March 30, 1948. F. GARNER 2,438,660

EXCAVATING AND LOADING APPARATUS

Filed Sept. 8, 1944 5 Sheets-Sheet 1

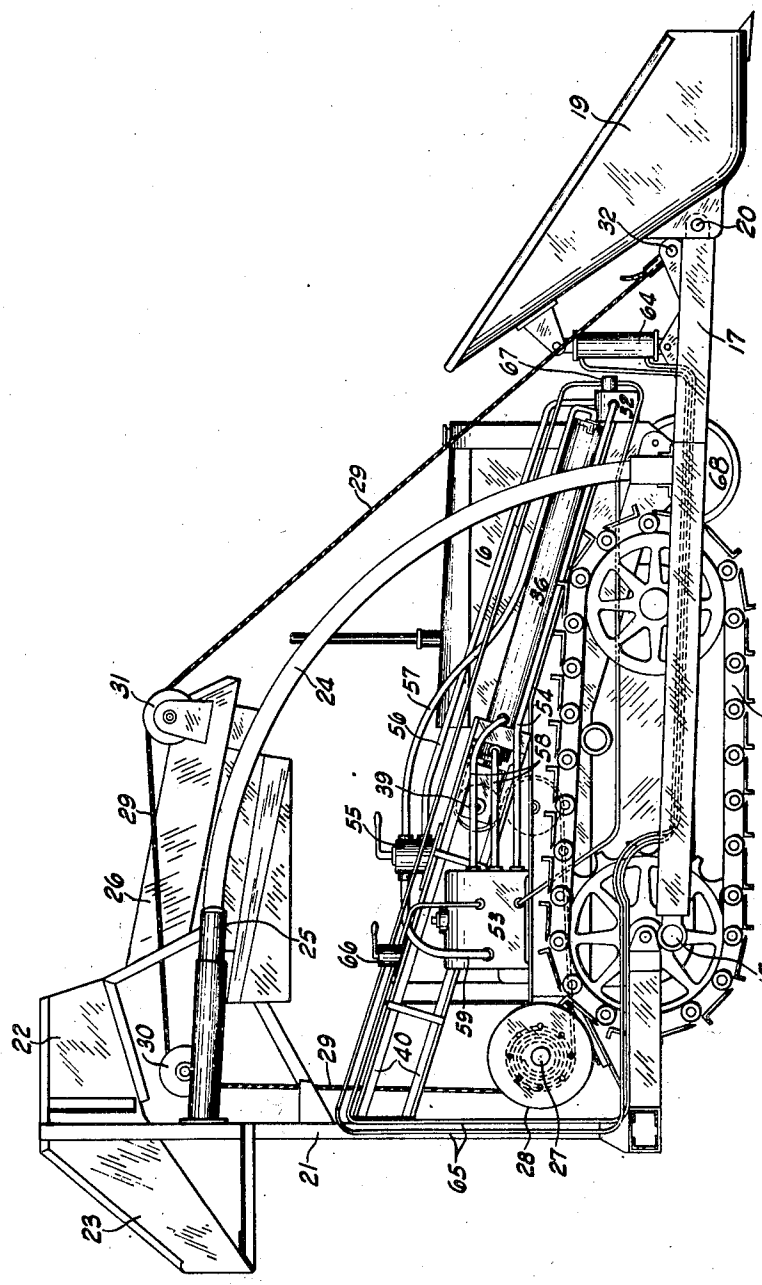


Fig. 1

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March 30, 1948. F. GARNER 2,438,660

EXCAVATING AND LOADING APPARATUS

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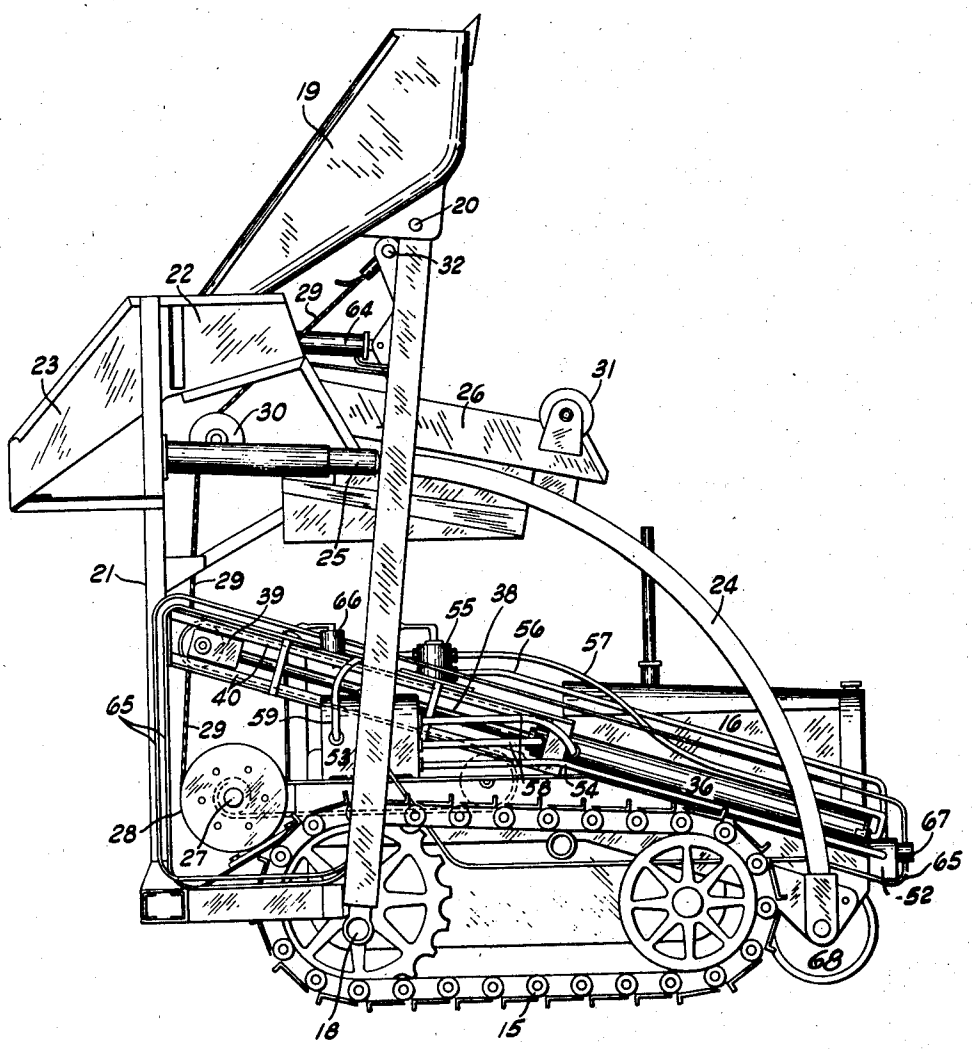


