituted for the winch shown in our aforesaid patents a hydraulic ram to operate the receptacle and have designed novel and efficient motion translating connections for converting the sliding rectilinear movement of the ram piston to rotary motion and applying it to the receptacle.

In conjunction therewith we have also provided our present machine with certain safety devices designed to prevent damage to the machine by reason of carelessness or lack of judgment on the part of the operator or mechanical failure of essential parts.

These, and other features of advantage which will appear as the description proceeds, are illustrated in the accompanying drawings, wherein

Fig. 1 is a side elevation of our machine illustrating in full lines at the left hand end of the view the digging or loading position of the receptacle and in dotted lines several of its numerous positions as it travels from loading to dumping position.

Fig. 2 is a fragmentary detail at one of the cable hoisting drums.

Fig. 3 is a fragmentary elevation of Fig. 1 on a larger scale.

Fig. 4 is a fragmentary detail of the automatic safety device with which our machine is preferably equipped.

Fig. 5 is a partly broken away top plan view of Fig. 1.

Fig. 6 is a fragmentary side elevation partly in section of the hydraulic ram and windlass in the position they assume when the receptacle is being lowered.

Fig. 7 is a view similar to Fig. 6 but showing the position of said parts when the receptacle is being raised.

Fig. 8 is a fragmentary detail of the windlass.

Figs. 9 and 10 are fragmentary details of the equalizing device for the receptacle hoisting cables, and

Fig. 11 is a diagram of the fluid pressure circuit.

Referring to Figs. 1 and 3, the sub-frame of the tractor is designated at 10 and the pump support at 11. Rising from the sub-frame at the four corners thereof are uprights 12 supporting a roof 13. Pivoted at 14 to the sides of the tractor is a pair of receptacle arms 15 of the required shape and length to carry the receptacle 16 in an arcuate overhead path from one end to the other of the machine.

The receptacle is actuated by a hydraulic ram comprising a cylinder 17 and a piston 18, and the straight line reciprocating movement of said piston is applied to said receptacle as rotary motion by suitable motion transmitting connections from the piston to the receptacle.

The hydraulic ram and its associated parts are mounted in the roof of the machine longitudinally thereof and preferably in its central fore and aft line. So located, the mechanism is protected by the roof against accidental injury. Moreover, the mechanism may be more compact in design and more efficient in operation than would otherwise be the case.

The ram piston is connected to the receptacle through a windless 19 of modified "Chinese" type which winds and unwinds the receptacle hoisting cables 20 accordingly as the piston 18 is projected from or retracted within its cylinder 17.

The windlass includes a drum shaft 21 transversely journaled in suitable bearings carried by the roof structure. Keyed to said shaft is a pair of laterally spaced chain drums 22 (Fig. 5) between which the stem 23 of the piston 18 extends. Yoked to the forward end of the stem 23 is a longitudinally sliding crosshead 24 which guides on suitably spaced guides 25 carried by the roof structure. Fast on the crosshead at either side of the piston stem 23 is a pair of laterally spaced chain rolls 26 which are longitudinally alined with the drums 22. Passing around each alined drum and roll is a chain 27 or its equivalent. Each chain is dead-ended at 28 to a drum 22 and at 29 to a fixed point. (See Fig. 6.)

When power is applied to the piston 18 to slide it forwardly or rearwardly in the cylinder 17, the chains 27 are wound upon or unwound from the drums 22, rotating said drums and their shaft 21 in one direction or the other (see Figs. 6 and 7), and causing the receptacle to raise or lower by virtue of the fact that the hoisting cables 20 for said receptacle are trained over and dead-ended to drums 30 fast on the ends of said shaft (see Fig. 5).

Pairs of guide rolls 31 and 32 mounted at the ends of the roof structure in longitudinal alinement with the cable drums 30 guide and control the receptacle hoisting cables as the receptacle moves from one end of the machine to the other.

The hoisting cables 20 are preferably made fast to the receptacle by means of a suitably reinforced equalizer bar 33 to the ends of which the lower ends of the cables are fastened as at 34 and

35 (see Figs. 9 and 10). The equalizer bar 33 is bifurcated to straddle a block 36 to which it is centrally pivoted at 37. The block 36 itself is supported at its ends on oppositely disposed trunnions 38 extending from a pair of spaced bracket arms 39 carried by the receptacle. By this construction the hoisting effect of the two cables 20 is equalized.

At either side of the pivot 37 the upper face of block 36 is provided with raised stops 36'. One or the other of these stops will be contacted by an adjacent portion of bar 33 should one of the cables 20 break (see dotted line showing of Fig. 9) thereby enabling the other cable to continue to function.

