

Oct. 5, 1943.

T. K. ANDERSEN ET AL

2,330,802

HYDRAULIC RAM

Filed Aug. 30, 1941

3 Sheets-Sheet 1

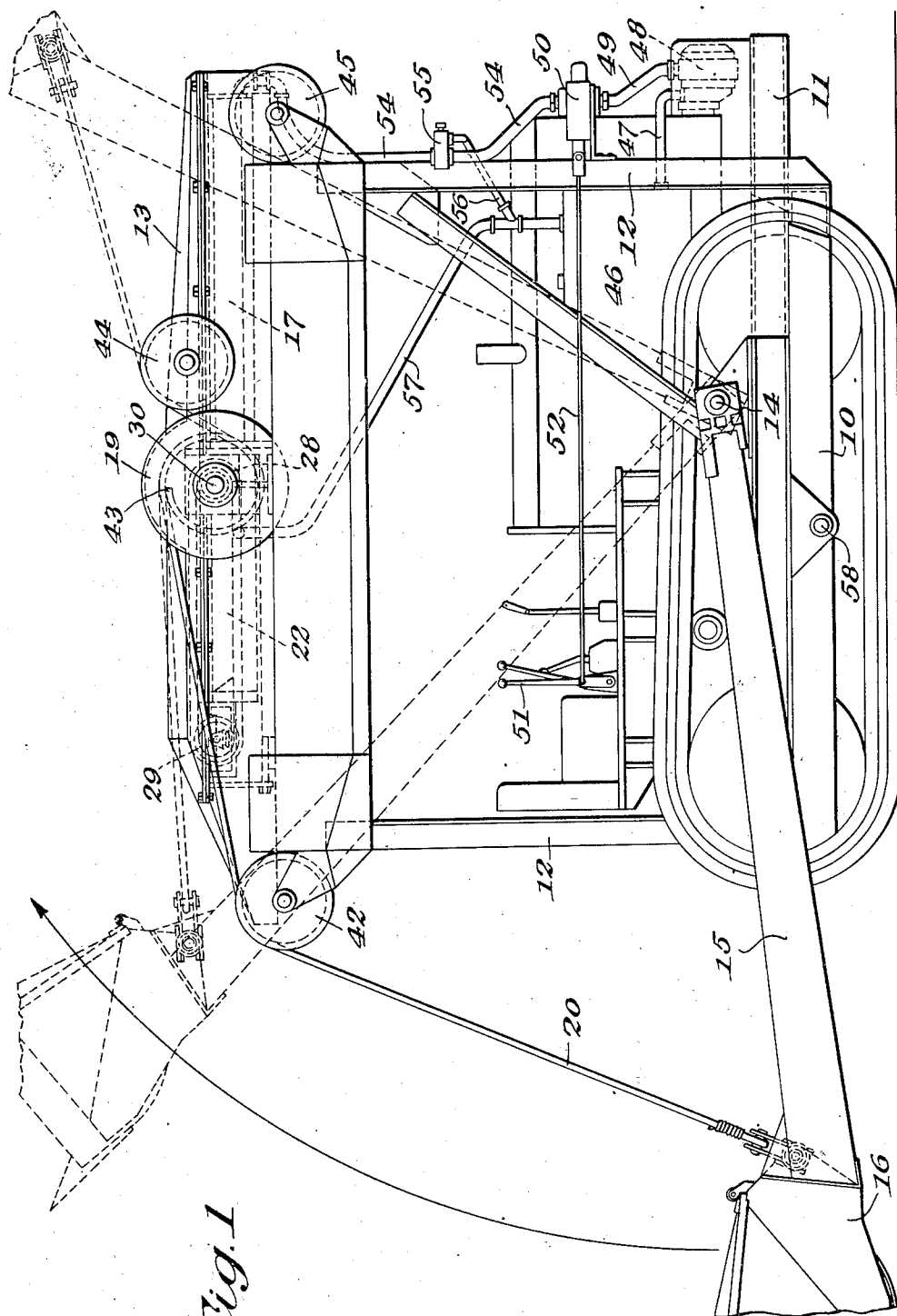


Fig. 1

