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HYDRAULIC CRANE

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INVENTOR.
WALTER HARBAUGH,
BY: *Harold B. Hood.*
ATTORNEY.

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W. HARBAUGH
HYDRAULIC CRANE

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2 Sheets-Sheet 2

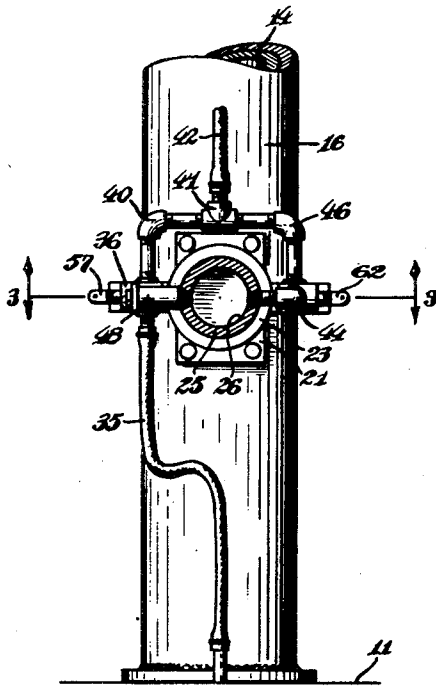


Fig. 2.

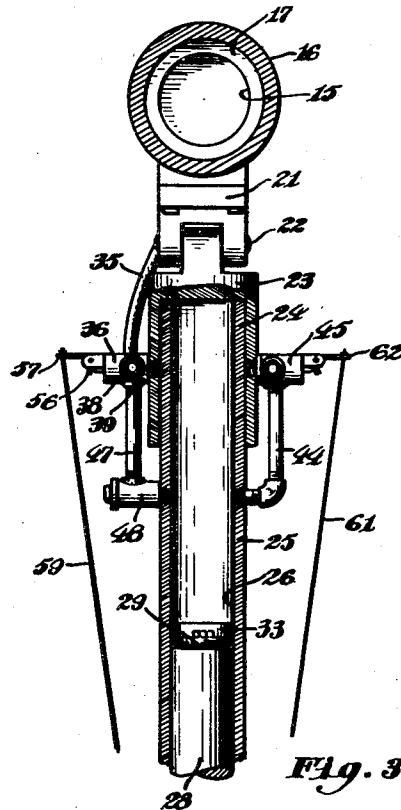


Fig. 3.

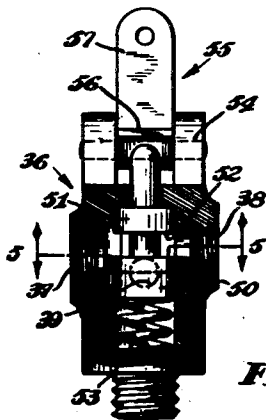


Fig. 4.

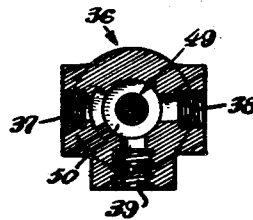


Fig. 5.

INVENTOR.
WALTER HARBAUGH,
BY: *Harold B. Hood*
ATTORNEY.

UNITED STATES PATENT OFFICE

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HYDRAULIC CRANE

Walter Harbaugh, Indianapolis, Ind.

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10 Claims. (Cl. 212—35)

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The present invention relates to hydraulic cranes, and while the invention is applicable to hydraulic cranes wherever installed, it is particularly adaptable to installation upon trucks, and therefore it has been so shown and will be so described. The primary object of the invention is to provide, at minimum cost, mechanism which may be effectively used to lift and to shift relatively heavy loads. As particularly embodied in the illustration of the present application, it is admirably adapted for loading and unloading a truck upon which it may be mounted. A further object of the invention is to provide a fluid operated crane, all of whose lifting and shifting operations can be controlled through the manipulation of two simple valves, resulting in elongation and contraction of the boom forming a part of the crane. A further object of the invention is to provide an organization of the character here under consideration which involves only two operated parts. A still further object of the invention is to provide an organization of the character here under consideration, devoid of a boom lifting winch. Still further objects of the invention will appear as the description proceeds.

To the accomplishment of the above and related objects, my invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific construction illustrated and described, so long as the scope of the appended claims is not violated.

Fig. 1 is a side elevation of a truck with my improved hydraulic crane installed thereon;

Fig. 2 is an enlarged sectional view taken substantially on the line 2—2 of Fig. 1;

Fig. 3 is a horizontal section taken substantially on the line 3—3 of Fig. 2;

Fig. 4 is an enlarged longitudinal section through a control valve forming a feature of my invention;

Fig. 5 is a transverse section therethrough taken substantially on the line 5—5 of Fig. 4; and

Fig. 6 is a reduced, somewhat diagrammatic plan of the truck of Fig. 1, showing a preferred location for the crane of the present invention.

