Oct. 27, 1964 W. O. JOHNSON 3,154,290

TRAILER-TYPE HYDRAULIC LIFT

Filed March 11, 1963 2 Sheets-Sheet 1

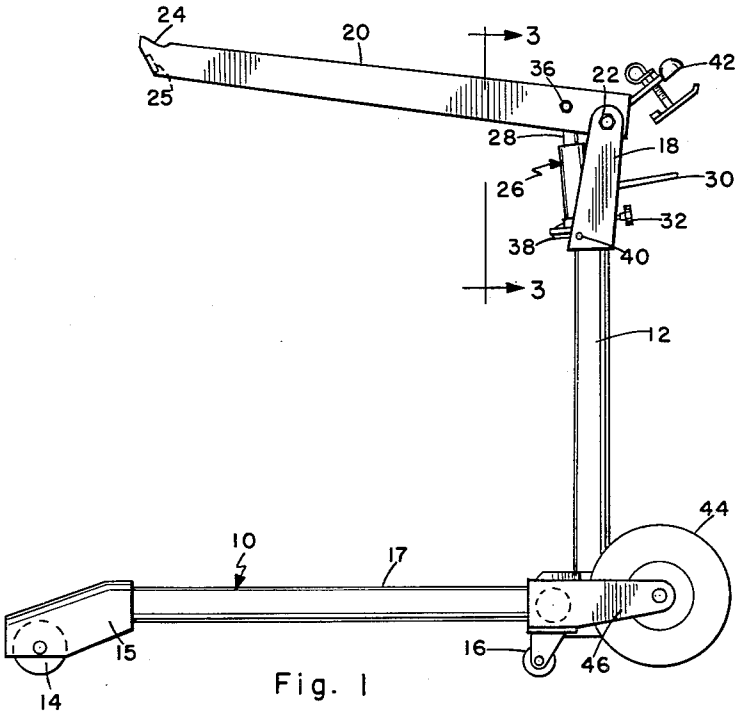


Fig. 1

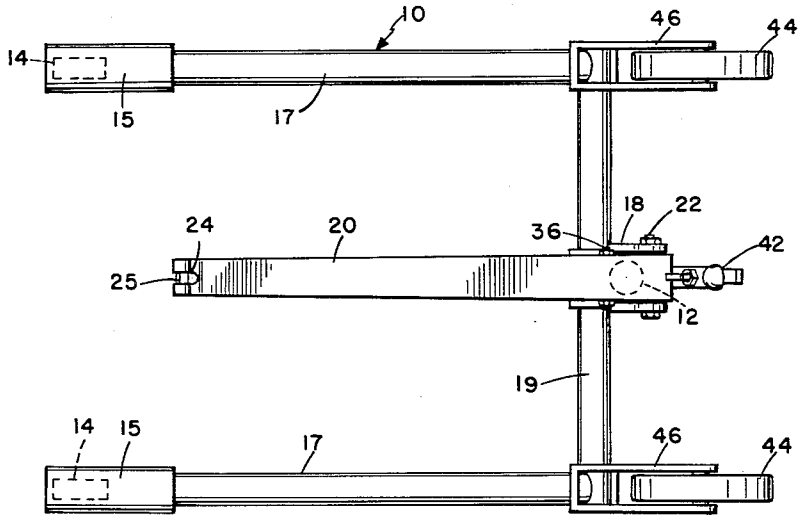


Fig. 2

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TRAILER-TYPE HYDRAULIC LIFT

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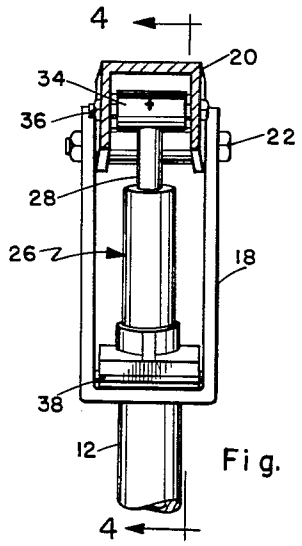