Power is applied to the ram from a reserve tank 40, preferably mounted on the forward end of the tractor and containing oil or other fluid under presure. Said tank communicates by a pipe 41 with the inlet side of a pump 42 also mounted on the forward end of the tractor and preferably driven from the tractor motor by any suitable power take-off. Pipe 43 leads from the outlet side of the pump to a control valve 44 mounted on the tractor and operated by a hand lever 45 arranged within convenient reach of the operator's hand (see Figs. 1 and 3). Lever 45 is linked to valve 44 by links 46, 46'. By arranging both the reserve tank and the pump at the forward end of the tractor, we counterbalance to some extent the tendency of the tractor to tip when the receptacle is in digging position.

The control valve 44 may be similar to that disclosed in the companion application of Carle D. Henry, Serial No. 405,307 filed August 4, 1941. It has three operating positions, viz., a receptacle raising position, and a receptacle stop and hold position.

When the valve is adjusted to receptacle holding position, the pressure fluid is passed through said valve to the reserve tank by means of pipe 47. (See fluid circuit diagram Fig. 11.)

When the valve is adjusted to receptacle raising position, the pressure fluid travels through the valve and along pipe 48 to the cylinder 17 and impinges upon the piston head 18 to slide the piston forwardly to the receptacle raising position of Fig. 7.

When the valve is adjusted to receptacle lowering position, the weight of the load against the piston forces the fluid back out of cylinder 17 and along pipe 48 in reverse direction back to the valve and thence by way of pipe 47 back to the reserve tank.

In order to permit the pressure fluid to return directly to the tank if an overload is applied to the load end of the ram, we preferably cause the fluid in reaching the ram to pass through a conventional safety valve 49 interposed in the circuit between the control valve 44 and the reserve tank and connected by pipe 50 with said tank.

The raising effect exerted by the hydraulic ram is preferably discontinued substantially at the moment that the receptacle reaches approximately vertical position in its travel. The receptacle continues its descent by gravity and momentum, but under the control, however, of the valve 44 which at substantially this moment is shifted to lowering position so that the pressure fluid returning from the ram to the reserve tank through said valve may act to decelerate the speed of descent of the receptacle and to cushion its drop. As the receptacle approaches its final lowered position, or whenever it is desired to stop and hold the receptacle at any point in its travel between its raised and lowered positions, the control valve 44 is shifted to hold position, causing the pressure fluid pasing therethrough to cushion the shock of the stopping action.

In order to ensure against failure of the operator, through inattention or carelessness, to adjust the valve to its proper position accordingly as the receptacle moves in either direction past vertical, we provide the automatic safely detailed in Fig. 4. This comprises a trip cam 51 pivoted at 52 to one of the receptacle arms 15 and constructed as a generally triangular plate having the side thereof which is remote from the pivot point 52 formed with two oppositely inclined cam surfaces 53 and 54, terminating at their low points in down-turned stops 55 and 56.

The adjacent ends of the links 46—46' which transmit the operating motion of the valve shift lever 45 to the control valve 44 are fastened at 57—58 to a bell crank lever 59 which is pivoted at 60 to a suitable upright 61 rising from the tractor frame. The lever 59 carries a cam roll 62 disposed in the path of movement of the trip 51 as said trip swings with the receptacle arms 15 in either direction past vertical.

The automatic safety operates as follows:

The lever 45 is first manually shifted to receptacle raising position. As the receptacle arms approach vertical, cam surface 53 of trip 51 contacts roll 62 and rocks lever 59 in a direction to shift valve 44 automatically to receptacle lowering position, whereupon the operator manually holds lever 45 in load lowering position to permit the receptacle to continue its descent. When the receptacle reaches the desired lowered position the stop 56 of trip 51 contacts the adjacent edge of arm 15 (see Fig. 3), thus setting the trip in position to again coact with the cam roll 62 in the return movement of the receptacle.

In such return, the operator first manually shifts the valve to load-raising position. As the receptacle reaches approximately vertical position, the other cam surface 54 of the trip 51 coacts with roll 62 to rock lever 59 in the opposite direction, thereby automatically moving the valve to load-lowering position, after which the operator manually holds the valve 44 in load-lowering position. When the receptacle reaches its final lowered position in its return travel, stop 55 of trip 51 contacts the adjacent edge of arm 15 to re-set the trip.

In order to avoid a change in leverage, due to the unwinding of the cables from drums 30 as the receptacle passes vertical center position and approaches lowering position, we preferably mount a pair of idler rolls 63 (see Figs. 2 and 5) between said drums and the forward guide rolls 32. These idlers are longitudinally alined with the drums 30 and with both sets of guide rolls 31 and 32, and in addition to the function just stated have the further function of taking up the cable slack (see Fig. 2) as well as assisting to keep the cables in line with the guide roll at all times.