Referring more particularly to the drawings, it will be seen that I have illustrated a truck indicated generally by the reference numeral 10 and having a chassis and a bed 11 which is preferably substantially rectangular in plan. Mounted at one corner 12 of the bed 11, and supported upon a frame member 13, is an upstanding element 14 which may preferably be hollow, as indicated at

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15, to constitute a liquid reservoir. Mounted on said element 14 is a sleeve 16, supported upon the truck bed 11, and obviously oscillable about the axis of the element 14, said sleeve projecting above the open upper end 17 of the element 14. A pump 18, of any suitable character, is connected to be driven by a power take-off shaft 19 with which the truck will be provided, and the intake of said pump communicates, as at 20, with the bottom of the reservoir 15.

Secured to a vertical wall of the sleeve 16, at any suitable point intermediate its ends, is a bracket 21 mounting a pivot pin 22 upon which is pivotally supported a socket member or cup 23, swingable, relative to the sleeve 16, about the substantially horizontal axis of the pin 22. One end 24 of a cylinder member 25, formed with a longitudinally extending bore 26, is received and secured in said cup 23. Thereby, the inner end 24 of said cylinder member 25 is operatively closed; while the opposite end 27 is open for the telescopic reception of a second member 28 whose inner end 29 functions as a piston head within the bore 26 of the cylinder member 25. At its outer end, the member 28 carries a cap 30 formed to support a journal pin 31 upon which is rotatably mounted a sheave 32. Usually, it will be desirable, in order to avoid the necessity for accurate engagement between the element 28 and the walls of the bore 26, to secure a cup member 33 of rubber, "neoprene," or other suitable flexible material, to the inner end 29 of said member 28. It will be seen that the two members 25 and 28 of the composite boom, generally indicated by the reference numeral 34, cooperate to constitute a fluid motor. The member 28 acts as a piston, and is suitably supported solely by the member 25, which also acts as the cylinder of the fluid motor.

Suitable conduit means, including a flexible section 35, will be provided to connect the outlet of the pump 18 with a valve unit indicated generally by the reference numeral 36. Said unit comprises a casing having an inlet port 37, to which the conduit section 35 is connected, an exhaust port 38, and an outlet port 39, said outlet port being located in a plane removed from the common plane of the inlet and exhaust ports. Piping 40 connects the port 38 with a T fitting 41, to the stem of which is connected a conduit 42 leading to the interior of the reservoir 15. One suitable means for providing this connection is illustrated herein, sleeve 16 being formed with a port 43 above the level of the open top 17 of the element 14, and the flexible conduit 42 being connected to said port.

Piping 44 opens from the bore 26 and leads to a suitable valve 45, controlling flow from said piping 44 to piping 46 connected with the fitting 41. When the valve 45 is opened, fluid may flow from the cylinder bore 26 through the piping 44, valve 45, piping 46, and conduit 42 to the reservoir 15.

A pipe 47 leads from the valve port 39 to a check valve 48 which, in turn, communicates with the cylinder bore 26.

The valve body, indicated generally by the reference numeral 49, is reciprocally mounted in the unit 36 and comprises a land 50 and a land 51 spaced from the land 50 by a groove 52. A spring 53 within the valve housing normally holds the valve body 49 in the position illustrated in Fig. 4, wherein communication between the port 37 and the port 38 is open but the port 39 is closed by the land 50. Mounted upon a suitable hinge pin 54 is a bellcrank lever 55 one arm 56 of which operatively engages the valve body 49, while the other arm 57 is presented for manual manipulation. Oscillation of the lever 55 in a clockwise direction, as viewed from the left in Fig. 4, will shift the valve body 49 against the tendency of the spring 53, tending to bring the land 51 into closing registry with the port 38, and to move the land 50 out of closing registry with the port 39. It will be seen that the designing and proportioning of the valve unit 36 is such that the port 39 begins to open as the port 38 begins to close, so that fluid can be permitted to bleed slowly through the port 39 and into the cylinder bore 26, while a part of the fluid being thrown by the pump 18 continues to be by-passed back to the reservoir. This arrangement provides for extremely delicate operation of the fluid motor.

The cap 30 is formed to provide two eyelets 58. A cable or cord 59 may be connected to the valve actuating lever arm 57 and led through one of the eyelets 58, being provided at its free end with a finger ring 60. The valve 45 is similarly operable by a lever 62 to which may be connected a cable 61 which may be similarly led through the other eyelet 58 and provided at its free end with a finger ring 63. Thereby, provision is made for manipulation of the valve units 36 and 45 from any station along the length of the boom 34.