Fig. 2

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EXCAVATING AND LOADING APPARATUS

Filed Sept. 8, 1944 5 Sheets-Sheet 3

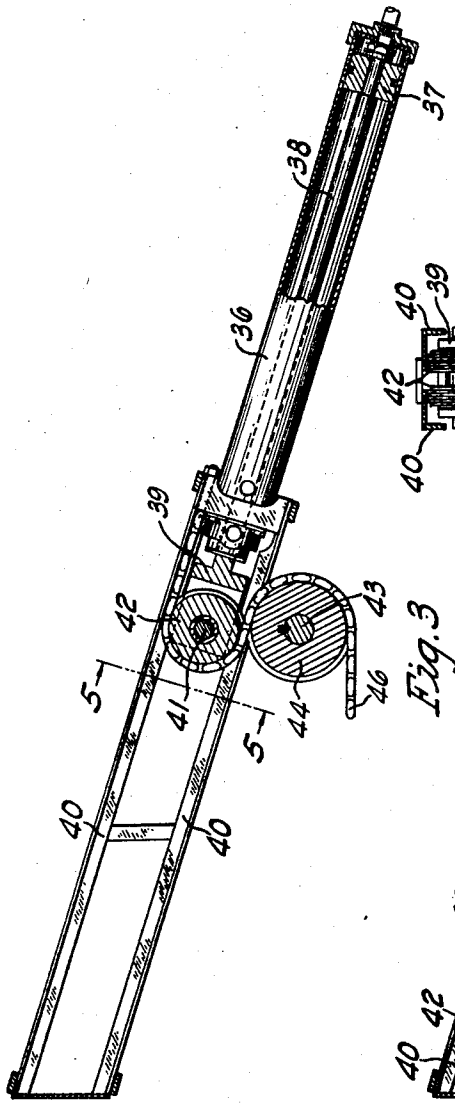


Fig. 3

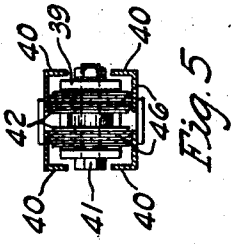


Fig. 5

Fig. 4

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March 30, 1948. F. GARNER 2,438,660