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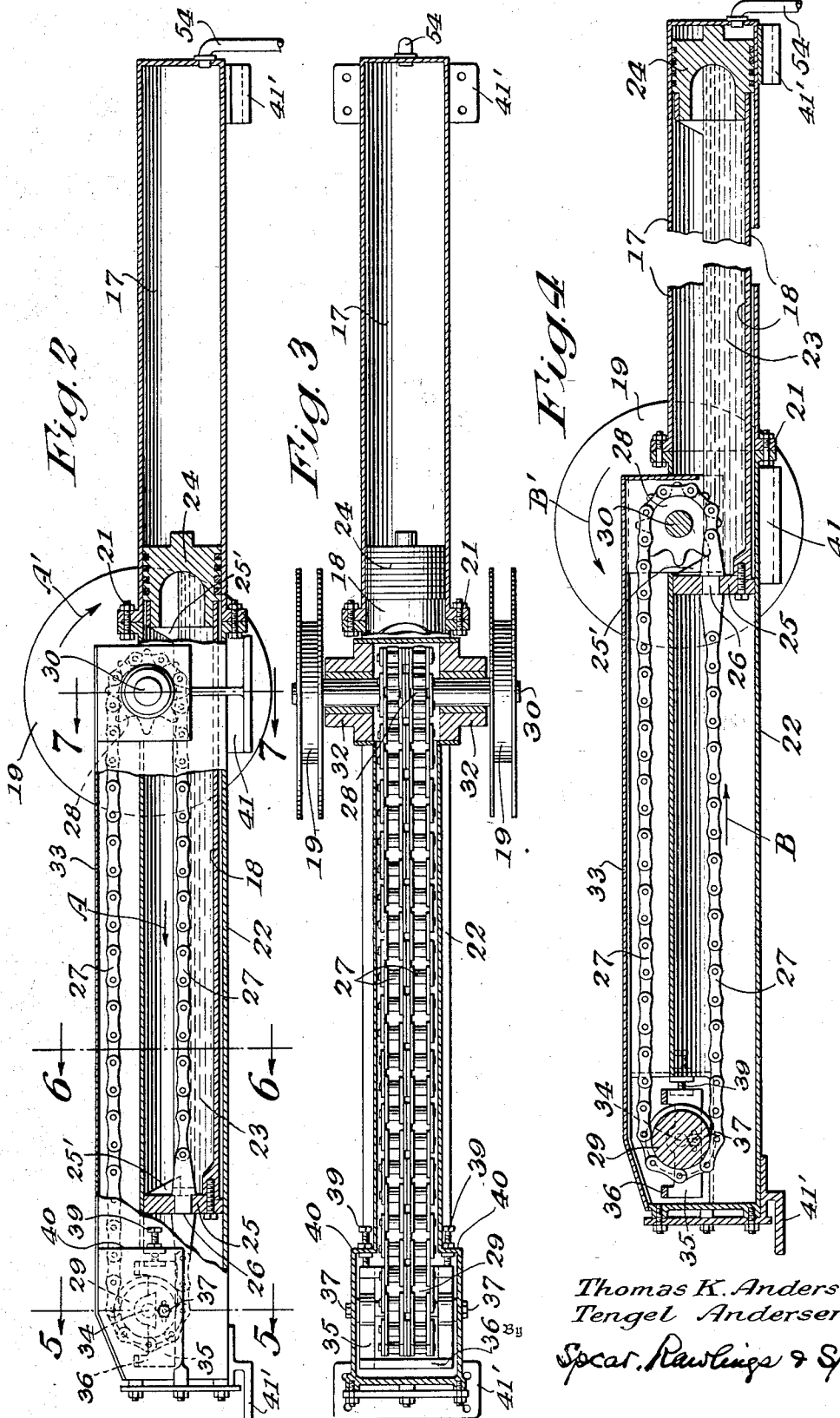
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