Fig. 3

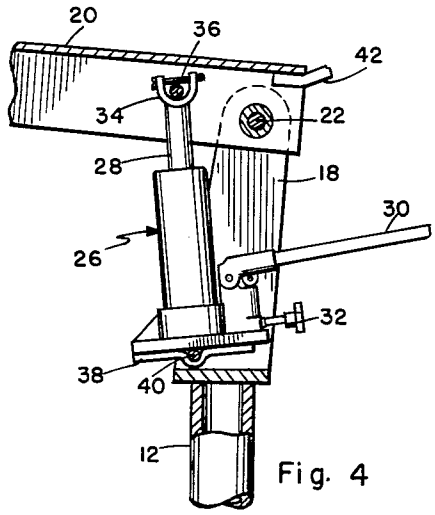


Fig. 4

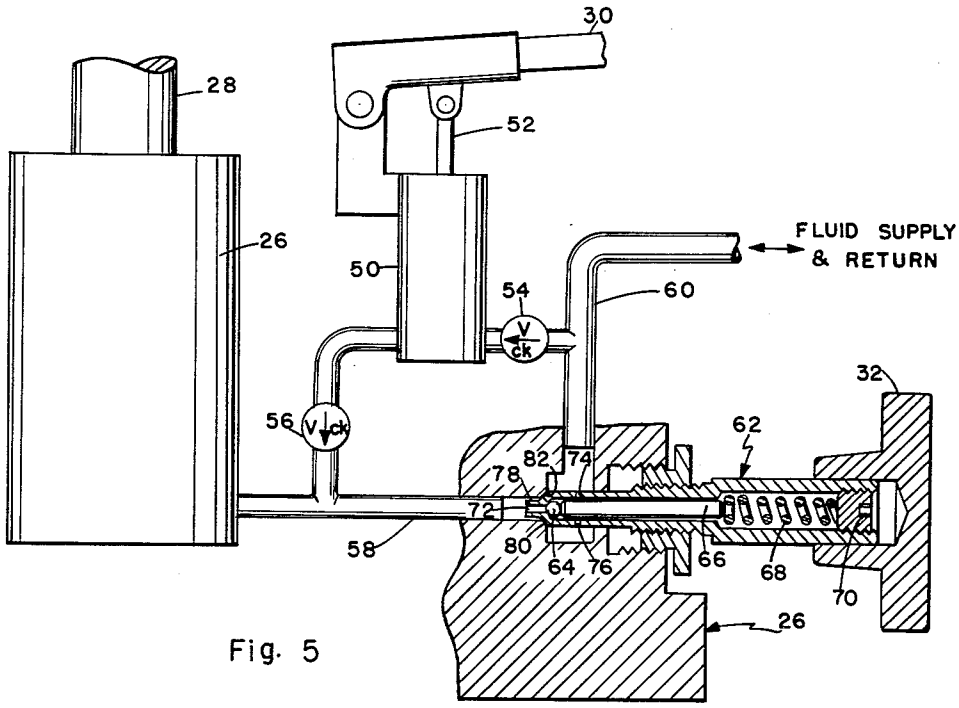


Fig. 5

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TRAILER-TYPE HYDRAULIC LIFT

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5 Claims. (Cl. 254—8)

This invention relates generally to hydraulic lifting apparatus and particularly to small towable, mobile hydraulic cranes.

Background

Many types of portable and mobile devices for lifting heavy objects of relatively small size are known to the art. Such devices usually are designed for a specific function in shops, factories, warehouses, and other related areas. Examples are jacks and cranes for lifting automobile engines, replacing heavy machinery in elevated positions, moving heavy objects between floor and shelves, and so on.

While a particular lifting device may perform its designed function satisfactorily, usually it is capable of performing only a limited number of lifting operations and its use may be further restricted due to immobility of the apparatus. Therefore, a definite need exists in the mechanical, construction, stevedoring, and similar fields for a versatile lifting apparatus that is easily transported from place to place and is capable of performing a variety of lifting and moving operations.

The instant invention is an improved crane-type lifting apparatus that provides the versatility and mobility discussed above. Additionally, the apparatus includes safety features not usually found in similar light weight equipment.

Objects

It is a principal object of this invention to provide an improved lifting apparatus for general use.

It is another object of this invention to provide an improved lifting apparatus that is mobile and particularly well adapted for being towed.

It is still another object of this invention to provide an improved lifting apparatus with automatic protection against overloading.

It is yet another object of this invention to provide an improved lifting apparatus that incorporates therein a safeguard against abruptly dropping a load.

With these and other objects definitely in view, this invention consists in the novel combination and arrangement of elements as will be hereinafter fully described in the specification, particularly pointed out in the claims, and illustrated in the drawings that form a material part of this disclosure, and in which:

FIGURE 1 is a side elevation view of the complete unit;

FIGURE 2 is a top plan view thereof;

FIGURE 3 is an enlarged sectional view taken on line 3—3 of FIGURE 1;

FIGURE 4 is a sectional view taken on line 4—4 of FIGURE 3; and

FIGURE 5 is a substantially diagrammatic view, partially in section, of the hydraulic system and safety valve.

Detailed Description

The complete structure of the invention is illustrated in FIGURES 1 and 2. An ambulant, U-shaped base

frame or member 10 supports a combination tow bar and mast 12 which in the present context will be nominated simply as a vertical mast 12. Ground contacting wheels 14 and casters 16 support and provide mobility for the entire structure. Small wheels are mounted on forks 15 fixed to the free ends of the arms 17 of the U-shaped base member 10, while casters 16 are mounted adjacent the other ends of the arms 17 to swivel through 360 degrees. The simple, open design of base member and mast provides means for straddling an object to be lifted or placing the base member beneath the object, such as in lifting an engine from the front or side of a car. The casters facilitate moving the apparatus with or without a load thereon.