EXCAVATING AND LOADING APPARATUS

Filed Sept. 8, 1944 5 Sheets-Sheet 4

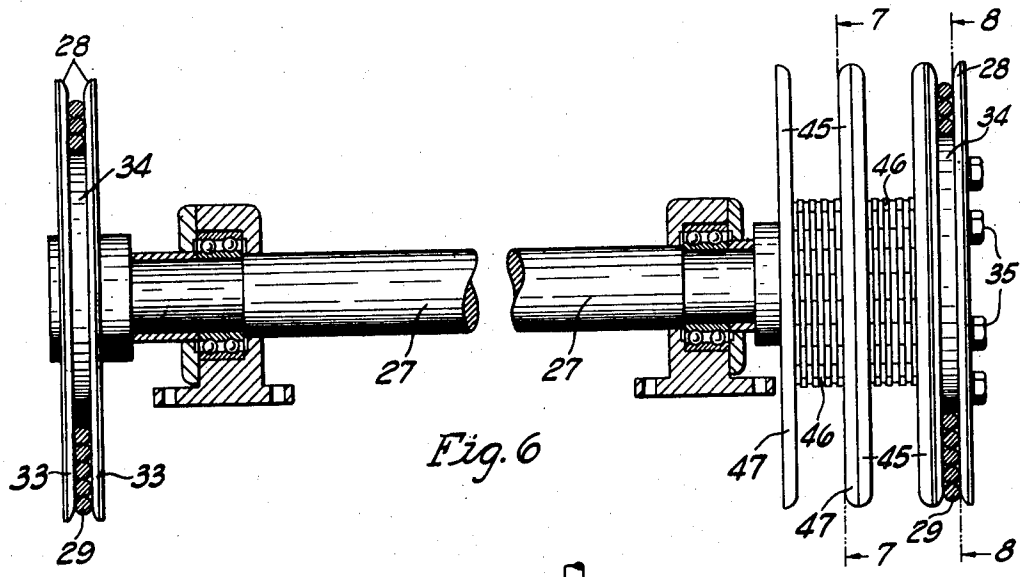


Fig. 6

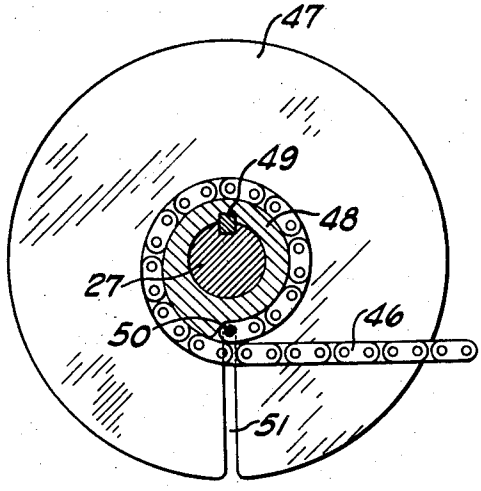


Fig. 7

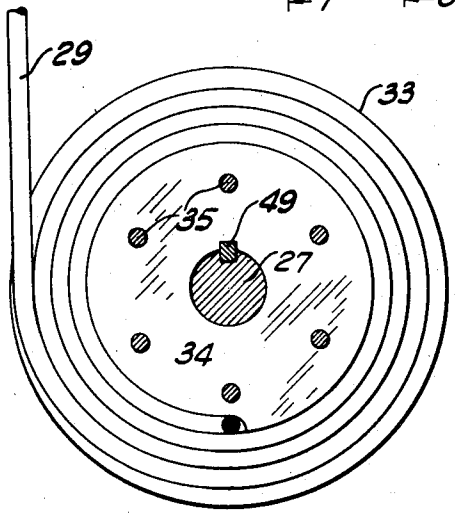


Fig. 8

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March 30, 1948. F. GARNER 2,438,660

EXCAVATING AND LOADING APPARATUS

Filed Sept. 8, 1944 5 Sheets-Sheet 5

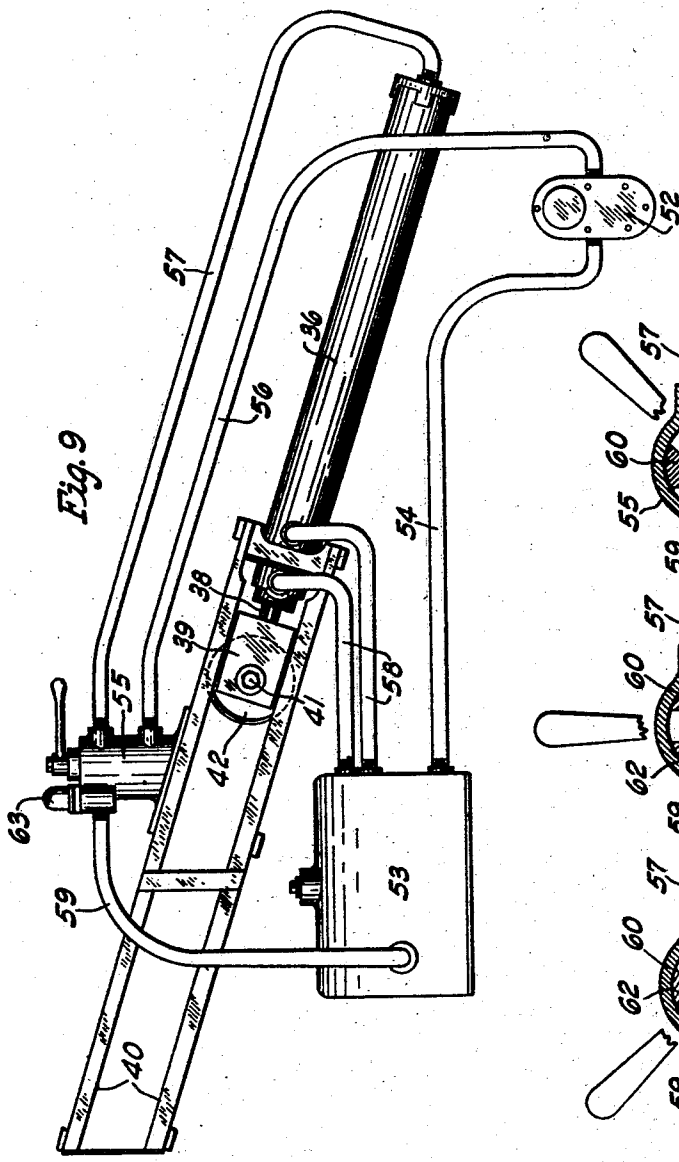


Fig. 9

Fig. 12

Fig. 11

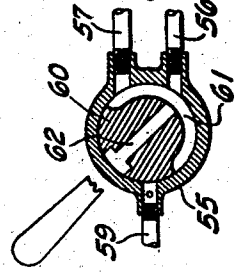


Fig. 10

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Patented Mar. 30, 1948 2,438,660

UNITED STATES PATENT OFFICE

2,438,660

EXCAVATING AND LOADING APPARATUS

Fay Garner, Longmont, Colo.

Application September 8, 1944, Serial No. 553,182

7 Claims. (Cl. 214—131)

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This invention relates to excavating and loading apparatus, and has as an object to provide an improved combination with a powered tractor unit of means and elements constituting such an apparatus.

A further object of the invention is to provide an improved operative combination and relationship of elements constituting excavating and loading means susceptible of association with a powered tractor unit to enhance and extend the operative utility of the latter.

A further object of the invention is to provide improved means for actuating and controlling movable elements of excavating and loading apparatus operatively associated with a powered tractor unit.