When the receptacle is being raised from loading position and as it reaches approximately vertical position, there will be approximately a quarter turn less cable wound on each drum 30 than when the receptacle was in lowered position. This quarter turn of cable assists to decrease the lifting speed of the receptacle until such time as the receptacle reaches approximately vertical position, but increases the lifting speed of the

empty (and lighter) receptacle in its return motion.

By enclosing the hydraulic ram and windlass within the roof structure, this mechanism is protected against falling dirt, rocks, etc. By making the roof sectional one or more sections thereof may be removed when access to the parts enclosed thereby is necessary for purposes of inspection or repair.

Where a bulldozer, snow plow blade, or other material-pushing implement is to be used in conjunction with our machine, the attaching arms of such implement may be made fast to the tractor frame at the points marked 64 in Fig. 3.

Various other modifications in construction and arrangement may obviously be made 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 combination with a self-propelling tractive vehicle having a roof, a receptacle, a pair of receptacle supporting arms pivoted adjacent the sides of said vehicle for swinging the receptacle in a vertical arc over said roof from a loading position at one end of the vehicle to a dumping position past the pivot points of said arms, power means for actuating said arms comprising a hydraulic ram mounted on said roof in the fore and aft line of the vehicle and motion translating connections also mounted on said roof and connected to the ram piston and the receptacle for converting the sliding rectilinear motion of the ram piston to rotary motion applied to the receptacle for swinging the receptacle upwardly from either said loading position or said dumping position past the pivot points of said arms, means for supplying pressure fluid to said ram, a valve in control of said pressure fluid, and a valve lever operatively connected to said valve.

2. The combination of claim 1, said motion translating connections comprising a drum shaft journaled transversely of the roof and carrying a hoisting drum and a driving drum, a longitudinally sliding cross-head yoked to the outer end of the ram piston and carrying a driving roll, a fixed guide for said cross-head extending longitudinally of the roof, and a flexible driving element passing around said driving roll and fastened at one end to the driving drum and at its other end to a fixed point adjacent said driving drum.

3. The combination of claim 1, and an automatic valve actuator comprising a trip element pivoted to one of the receptacle arms and engageable by such arm to travel therewith in a lagging relation in either direction of the swing of the arm, and a valve actuating element disposed in the path of travel of said trip element for actuation thereby as said receptacle arm passes approximately vertical center in either direction of its swing.

4. In combination with a self-propelling tractive vehicle, a receptacle, a pair of receptacle supporting arms pivoted adjacent the sides of said vehicle for swinging the receptacle in a vertical arc over said vehicle from a loading position at one end of the vehicle to a dumping position past the pivot points of said arms, a hydraulic ram for actuating said arms, means for supplying pressure fluid to said ram, a valve in control of said pressure fluid, a valve lever operatively connected to said valve, and motion translating connections from the ram piston to the receptacle for converting the sliding rectilinear motion of the ram piston to rotary motion applied to the ram, comprising a drum shaft carrying hoisting drums and driving drums, hoisting cables passing over said hoisting drums and anchored to said receptacle, a cross-head yoked to the outer end of the ram piston and carrying driving rolls, and flexible driving elements passing around the driving rolls and each fastened at one end to a driving drum and at its other end to a fixed point adjacent said driving drum.

5. The combination of claim 4, and idlers disposed in line with said hoisting drums at the side thereof remote from the receptacle when in loading position for taking up cable slack during the movements of the receptacle.

6. The combination of claim 4, and an equalizer device comprising a block pivotally carried by a wall of the receptacle, and a bar to the ends of which the cables are anchored, said bar being pivoted between its ends to said block, and there being a stop at either side of said pivot on one surface of said block for contact with the adjacent surface of said bar in the event that one of the hoisting cables should break whereby to enable the unbroken cable to continue to work.

7. The combination with a receptacle supporting arm pivoted to swing in a vertical arc past vertical center in either direction, a hydraulic ram for swinging said arm, means for supplying pressure fluid to said ram, a valve in control of said pressure fluid, and a valve lever and linkage from said lever to said valve, of an automatic valve actuator comprising a trip element pivoted to said receptacle arm, and a valve actuating element disposed in the path of travel of said trip element for actuation thereby as said arm passes approximately vertical center in either direction of its swing.

8. The combination of claim 7, said trip element having two spaced cam surfaces for alternate contact with said valve actuating element and two spaced stop surfaces for alternate contact with opposite edges of said arm.

9. The combination of claim 7, said valve actuating element comprising a bell-crank lever to which said linkage is connected, which lever has a portion projecting into the path of movement of said trip element.

10. The combination of claim 7, said trip element having two spaced cam surfaces for alternate contact with said valve actuating element and two spaced stop surfaces for alternate contact with opposite edges of said arm, and said valve actuating element comprising a bell-crank lever to which said linkage is connected, which lever has a portion projecting into the path of movement of said trip element.

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