Preferably, a cap 64 will be suitably mounted upon the upper end of the sleeve 16 to carry a winch 65 which, in the illustrated embodiment of the invention, is manually actuable, but which obviously may be power driven if desired. A cable 66 is wound upon the winch 65 and runs over the sheave 32, preferably carrying a hook 67 at its free end.

It will be clear, from the above description, that, when the power take-off shaft 19 is being driven, the pump 18 will operate continuously to withdraw liquid from the reservoir 15 and to force it through the conduit 35. With the valve unit 36 in its illustrated condition, that fluid will flow through the port 38 and piping 40, and through the conduit 42 to the port 43 and back to the reservoir 15. If, now, the lever 55 is swung in a clockwise direction, as viewed from the left in Fig. 4, a part or all of the fluid thrown by the pump 18 will be diverted through the port 39 and pipe 47 to the check valve 48. Assuming that the pump is developing a pressure in excess of that for which the check valve 48 is set, that fluid will now flow into the cylinder bore 26 to force the piston element 28 outwardly, thereby elongating the boom 34.

A cable 68 of fixed length has one end connected to the mast (and preferably to the sleeve ele-

ment 16 thereof near its top), and has its opposite end connected to an eyelet 69 formed on the cap 30. Thus, the distance between the cap 30 and the point on the mast to which the cable 68 is connected is maintained. Consequently, as the boom elongates, it must move upwardly about its pivot pin 22. Thus elevation of the boom is accomplished, without the provision of a boom lifting winch, purely through the act of elongating the boom.

Elongation of the boom will be discontinued when the valve body 49 is permitted to return to its illustrated position; and the boom will maintain its new length so long as both valves remain closed. If, now, the valve 45 is opened, fluid will be discharged from the cylinder bore 26 through said valve and the conduit 42 back to the reservoir 15, thereby permitting the piston element 28 to move inwardly; and the outer end of the boom will be lowered as the boom contracts.

In use, the boom will be lowered to a position somewhat like that illustrated in Fig. 1, the winch 65 will be released, and the cable 66 will be drawn out until the hook 67 can be engaged with the article to be loaded onto the truck. It will be clear that the boom can be swung about the axis of the upstanding element 14, through an arc somewhat in excess of 180°. With the boom pointing toward the article to be loaded, the winch 65 is locked, the valve actuating lever 55 is shifted to open the port 39, and the boom will thereby be elongated, whereby its outer end will be lifted, and thus moved toward the axis of the sleeve 16. Such movement will necessarily draw the article to which the hook 67 is attached toward the axis of said sleeve. If the article has originally been so far from the truck that complete elevation of the boom will not bring that article within the boundaries of the bed 11, the boom is stopped in its most elevated position, the winch 65 is unlocked and as the boom is slowly lowered, the winch is operated to hold the cable 66 taut. When the boom has reached its optimum position, the winch is again locked, and the above-described operation is repeated. This is continued until the article to be loaded is brought under the end of the boom, whereupon the next elevation of the boom will lift the article. Now, the boom and sleeve 16 are swung, about the axis of the element 14, until the article is in desired position above the truck bed 11, whereupon the winch 65 is released to lower the article onto the truck bed 11.

Preferably, the length of the cable 68 will be substantially equal to the horizontal distance from the position of the mast to the diagonally opposite corner of the bed. With such an arrangement, it will be readily seen, articles may be deposited anywhere on the truck bed 11.

The mounting of the mast at one corner of the truck bed permits the swinging of the boom through a longer arc than would otherwise be possible, and further, improves the capacity for load carrying of the truck bed over an arrangement in which the mast is mounted upon the center line of the truck bed.

I claim as my invention:

1. A fluid-operated crane comprising an axially-fixed, upstanding mast and a boom hingedly associated with said mast to oscillate about a horizontal axis, said boom comprising a hollow member and a second member telescopically received in said hollow member and projecting beyond the free end of said hollow member, the inner end of said second member being provided with means establishing a sliding fluid seal with

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the walls of said hollow member, a source of fluid under pressure, means for controlling the flow of fluid from said source to the interior of said hollow member, means for controlling the flow of fluid from the interior of said hollow member, and an element of fixed length connecting the outer end of said second member with said mast.

2. A fluid-operated crane comprising an axially-fixed, upstanding mast and a boom hingedly associated with said mast at a point spaced below the top of said mast to swing about a horizontal axis, said boom comprising a hollow member closed at its inner end and open at its outer end and a second member telescopically entered in the outer end of said hollow member and projecting beyond the free end of said hollow member, means for maintaining a fixed distance between the outer end of said second member and the upper end of said mast, the inner end of said second member being provided with means establishing a sliding fluid seal with the walls of said hollow member, a source of fluid under pressure, means for controlling the flow of fluid from said source to the interior of said hollow member, and means for controlling the flow of fluid from the interior of said hollow member.