A further object of the invention is to provide improved means for operatively associating movable elements of excavating and loading apparatus with the prime mover of a powered tractor unit whereon said apparatus is mounted.

A further object of the invention is to provide improved excavating and loading apparatus susceptible of convenient adaptation t' and operative association with various specific types and constructions of powered tractors, positive, efficient, and precise in operation, simple and relatively inexpensive of manufacture, installation, and maintenance, and adapted for use in the practical performance of a wide variety of specific functions.

My invention consists in the construction, arrangement, and combination of elements hereinafter set forth, pointed out in my claims, and illustrated by the accompanying drawings, in which—

Figure 1 is a side elevation of a preferred embodiment of the invention as operatively associated with a conventional type of tractor power unit and with the movable elements comprised within the invention adjacent one limit of their range of actuation. Figure 2 is a side elevation similar to Figure 1 illustrating the movable elements of the invention adjacent the limit of their range of actuation opposite to that whereas they are shown in the latter figure. Figure 3 is a fragmentary, detail section, on an enlarged scale, taken axially of hydraulic actuating means utilized in the invention. Figure 4 is a fragmentary, detail elevation partly in section, of the assembly of elements shown in Figure 3, and illustrating the movable elements of the assembly adjacent the limit of their range of actuation opposite to that whereat they are shown in the latter figure. Figure 5 is a cross section taken on

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the indicated line 5—5 of Figure 3. Figure 6 is a detail elevation, on an enlarged scale, of a power-transmitting assembly utilized in the invention. Figure 7 is a cross section taken on the indicated line 7—7 of Figure 6. Figure 8 is a cross section taken on the indicated line 8—8 of Figure 6. Figure 9 is a somewhat diagrammatic showing of the elements, means, connections, and controls constituting a principal hydraulic system whereby the movable elements of the invention are selectively actuated and controlled. Figures 10, 11, and 12 are detail sections through a conventionalized control valve susceptible of manipulation through the various positions shown to actuate and control the movable elements of the invention through the hydraulic system according to Figure 9.

The invention resides in a cooperatively-related assembly of elements adapted to be mounted on, carried by, and operatively associated with a powered, self-propelled vehicle of tractor type, thereby enhancing and extending the utility of the powered vehicle. Since the invention is susceptible of ready adaptation, through proper structural design of its constituent elements, to powered vehicles of varying type and specific construction, the representation of a tractor appearing in the drawings is largely diagrammatic and typical, without limitative significance, of any powered vehicle carrying a prime mover, equipped with ground-engaging propulsion means adapted to be driven by said prime mover, and having frame members whereto the elements of the invention may be suitably secured.

In the drawings, the powered vehicle is shown as a conventionalized, crawler-type, tractor having endless, ground-engaging tracks 15 for propulsion purposes, a prime mover housed within the hood 16 for selective driving engagement with the tracks 15, the main shaft of said prime mover being disposed longitudinally of the vehicle and arranged for convenient access to its forward end adjacent the tractor front end, and frame members, not specifically shown, supporting and interconnecting the tractor elements. Giving structural effect to the concept of the invention, a rigid boom 17 is hinged at its rearward end to and for actuation through a vertical arc about a pintle 18 fixedly and laterally projecting from a suitable rearward, lower, tractor frame member, and is thereby disposed to extend forwardly of and beyond the tractor in parallel, laterally and outwardly offset relation with the tractor side. A boom 17 and pintle 18 is provided on each side of the tractor assembly, axes of said

pintles 18 being aligned transversely of the tractor, and the portions of said booms extending forwardly beyond the tractor are suitably and rigidly interconnected to complete a yoke adapted for actuation through a vertical arc about the axis common to the pintles 18 in embracing relation with the major portion of the tractor assembly. The forward ends of the booms 17, or the corresponding end of the yoke formed thereby, hingedly support and carry a scoop or bucket 19 normally disposed transversely and in advance of the tractor for charging through forward travel thereof. The bucket 19 may be of any relative size, conformation, and specific construction best suited to the uses for which it is designed, and, in general, will include a substantially flat bottom plate offset somewhat below the plane of its supporting yoke and formed with a toothed or sharpened entering forward edge, a rearwardly and upwardly inclined, flat, back plate rising from the rear margin of the bottom plate, and end plates approximately perpendicular to and closing between end margins of said back and bottom plates. The hinge connection between the booms 17, or their yoke, and the bucket 19 is indicated at 20 and is so arranged as to provide an axis of oscillation parallel with the axis of the pintles 18 in or near the plane of the boom yoke and offset somewhat above the plane of the bucket bottom plate, so as to permit of ground engagement by said bucket bottom plate or its entering edge while the boom yoke is still relatively elevated, about which axis said bucket 19 may be oscillated and tilted through means and controls hereinafter to be described.

It is the function of the bucket 19 to collect and become charged with material, by means of excavation or otherwise, through forward travel of the tractor, and to then transport and deliver such material, through either forward or rearward dumping of said bucket, in and to a desired location, directly or through the agency of intermediate conveying means, to which end means are provided for swinging the boom yoke about its hinge axis, with consequent elevation of said bucket, to any extent desired between the limits of ground engagement by said bucket, on the one hand, and substantially vertical disposition of said yoke, on the other hand. For the purpose noted, a rigid frame, of any suitable specific construction, is mounted on and connected with the tractor frame members in such manner as is best adapted to the given tractor frame construction, and preferably rises from and as a rearward extension of the tractor to forwardly and longitudinally bridge the latter. In the frame construction shown, risers 21 are supported from and rearwardly of the tractor and extend thereabove to supporting engagement with a hopper 22 and gravity chute 23, and brace members 24 arch forwardly and downwardly longitudinally of the tractor to rigidly connect between the riser frame and a forward, lower portion of the tractor frame. The hopper 22 is sized and positioned to receive the rearward, normally upper, margin of the bucket 19 when the boom yoke is swung upwardly and rearwardly to the position shown in Figure 2, and said hopper is preferably formed with a rearwardly and downwardly inclined bottom and registers and communicates with the more steeply rearwardly and downwardly inclined chute 23, so that material charged into the bucket 19 may be gravity-discharged therefrom and into