A U-shaped fork 18, rigidly attached to the upper end of mast 12, supports lifting boom 20 by means of pivot bolt 22. A slotted hook 24 at the free end of boom 20 permits attachment of a chain to the lifting end of the boom, the chain being passed through the slot and around a cross bar 25 below the slot, which prevents the chain from sliding off the hook.

The lifting mechanism is a hydraulic jack 26 with piston 28, handle 30, and pressure release and lowering valve control 32. Piston 28 is pivotally attached to lifting boom 20 by means of a U-shaped yoke 34 and bolt 36. The base of jack 26 is pivotally attached to mast 12 at the base of fork 18 by means of rocker plate 38 and bolt 40. Special safety features of the jack will be described in detail hereinafter.

Towing fitting 42, operatively mounted on the pivot end of lifting boom 20 is designed for easy attachment to a conventional ball mounting on the rear bumper of an automobile or other suitable means for towing. Road-contacting towing wheels 44, equipped with pneumatic tires, are secured to base member 10 by brackets 46. The towing fitting and wheels, with the hereinbefore mentioned combination tow bar and mast 12 functioning as a tow bar, convert the lifting apparatus into a self-contained trailer for rapid transport from job to job. Attaching fitting 42 for towing places boom 20 in the extreme lowered position.

The hydraulic jack is illustrated in FIGURES 3, 4, and 5. The jack structure is of usual hydraulic cylinder and piston design comprising main ram cylinder 48 with ram piston 28 and pump cylinder 50 with pressure piston 52. Check valve 54 permits fluid to enter pump cylinder 50 and pressurized fluid enters main cylinder 48 by way of check valve 56. When pressure is released in a manner hereinafter described, fluid returns to the supply end of pump cylinder 50 and check valve 54 by way of lines 58 and 60.

Unusual features of jack 26 are dual-purpose safety valve 62, yoke 34, and rocker plate 38. The yoke and rocker plate permit rotatable movement of the entire jack about pivots at the end of the piston and the base of the jack. Safety valve 62 protects against overloading caused by excessive pressure created in cylinder 48. Excessive pressure would damage the jack and might cause the cylinder to explode with resultant injury to personnel. Safety valve 62 also protects against abruptly releasing pressure and dropping a load with resultant damage as hereinafter explained.

Protection against overloading is provided by ball 64, push rod 66, spring 68, set screw 70, and orifices 72, 74, and 76. Set screw 70 adjusts tension on spring 68 to

exert pressure on push rod 66 and ball 64 and close orifice 72 against the pressure in line 58 and cylinder 48. This pressure is adjusted at the safe working capacity of the jack. If this pressure is exceeded, ball 64 is forced back from orifice 72 annd fluid flows back to return line 60 by way or orifice 72 and apertures 74 and 76 until the pressure in cylinder 48 and line 58 is reduced to the adjusted pressure and ball 64 closes orifice 72. As a result, after the rated capacity of the jack is reached, repeated operation of the pump cylinder handle 30 has no effect on ram piston 28 operation, the excessive fluid merely circulating in lines 58 and 60 and pump cylinder 50 by way of safety valve 62. Consequently, the jack will not lift a load above its rated capacity and no damage will result if the load is too heavy to lift.

Protection against abrupt and rapid lowering is achieved by the valve 62 which has a reduced incremental opening rate subsequent to initial opening movement of the valve, provided by two tapers at 78 and 80. Both tapers diverge from the end at orifice 72. Taper 80 makes a snug fit with bevel 82 in the jack body when safety valve 62 is fully closed. The jack is lowered by turning valve control 32 counterclockwise and disengaging the taper 80 of safety valve 62 slightly from contact with the valve body. Fluid then flows from line 58 to line 60 through the gap thus created. The taper at 78 is slight so that even careless or recklessly fast opening of the control 32 causes the jack to lower slowly and further turning causes little change in lowering speed until the valve element is disengaged. This feature eliminates the need for a precise setting of control 32 for safe lowering speed and prevents damage to loads resulting from accidental dropping or careless operating procedure.

Referring to FIGURE 1, the hydraulic lift is shown in operating position wherein the small wheels 14 and casters 16 support the entire structure and wheels 44 are suspended in an upraised position. A chain attached to fitting 24 is used for connection to a load. The load is raised by pumping handle 30, thus extending ram piston 28, and raising lifting boom 20. When control 32 is turned counterclockwise, the weight of the load lowers boom 20 and piston 28 opposed by the slowly decreasing pressure as regulated by the tapers 78 and 80 on valve 62. When the hydraulic lift is rotated 90 degrees to the right from the position shown in FIGURE 1, wheels 44 support the structure in position for towing. In this position, the combination tow bar and mast 12 becomes a tow bar, and fitting 42 provides attachment means for towing.