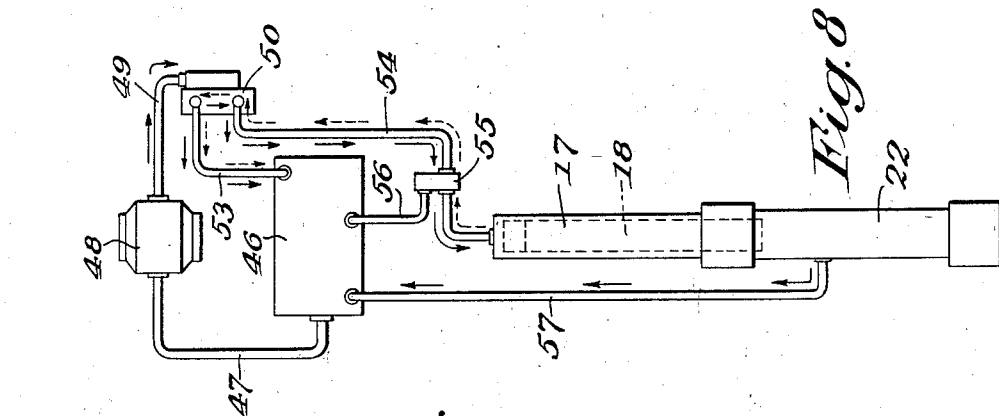


Fig. 8

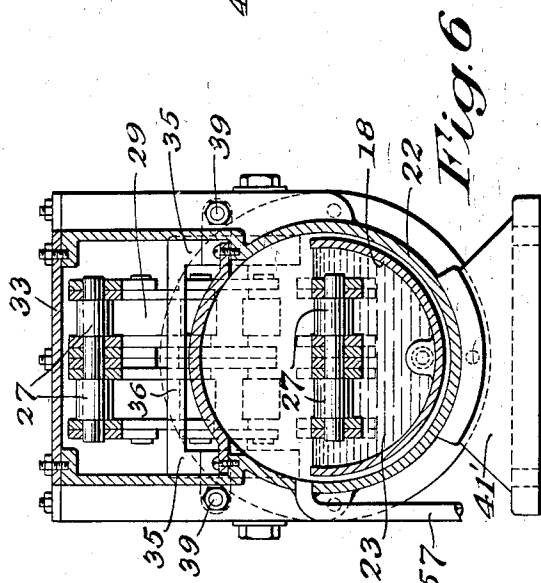


Fig. 6

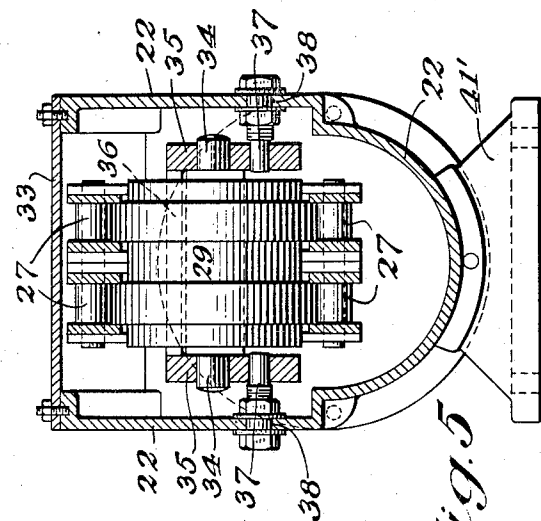


Fig. 5

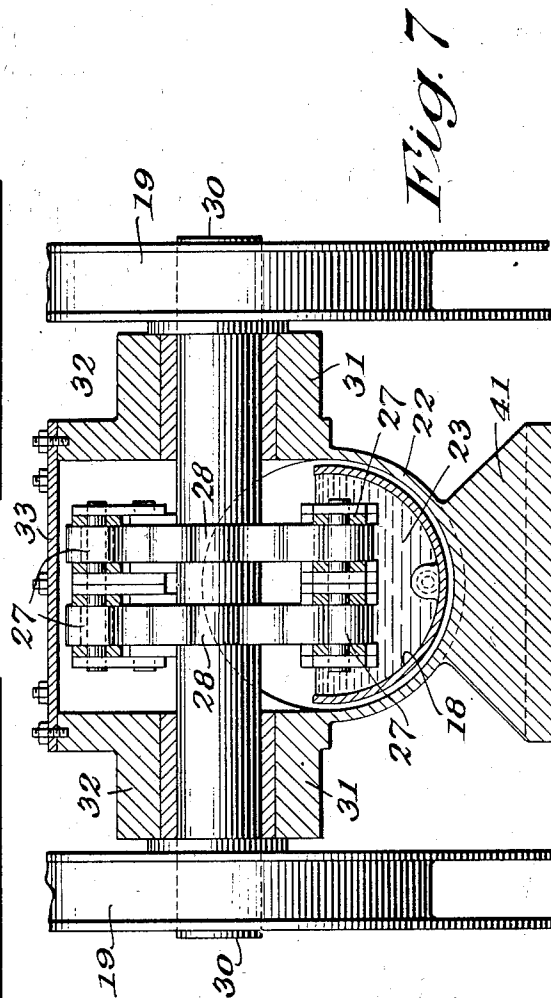


Fig. 7

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UNITED STATES PATENT OFFICE

2,330,802

HYDRAULIC RAM

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Application August 30, 1941, Serial No. 408,915

6 Claims. (Cl. 214—131)

This invention relates to hydraulic rams, and although useful in many different industrial applications, is particularly intended to be used as the power means for swinging the receptacle disclosed in our prior Patents Nos. 2,182,781 and 2,233,237 in an overhead arcuate path from end to end of the vehicle.

For the purposes of this application, we shall discuss our invention in such adaptation, although it will be understood that this treatment is purely illustrative and in no way limiting.

The general object of our invention is to provide a ram which will be positive and reliable under all conditions of service.

Another object is to so design the ram that the sliding rectilinear movement of the ram piston will be most efficiently applied as rotary motion to the receptacle of our patented machine, or to any other load which is to be swung in an arcuate path.

A further object is to so design the ram that the motion-translating parts thereof will be self-lubricating in the operation of the ram.

Other objects and advantages will appear as the description proceeds.