the hopper 22 for direction by means of the chute 23 onto conveyers or stock-piles, into trucks, wagons, or cars, or to such other disposition as may be desired, when the boom yoke and bucket are swung to the rearward limit of their range of actuation. The riser frame mounts and supports resiliently-yieldable buffers 25, of any suitable specific construction, disposed in the orbits of the booms 17 and positioned in forwardly-projecting relation with the tractor for engagement by said booms as the boom yoke approaches the rearward limit of its range of travel, said buffers operating to cushion rearward limitation of the boom yoke travel and to initially stimulate forward or return travel of said yoke. As a protection for the operator and the control mechanism of the apparatus, a canopy 26 is supported by the riser frame and brace members 24 somewhat below and extending forwardly from the hopper 22.

Mounted for free rotation in suitable bearings fixed for such purpose to lower members of the riser frame just rearwardly of the tractor, a shaft 27 is positioned in axially-parallel relation with the pintles 18 transversely of and behind said tractor. Like cable drums 28 are fixed adjacent each end of the shaft 27, and from each of said drums a cable 29 rises forwardly of and adjacent the riser frame to engagement with and partially about a grooved idler guide wheel 30 supported for free rotation by the brace members 24 or related frame elements beneath one end of the hopper 22 in coplanar relation with its associated drum 28, from which engagement the cable 29 extends forwardly and slightly upwardly of the assembly to engagement with and partially about the upper periphery of a second grooved idler guide wheel 31 suitably supported for free rotation in fixed position by or from the brace members 24, and thence forwardly and downwardly to connection of its forward end, as at 32, with the boom yoke at a point adjacent and behind the back plate of the bucket 19. With a pair of like cables 29, each fixed at one end to a drum 28 and at the other end to a suitable point adjacent the forward end of the boom yoke and arranged as shown and described, it is apparent that rotation of the shaft 27 in one direction will operate to wind the cables 29 on and about their drums 28 and thereby actuate the boom yoke about its hinge axis for upward and rearward travel of the bucket 19 until the booms 17 engage against the buffers 25 and said bucket is in discharging registration with the hopper 22, while opposite rotation of said shaft operates to unwind the cables 29 from about their drums 28 with consequent extension of the cables permitting of forward and downward travel of the boom yoke and bucket. The guide wheel 31 is disposed below the orbit of the point of connection of its cable with the boom yoke, and hence the cable lifts out of engagement with said guide wheel as the boom yoke swings upwardly and to the position shown in Figure 2, said cable again engaging with the said guide wheel during descending travel of the boom yoke and being thereby directed for the application of advantageous leverage in the initial lifting of the boom yoke and its load.

The drums 28 are, of course, operatively and preferably structurally alike in a given installation, but the specific type and construction of the paired drums used in different installations may vary widely without departing from the operative principles of the invention. However, the

general type and construction of drum illustrated and hereinafter described has certain operative advantages that distinguish it as preferred. As shown, each drum 28 preferably consists of a pair of like discs 33 disposed in spaced opposition and detachably fixed concentrically with, to, and against the opposite sides of a circular hub member 34 having an axial dimension substantially equal to the diameter of the cable 29 to be used therewith. The hub and disc assembly constituting the complete drum is centrally apertured to receive the shaft 27 and is arranged to be keyed or otherwise held to and against rotation on said shaft, and the elements of each drum assembly are conveniently held and clamped together in the desired relationship by means of an annular row of bolts, screws, or the like, indicated at 35. Any convenient and suitable means may be provided for securing an end of the cable 29 to the drum assembly adjacent the periphery of the hub 34. The principal advantage of the drum construction shown and described derives from the arrangement whereby the cable is caused to wind about and upon itself during rotation of the drum, which arrangement provides for maximum application of power to the cable, due to the relatively short effective drum radius, when the cable is at its maximum extension and the load factor is greatest, and for automatically increasing the speed of cable travel, and consequently the speed of load travel, as the cable load factor decreases during upward swinging of the load. The second advantage of the drum construction is found in the ease with which hubs 34 of different diameters may be interchanged in a given drum for adjustment of the operative speed and power thereof to the requirements of a given use.

Rotation of the shaft 27 to wind the cables 29 upon their drums 28 is accomplished by means and connections operatively engaging between said shaft and a pressure-responsive, hydraulic cylinder and piston assembly carried by the tractor. For this purpose, a relatively long pressure cylinder 36 is fixed to and longitudinally along one side of the tractor in clearing relation of its forward end with the boom yoke and bucket 19 and at such an angle with the horizontal as the operative needs of the installation may require. The cylinder 36 houses and slidably accommodates a piston 37 fixed to one end of a piston rod 38 disposed axially of said cylinder and slidably intersecting the rearward end thereof. The end of the piston rod 38 extending beyond the rearward end of the cylinder 36 carries a head 39 fixed thereto and slidably engaging with and between fixed tracks or guides 40 connecting in spaced relation and in parallelism with the cylinder axis between the rearward end of said cylinder and elements of the riser frame, and said head 39 is transversely intersected by a pin 41, axially parallel with the shaft 27, whereon is spacedly mounted for free, independent rotation a pair of like wheels 42. Adjacent, rearwardly of, and below the rear end of the cylinder 36 a shaft 43, axially parallel with the pin 41, rotatably supports for free rotation a pair of idler wheels 44 respectively coplanar with the wheels 42, said idler wheels 44 preferably being somewhat larger than the said wheels 42 and positioned with their upper peripheral margins intersecting the plane of the lower tracks or guides 40. A pair of like drums 45 is fixed to and in adjacent relation on the shaft 27 in respective alignment longitudinally of the tractor