The instant invention is an improvement over similar prior art devices in that it incorporates the safety features described and may be used for a variety of jobs, many of which are performed by special purpose lifting devices. The invention is particularly useful as a combination trailer and crane for loading and unloading trucks, handling heavy equipment and material in machine shops, replacing engines in automotive equipment, and handling various lifting, pulling, and transporting chores at construction projects, ranches, and farms.

It is understood that minor variation from the form of the invention disclosed herein may be made without departure from the spirit and scope of the invention, and that the specification and drawing are to be considered as merely illustrative rather than limiting.

I claim:

1. A towable hydraulic lift comprising:
an ambulant base frame;
a combination tow bar and mast rigidly secured at one end to said base frame;
a lifting boom pivotally mounted on the other end of said combination tow bar and mast;
a hydraulic jack having a piston and cylinder mounted on said other end operatively connected with said boom;
and a safety valve in said jack having a reduced incremental opening rate after initial opening of the valve thus assuring that the valve cannot quickly be fully opened and preventing the boom from being lowered at a dangerous rate.

2. A towable hydraulic lift comprising:
an ambulant base frame;
a combination tow bar and mast rigidly secured at one end to said base frame;
a lifting boom pivotally mounted on the other end of said combination tow bar and mast;
a hydraulic jack having a piston and cylinder mounted on said other end operatively connected with said boom;
and a safety valve in said jack having a reduced incremental opening rate after initial opening of the valve thus assuring that the valve cannot quickly be fully opened and preventing the boom from being lowered at a dangerous rate, said valve also having means to bypass said cylinder at a predetermined cylinder pressure, thus preventing overloading of the lift.

3. A towable hydraulic lift comprising:
an ambulant base frame;
a combination tow bar and mast rigidly secured at one end to said base frame;
a lifting boom pivotally mounted on the other end of said combination tow bar and mast;
a hydraulic jack having a piston and cylinder mounted on said other end operatively connected with said boom;
a safety valve in said jack having a reduced incremental opening rate after initial opening of the valve thus assuring that the valve cannot quickly be fully opened and preventing the boom from being lowered at a dangerous rate, said valve also having means to bypass said cylinder at a predetermined cylinder pressure, thus preventing overloading of the lift;
and means to adjust said valve to achieve said predetermined pressure.

4. In a towable hydraulic lift, the combination comprising:
a U-shaped base frame having ground contacting wheels thereon for mobility;
a combination tow bar and mast rigidly attached at one end to the center of said base frame, said mast having a fork at the unattached end;
a hydraulic jack attached to said mast at the base of said fork, said jack having a safety valve preventing overloading and rapid lowering;
a lifting boom having one end pivotally attached to said fork and a pivotal connection with the piston of said jack, whereby said piston raises and lowers said boom;
towing wheels mounted on said base frame above the ground line when said base frame is in a horizontal position, said towing wheels being positioned for road contact when the combination tow bar and mast is lowered for use as a tow bar;
and a towing fitting attached to the lift adjacent to the mast end of said lifting boom.

5. In a towable hydraulic lift, the combination comprising:
a base frame having casters thereon for mobility, said base frame including a pair of parallel arms and a horizontal cross member rigidly attached to and between said arms;
a combination tow bar and mast rigidly attached at one end to the center of said cross member;
a hydraulic jack pivotally mounted on the other end of said combination tow bar and mast and having a cylinder with a piston operatively engaged with said combination tow bar and mast;
a safety valve in said jack, said valve being adjustable for bypassing fluid exteriorly of said cylinder at a predetermined hydraulic pressure whereby overloading is prevented, said valve having a reduced incre-

mental opening rate after initial opening of the valve, whereby rapid lowering is prevented; and

a lifting boom pivotally mounted on said combination tow bar and mast and operatively connected with said hydraulic jack.

References Cited in the file of this patent

UNITED STATES PATENTS

1,771,879	Dowd et al.	July 29, 1930
2,085,111	McConnell	June 29, 1937
2,104,576	Zagelmeyer	Jan. 4, 1938
2,361,197	Hallinan	Oct. 24, 1944
2,517,434	Humpal et al.	Aug. 1, 1950
2,517,813	Wallace	Aug. 8 1950
2,535,753	Parker	Dec. 26, 1950
2,643,779	Hamlin	June 30, 1953
2,786,589	Garrett	Mar. 26, 1957
2,842,271	Witcher	July 8, 1958
2,975,803	Vallee	Mar. 21 1961

FOREIGN PATENTS

557,179	Belgium	May 31, 1957
117,957	Sweden	Jan. 14, 1947