In carrying out our invention, we construct the piston of our ram as a container for a supply of lubricating fluid, and attach to the inner end of the piston rod a guide block to which is anchored an endless chain. The chain is trained over an adjustable chain idler and over a driven sprocket mounted respectively at the ends of a guide cylinder which is aligned with the power cylinder of the ram and within which guide cylinder the anchor block for the chain is guided. Fast to the ends of the sprocket shaft is a pair of cable hoisting drums to which are dead-ended the hoisting cables for the receptacle or other load.

By this construction, the sliding rectilinear motion of the piston is not only efficiently applied to the receptacle or other load as rotary motion, but the sprocket chain and its shaft is continuously lubricated during the operation of the ram.

In the accompanying drawings we have illustrated an embodiment of our invention which we have found highly satisfactory under actual service conditions when installed on a loading machine of the type disclosed in our aforesaid patents.

Fig. 1 is a side elevation of such machine equipped with a hydraulic ram in accordance with our present invention, and showing 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 the numerous positions which the receptacle may assume in its travel from loading to dumping position or vice versa.

Fig. 2 is a side elevation, partly in section, of our novel ram removed from the machine, and showing the ram piston in load-raising position.

Fig. 3 is a plan section of Fig. 2.

Fig. 4 is a view similar to Fig. 2, but showing the ram piston in load-lowering position.

Figs. 5, 6, and 7 are sections on the lines 5—5, 6—6, and 7—7, respectively, of Fig. 2, and

Fig. 8 is a diagram of the fluid pressure circuit.

Referring to Fig. 1, we have designated at 10 the sub-frame of a tractor and at 11 a pump support carried thereby. 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.