with the wheels 44, and a pair of identical, flat, link chains 46 is fixed at one end adjacent the upper, rearward margin of the cylinder 36 just below the plane of the upper tracks or guides 40 and extends, in spaced, parallel relation of its units corresponding with the spacing and position of the wheels 42, rearwardly of and beneath the upper tracks 40, downwardly and forwardly about and in engaged relation with the rearward semi-circumferences of the wheels 42, thence through the lower tracks 40 and downwardly and rearwardly about and in engaged relation with the forward semi-circumferences of the wheels 44, and finally longitudinally and rearwardly of the tractor to fixed connection at its other end with the drums 45 in such manner as to wind on said drums in a direction opposite to the winding of the cables 29 on their drums 28. The drums 45 may be of any specific construction suited to their purpose, which is to accommodate spiral winding and unwinding of the chains 46 thereon, and are shown as each consisting of opposed circular webs 47 formed integrally with and extending radially from opposite ends of a hub 48 in such spacing of their inner surfaces as will freely receive the width of a chain 46 therebetween, said hub 48 being axially apertured to receive the shaft 27, whereto it is rotatably fixed, as by means of a key 49, and preferably having a spirally contoured periphery interrupted by a transverse shoulder 50 whereagainst the end of its associated chain 46 may abut for smooth winding of said chain about said hub, connection of said chain end with its drum being conveniently had through the agency of slots 51 formed radially of the webs 47 in registration of their inner ends adjacent the hub shoulder 50 and adapted to slidably receive and engage oppositely-projecting ends of a pin transversely engaging through the chain end. While the disclosure of the invention includes paired wheels 42 and 44, drums 45, and chains 46, it is obvious that a comparable arrangement of single such units would be functionally identical with and could be readily substituted for that shown, the paired arrangement having certain structural, practical, and operative advantages that render it the more desirable.

With the operative relationship of elements shown and described, travel of the piston 37 rearwardly of its cylinder 36 acts through the head 39 and wheels 42 carried thereby to rearwardly extend the bights of the chains 46 engaged by said wheels, thereby withdrawing and unwinding said chains from their drums 45, with consequent rotation of the shaft 27 in a direction to take up the cables 29 on their drums 28 and lift the boom yoke and its bucket load, the rate of chain unwinding and the length of chain unwound being, of course, twice the rate and distance of piston travel. A particular feature of the invention resides in the use of cable and chain drums whereon the cables and chains are caused to wind upon themselves in the form of flat spirals with consequent variation in the length of lever arm through which power is applied to or through said cables and chains as an incident of shaft rotation. When the cables 29 wind on their drums 28 in a direction opposite to that of the chains 46 relative to their drums 45, which is the arrangement illustrated and described, the amount of cable on the drums 28 is at its minimum diameter when the amount of chain on the drums 45 attains its maximum diameter, and this condition obtains when the

boom yoke is lowered with its bucket 19 at or close to ground engagement in position of maximum load on the cables 29, so that, when power is applied through the chains 46 for rotation of the shaft 27 to take up the cables 29 on their drums 28, said power acts on said shaft through a maximum lever arm and is transmitted from the shaft to the cables 29 through a minimum lever arm for the development of pronounced mechanical advantage aiding to elevate the load. At the other extreme of boom yoke travel, a condition of minimum load on the cables 29, the amount of cable on the drums 28 presents a maximum diameter as against a minimum diameter of chain on the drums 45, so that the unbalanced weight of the boom yoke and its bucket acts through a maximum lever arm to unwind the cables from their drums and through a minimum lever arm to take up the chains on their drums 45, and hence functions with desirable mechanical advantage through the chains 46 to return the piston 37 and the head 39 actuated thereby to the forward limit of their range of travel.