3. A fluid-operated crane comprising a mast and a boom, said mast comprising a tubular, vertical liquid reservoir, said boom being hingedly associated with said mast at a point spaced below the top of said mast, said boom comprising a hollow member closed at its inner end and open at its outer end and a second member telescopically entered in the outer end of said hollow member, means for maintaining a fixed distance between the outer end of said second member and the upper end of said mast, the inner end of said second member being provided with means providing a sliding fluid seal with the walls of said hollow member, a pump, means providing communication between the bottom of said reservoir and the intake for said pump, conduit means connecting the outlet for said pump with the interior of said hollow member, valve means controlling fluid flow through said last-named means, conduit means connecting the interior of said hollow member directly with said reservoir, and valve means controlling fluid flow through said last-named conduit means.

4. A hydraulic crane comprising a mast and a boom, said mast comprising an upstanding element of circular cross section, and a sleeve swivelly supported on said element, a bracket fixed to said sleeve, said boom comprising a hollow member closed at one end, means at the closed end of said hollow member connecting said member to said bracket to swing with respect thereto about a substantially horizontal axis, and a second member having one end telescopically received in the open outer end of said hollow member, means providing a sliding liquid seal between said members, a source of liquid under pressure, means for controlling the flow of liquid from said source to the interior of said hollow member, means for controlling the flow of liquid from the interior of said hollow member, and means for maintaining a fixed distance between the outer end of said second member and a predetermined point outside said boom.

5. A hydraulic crane comprising a mast and a boom, said mast comprising an upstanding element of circular cross section, and a sleeve swivelly supported on said element, said boom comprising a cylinder member and a piston member telescopically associated therewith, means

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pivotaly connecting one end of one of said members to said sleeve for movement relative thereto about a substantially horizontal axis, means tethering the remote end of the other of said members against movement away from a fixed point on said mast, a source of fluid under pressure, and means for controlling fluid flow from said source into said cylinder member, and out from said cylinder member.

6. The device of claim 5 including a sheave carried at said remote end of said other member, a winch carried on and movable with said sleeve, and a cable wound on said winch and passing over said sheave.

7. In a device of the class described, a base, an upstanding tubular element closed at its bottom and open at its top to provide a liquid reservoir, a sleeve swivelly supported on said element, resting on said base and projecting above the open top of said element, a boom pivotaly carried by said sleeve for oscillation with respect thereto about a substantially horizontal axis, said boom comprising a cylinder member and a piston member having one end slidably received within said cylinder member, a pump, means providing communication between the bottom of said reservoir and the intake for said pump, conduit means connecting the outlet for said pump with the interior of said cylinder member, valve means controlling fluid flow through said conduit means, a port in said sleeve above the level of the upper end of said tubular element, conduit means connecting the interior of said cylinder member with said port, and valve means controlling fluid flow through said last-named conduit means.

8. In a device of the class described, a base, an upstanding tubular element closed at its bottom and open at its top to provide a liquid reservoir, a sleeve swivelly supported on said element, resting on said base and projecting above the open top of said element, a boom pivotaly carried by said sleeve for oscillation with respect thereto about a substantially horizontal axis, said boom comprising a cylinder member and a piston member having one end slidably received within said cylinder member, a pump, means providing communication between the bottom of said reservoir and the intake of said pump, a port in said sleeve above the level of the upper end of said tubular element, conduit means connecting the outlet of said pump with said port, valve means interposed in said conduit means and manipulable to divert flow, at times, to the interior of said cylinder, and other valve means manipulable to direct liquid flow from the interior of said cylinder member to said port.

9. For use with an automotive vehicle having a substantially rectangular bed, a prime mover, and a power take-off, a fluid operated crane comprising an upstanding element fixedly mounted near one corner of said bed, a sleeve swivelly mounted on said element and supported by said bed, a boom comprising a cylinder member and a piston member telescopically received in said cylinder member, one end of one of said members being pivotaly mounted on said sleeve for swinging movement relative thereto about a substantially horizontal axis, a cable having a length substantially equal to the horizontal distance from said upstanding element to the diagonally opposite corner of said bed, one end of said cable being secured to said sleeve and the other end of said cable being secured to the remote end of the other of said members, means for applying pressure to a fluid, means connecting said power

take-off to drive said pressure-applying means, conduit means connecting said pressure-applying means to supply fluid under pressure to the interior of said cylinder member, valve means controlling fluid flow through said conduit means, and valve means for controlling fluid flow from the interior of said cylinder.

10. The organization of claim 9, including a sheave carried at said remote end of said other member, a winch mounted on and movable with said sleeve, and a cable wound on said winch and running over said sheave.

WALTER HARBAUGH.

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