Our novel hydraulic ram comprises a cylinder 17 and a tubular piston 18, together with suitable motion translating connections for converting the straight line reciprocating movement of said piston as rotary motion applied to said receptacle, and such 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 as to be protected by the roof against accidental injury.

The ram piston operates a pair of hoisting drums 19 for the receptacle hoisting cables 20.

The power cylinder 17 is fastened at one end as at 21 in any suitable manner to the adjacent end of an aligned guide cylinder 22. The piston rod 18 is half-round in cross-section (see Figs. 6 and 7), but may be of such other appropriate shape as to hold a supply of lubricating fluid 23. This fluid is confined between the head 24 of the piston rod and a guide or equalizing block 25 having stops 25' on its outer face. The piston head 24 is fast to the outer end of the piston rod and snugly fits within power cylinder 17. Block 25 is fast to the inner end of the piston rod and snugly fits within guide cylinder 22.

Anchored as at 26 to block 25 is a chain drive comprising, preferably, a double sprocket chain 27 trained over driven sprockets 28 and idlers 29 at the respective ends of the guide cylinder.

Sprockets 28 are mounted on a transversely extending sprocket shaft 30 to the outer ends of which the hoisting drums 19 are fast. Shaft 30 is journaled in suitable bearings 31 and 32 (Fig.

7) furnished respectively by guide cylinder 22 and a superposed chain box or housing 33. The top wall of chain box 33 is preferably removable to permit ready access to the upper flight of chains.

The idlers 29 are mounted on a shaft 34 (Fig. 5) extending transversely between the side walls 35 of a longitudinally adjustable hanger 36. Hanger 36 is supported from the side walls of guide cylinder 22 by bolts 37 which have limited longitudinal adjustment in slots 38 formed in the side walls of the hanger. The longitudinal adjustment of hanger 36 is effected by means of adjustment screws 39 (Figs. 2, 3, and 4) extending through flanges 40 on guide cylinder 22 and engaging the adjacent end wall of the hanger.

The ram unit is mounted in any suitable manner, as by means of the flanged base 41 and brackets 41' on the roof of the tractor or other vehicle.

The receptacle hoisting cables 20 are guided over suitable guide rolls 42 at the rear end of the vehicle roof and are dead-ended as at 43 to hoisting drums 19, which drums are longitudinally aligned with said guide rolls 42. Forwardly of drums 19 and longitudinally aligned therewith is a pair of spaced idler rolls 44, which take up cable slack as the receptacle passes vertical center position and approaches lowering position and also assist to guide cables 20 onto a pair of guide rolls 45 at the forward end of the vehicle roof.

Pressure fluid is supplied to the ram from a reserve tank 46 (see Fig. 8) preferably mounted on the forward end of the tractor, and containing oil or other fluid. Said tank communicates by a pipe 47 with the inlet side of a pump 48 also mounted on the forward end of the tractor and preferably driven from the tractor motor by any suitable power take-off. Pipe 49 leads from the outlet side of the pump to a control valve 50 mounted on the tractor and operated by a hand lever 51 arranged within convenient reach of the operator's hand. (See Fig. 1.) Lever 51 is linked to valve 50 by suitable linkage 52. The reserve tank and pump are preferably mounted at the forward end of the tractor so as to counterbalance to some extent the tendency of the tractor to tip when the receptacle is in digging position.

The control valve 50 may be similar to that disclosed in the companion application of Carle Henry, Serial No. 405,307, filed August 4, 1941, now Patent No. 2,295,948, dated March 6, 1942. It has three operating positions, viz. a receptacle raising position, a receptacle lowering 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 reserve tank 46 by means of pipe 53.

When the valve is adjusted to receptacle raising position, the pressure fluid travels through control valve 50 and along pipe 54 to power cylinder 17 and impinges upon the piston head to slide the piston inwardly to receptacle raising position. (See Fig. 2.) In this action, the chain anchor block 25 at the inner end of the piston reciprocates chains 27 in the direction of arrow A in Fig. 2, rotating sprockets 28 and with them the cable hoisting drums 19 in a clockwise direction as indicated by arrow A' until the piston has reached the limit of its inward stroke.