To selectively move and position the piston 37 relative to its cylinder 36, with consequent and corresponding actuation and control of the elements operatively associated therewith, an hydraulic system of the type shown in Figure 9 is provided. The hydraulic system includes a pressure pump 52, of any suitable specific type and construction, operatively associated in constantly-driven relation with the main shaft of the tractor prime mover in any convenient and satisfactory manner, a tank or reservoir 53 adapted to contain a supply of suitable pressure-transmitting liquid, such as oil, disposed at an elevation somewhat above that of the pump 52, a flow line 54 communicating between a lower portion of the tank 53 and the intake port of the pump 52 for constant supply of liquid from said tank to said pump, a control valve assembly 55, a pressure flow line 56 communicating between the outlet side of the pump 52 and the valve assembly 55, a pressure flow line 57 connecting between the valve assembly 55 and the forward end of the cylinder 36 and opening through said end of said cylinder to the space therein between the cylinder forward end and the forward face of the piston 37, flow lines 58 connecting spaced ports at the rearward end of the cylinder with the tank 53, and a flow line 59 communicating between the valve assembly 55 and the tank 53. The valve assembly 55 may be of any such specific construction as is suited to its purpose of selectively establishing a flow passage between the lines 56 and 57, between the lines 56 and 59, or between the two lines 56 and 57 on the one hand and the line 59 on the other hand, a diagrammatic representation of a conventionalized such valve in each of its three operative positions being shown in Figures 10, 11, and 12. The typical valve construction illustrated includes a handled rotor 60 revolubly fitted within and for manual adjustment relative to the valve assembly casing, which rotor is provided with a peripheral, semi-circular groove or channel 61 disposable to function as a flow passage connecting between the lines 56 and 57, or between the lines 56 and 59, but not between the lines 57 and 59, and a diametric channel 62 opening at one end into and at approximately the midpoint of the groove 61 for disposition of its other end, at times, in registration with the line 57. With the prime mover of the tractor operating and the pump 52 consequently functioning to draw fluid inwardly from the tank 53 through the line 54 and deliver said fluid under pressure outwardly through the line 56, the rotor 60 of the valve assembly 55 is positioned, when there is no occasion to alter the altitudinal disposition of the boom yoke and its associated bucket 19, as shown in Figure 11 with its groove 61 affording communication between the lines 56 and 59 and the line 57 obstructed by a wall of said rotor, so that fluid from the pressure side of the pump 52 may flow through the line 56, groove 61, and line 59 to the tank 53 without entering the cylinder 36, while fluid in said cylinder 36 forwardly of the piston 37 is held against escape through the line 57 by the wall of the rotor 60 and is thereby entrapped to hold said piston in whatever may be its adjusted relation along said cylinder. When it is desired to elevate the boom yoke and bucket 19, the rotor 60 is moved to the position shown in Figure 10 to place its groove 61 in interconnecting relation with the lines 56 and 57 and out of registration with the line 59, so that fluid delivered under pressure from the pump 52 through the line 56 will pass through the groove 61 and line 57 to and within the forward end of the cylinder 36 and therein act to move the piston 37 rearwardly of said cylinder, the fluid in said cylinder rearwardly of said piston escaping through the lines 58 to the tank 53, two of said lines 58 preferably being employed to more completely neutralize any possible resistance to rearward travel of the piston within the cylinder 36, particularly when and as said piston closely approaches the rearward cylinder end. Lowering of the boom yoke and bucket 19 is a gravity-responsive operation requiring no delivery of fluid under pressure to the cylinder 36 rearwardly of the piston 37, the unbalanced weight of said yoke and bucket being adequate, especially when initially aided by the reaction of the buffers 25, to rotate the shaft 27 through the agency of the cables 29 in a direction to wind the chains 46 on their drums 45 and thereby move the head 39 forwardly along its guides 40 for forward travel of the piston 37 within the cylinder 36 when a passage is opened for escape of fluid from the portion of the cylinder forwardly of the piston. To permit lowering of the boom yoke and bucket, the valve rotor 60 is moved to the position shown in Figure 12 wherein the groove 61 intercommunicates between the lines 56 and 59 and the channel 62 registers at its end remote from said groove with the end of the line 57, so that the fluid under pressure from the pump 52 can pass through the groove 61 and line 59 to the tank 53 and at the same time the fluid in the cylinder 36 resisting forward travel of the piston 37 may escape, under the pressure imposed by said piston, through the line 57, channel 62, groove 61, and line 59 to said tank 53 and thus permit return of the piston to the forward end of its cylinder. While not strictly essential to operation of the system, it is desirable that the tank 53 and lines 58 be so arranged that forward travel of the piston 37 will operate to draw fluid from said tank and through said lines to fill the cylinder space behind the piston. Suitable check valves and a pressure relief 63 may, of course, be associated in and with the system as practical considerations warrant.

The three typical positions of the conventional control valve illustrated and above described provide, in a simple, convenient, and positive manner, complete and precise control of the boom yoke position and attitude without recourse to clutches, brakes, gear transmissions, and the

like, since, through control of fluid pressure flow from the pump 52 to the forward end of the cylinder 36, and tank 53, by manipulation of the valve rotor 60, it is possible to initiate and exactly regulate arcuate travel of the boom yoke throughout and in each direction of its range of actuation and to positively hold said boom yoke in any desired attitude relative to the tractor assembly. Precision and speed of control had through the valve assembly 55 is accentuated by the leverages and mechanical advantages inherent in the construction and arrangement of the cooperating elements connecting between the boom yoke and the piston 37.

In the practical use of the improvement it is frequently desirable to vary the angular relation between the boom yoke and bucket 19, so that, for example, said bucket may be tilted forwardly about its hinge axis 20 to discharge its load forwardly and in advance of the tractor assembly, or rearwardly to lift its entering edge above the plane of the bucket heel, and for such purpose hydraulic means of the character illustrated have been found practical, convenient and efficient. As shown, an extensible and retractable, hydraulic, cylinder and piston assembly 64 is operatively connected between a fixed element of the boom yoke and an upper, rearward point on the bucket back plate and is served, on opposite sides of its piston, by a fluid pressure system 65 including a control valve assembly 66 and a pressure pump 67 in driven relation with the prime mover main shaft, said system 65 and valve assembly 66 being so interrelated and associated with the pump 67 and assembly 64 as to extend the latter for forward tilting of the bucket when the valve is in one position, retract said assembly for rearward tilting of the bucket when said valve is in a second position, and hold said assembly against length variation for retention of said bucket in an adjusted relation with the boom yoke when said valve is in yet another position, thus providing for full control of bucket attitude relative to the boom yoke, regardless of the boom yoke attitude relative to the tractor assembly. While the system 65 is shown as including a separate pump 67, it is obvious that said system could conveniently be arranged to be served by the pump 52.