When control valve 50 is adjusted to receptacle lowering position, the weight of the load against the piston forces the piston outwardly (see Fig. 4) and the pressure fluid is caused to flow out of power cylinder 17 and along pipe 54 in reverse

direction back to valve 50 and thence by way of pipe 53 back to reserve tank 46.

In this action, the chains 27 are reciprocated in the direction of arrow B in Fig. 4, and the sprockets 28 and drums 19 are rotated counterclockwise, as indicated by arrow B', until the piston reaches the limit of its outward stroke and is stopped by contact of stops 25' on block 25 with said sprockets.

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 55 interposed in the circuit between control valve 50 and reserve tank 46 and connected by pipe 56 with said tank. If desired, also, we may provide an overflow pipe 57 from guide cylinder 22 back to the reserve 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 valve 50 which at substantially this moment is shifted to lowering position so that the pressure fluid returning from the ram to reserve tank 46 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, control valve 50 is shifted to "hold" position, causing the pressure fluid passing therethrough to cushion the shock of the stopping action.

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 58 in Fig. 1.

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. A hydraulic ram, comprising a power cylinder, a guide cylinder abutting said power cylinder and aligned therewith, a piston in said power cylinder, an anchoring element fast to the inner end of said piston to fit within and be guided by said guide cylinder and a head fast to the outer end of said piston to fit within and be guided by said power cylinder, an idler shaft carrying an idler and a driven shaft carrying a sprocket mounted adjacent the respective ends of said guide cylinder and disposed transversely thereof, an endless sprocket chain reciprocable in said guide cylinder and trained over said idler and said sprocket and anchored at a point along its lower flight to said anchoring element, and a drum fast on said sprocket shaft to rotate therewith.

2. The ram of claim 1, the piston being trough-like in cross-section to provide between said anchoring element and said piston head an open top container for a supply of lubricating fluid.

3. The ram of claim 1, the idler shaft and its idler being mounted in a cradle-like hanger disposed within and adjustably connected to the guide cylinder.

4. The ram of claim 1, and a cradle-like hanger for the idler shaft and its idler disposed within said guide cylinder, said hanger having longi-

tudinally extending slots in its side walls and said guide cylinder having suspension bolts projecting inwardly from its side walls and disposed within said slots for permitting longitudinal adjustment of said hanger relative to said cylinder, and adjusting means disposed exteriorly of said cylinder and engaging said hanger for effecting such longitudinal adjustment.

5. For use with a material digging and collecting machine having a roof and having a receptacle to be swung over said roof from one end towards the other thereof, a hydraulic ram mounted on the roof of said machine in the fore and aft line thereof for swinging said receptacle comprising a power cylinder, means to supply pressure fluid to said power cylinder, a guide cylinder abutting said power cylinder and aligned therewith, a piston in said power cylinder, an anchoring element fast to the inner end of said piston to fit within and be guided by said guide cylinder and a head fast to the outer end of said piston to fit within and be guided by said

power cylinder, an idler shaft carrying an idler and a driven shaft carrying a sprocket mounted adjacent the respective ends of said guide cylinder, an endless sprocket chain reciprocable in said guide cylinder and trained over said idler and said sprocket and anchored at a point along its lower flight to said anchoring element, and a receptacle hoisting drum fast on said sprocket shaft to rotate therewith and operatively connected to the receptacle of the machine.

6. A hydraulic ram, comprising a power cylinder, an elongated hollow piston forming a lubricant reservoir, an anchoring element fast to the inner end of said piston, an endless chain anchored to said element, a pair of spaced sprockets over which said chain is trained, one of said sprockets being journaled on the cylinder between the ends of said piston to guide the chain within said lubricant reservoir, and a drum driven by said last-named sprocket.

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