When the elements comprising the invention are associated, as shown, with a crawler type tractor, it is expedient to provide a pair of freely-rotatable, auxiliary wheels 68 beneath the forward end of the tractor assembly, which wheels are disposed to be carried in slightly-spaced relation with the ground or tractor-supporting surface during usual tractor operations and in position for ground engagement as auxiliary supports for the forward end of the tractor when said tractor forward end is tilted downwardly in reaction to early stages of boom yoke and bucket elevation.

Since many changes, variations, and modifications in the form, construction, and arrangement of the elements shown and described may be had, and may be necessary in the adaptation of the improvement to specific types and constructions of powered vehicles, without departing from the spirit of the invention, I wish to be understood as being limited solely by the scope of the appended claims, rather than by any details of the illustrative showing and foregoing description.

I claim as my invention:

1. Excavating and loading apparatus for association with a powered tractor, comprising an auxiliary frame fixedly mountable on the tractor, a bucket-equipped yoke hinged for actuation through a vertical arc in embracing relation with the tractor and frame, means including a rotatable winding shaft and associated cables wholly and operatively carried by said frame and connecting with said yoke power-actuatable to swing the latter relative to said frame, an hydraulic system including a pressure pump and an extensible ram fixedly mountable on and in powered relation with the tractor independently of the frame, and flexible connections operatively between the shaft of said means and said ram for the reflection of ram displacement as proportional rotation of said shaft.

2. Excavating and loading apparatus for association with a powered tractor, comprising an auxiliary frame fixedly mountable on the tractor, a bucket-equipped yoke hinged for actuation through a vertical arc in embracing relation with the tractor and frame, means including a winding shaft and associated cables, wholly and operatively carried by said frame and connecting with said yoke power-actuatable to swing the latter relative to said frame, an extensible hydraulic ram mountable longitudinally of one side of the tractor independently of said frame, an hydraulic system including a pressure pump wholly carried by and in powered relation with the tractor operatively serving said ram, flexible connections operatively between the shaft of said means and the tractor, and bights in said connections engageable by said ram for reflection of ram displacement as proportional rotation of said shaft.

3. In excavating and loading apparatus for association with a powered tractor having an auxiliary frame fixedly mountable on the tractor, and a bucket-equipped yoke hinged for actuation through a vertical arc in embracing relation with said frame, a winding shaft rotatably carried by said frame transversely of and closely adjacent the tractor, means operatively between said shaft and yoke for the oscillation of the latter as an incident of shaft rotation, a hydraulic actuator wholly carried by and in powered relation with said tractor independently of said frame, and flexible connections between said actuator and shaft for the selective rotation of the latter.

4. In excavating and loading apparatus for association with a powered tractor having an auxiliary frame fixedly mountable on the tractor, and a bucket-equipped yoke hinged for actuation through a vertical arc in embracing relation with said frame, a winding shaft rotatably carried by said frame transversely of and closely adjacent the tractor, means operatively between said shaft and yoke for the oscillation of the latter as an incident of shaft rotation, a hydraulic ram mountable longitudinally of one side of the tractor independently of said frame for extension and retraction in a plane perpendicular to said shaft, a hydraulic system including a pressure pump wholly carried by and in powered relation with the tractor operatively serving said ram, and flexible connections operatively between said shaft and ram for the selective rotation of the former.

5. In excavating and loading apparatus for association with a powered tractor including an auxiliary frame fixedly mountable on the tractor, a bucket-equipped yoke hinged for actuation through a vertical arc in embracing relation with said frame, a winding shaft rotatably carried by said frame transversely of and closely adjacent the tractor, and means operatively between said shaft and yoke for oscillation of the latter as an

incident of shaft rotation, a hydraulic ram and a hydraulic system serving said ram wholly carried by and in powered relation with the tractor independently of said frame and flexible connections operatively between said shaft and ram for the transmission of ram displacement as proportional shaft rotation.

6. In excavating and loading apparatus for association with a powered tractor including an auxiliary frame fixedly mountable on the tractor, a bucket-equipped yoke hinged for actuation through a vertical arc in embracing relation with said frame, and means including a winding shaft and associated cables wholly carried by said frame actuatable to oscillate said yoke about its hinge mounting, means wholly carried by the tractor independently of said frame for the selective actuation of said yoke-oscillating means comprising a hydraulic ram fixed to and for extension and retraction longitudinally along one side of the tractor, a hydraulic system powered by the tractor in serving relation with said ram, and flexible connections operatively between said ram and the winding shaft of the yoke-oscillating means.

7. In excavating and loading apparatus having a powered tractor, an auxiliary frame carried by said tractor, a bucket-equipped yoke hinged to said tractor for actuation through a vertical arc in embracing relation with said tractor and frame, a shaft rotatably carried by said frame transversely of and closely adjacent said tractor, and means operatively between said shaft and yoke for oscillation of the latter as an incident of shaft rotation, means wholly carried by said tractor for the selective rotation of said shaft, said latter means comprising a hydraulic ram fixed to and for extension and retraction longitudinally along one side of the tractor, a hydraulic system powered by said tractor in serving

relation with said ram, selectively-actuatable valves in flow-controlling relation with said system, a roller-equipped head terminating the movable elements of said ram, flexible, non-extensible connections between coiled relation at one end with said shaft and fixed attachment at the other end adjacent one side of said head, and guide rollers freely rotatable adjacent the side of said head opposite the points of connection end fixed attachment disposed to engage said connections between said shaft and ram to form and maintain bights in said connections embracing outward arcs of said head rollers.

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