May 12, 1959 D. A. HARRIS 2,886,197

WIDE-SPREAD LOAD CLAMP

Filed Aug. 18, 1955 2 Sheets-Sheet 1

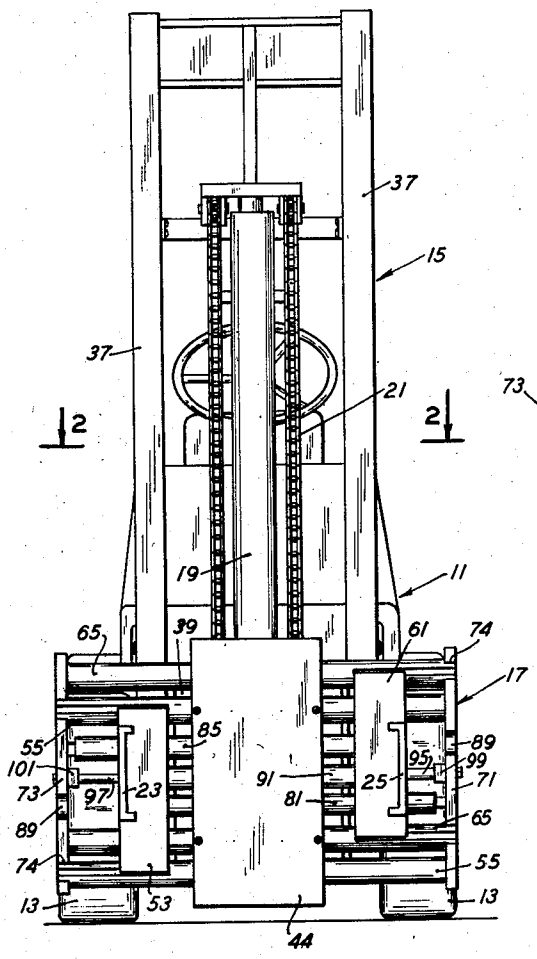

FIG. 1

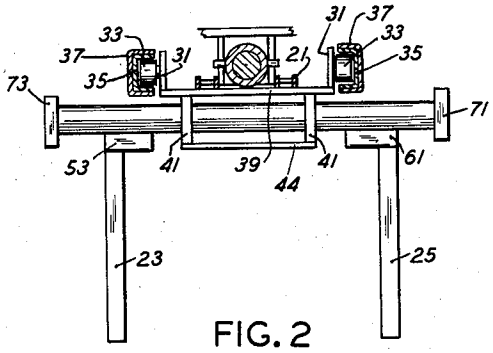

FIG. 2

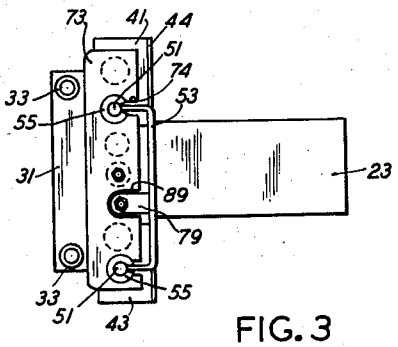

FIG. 3

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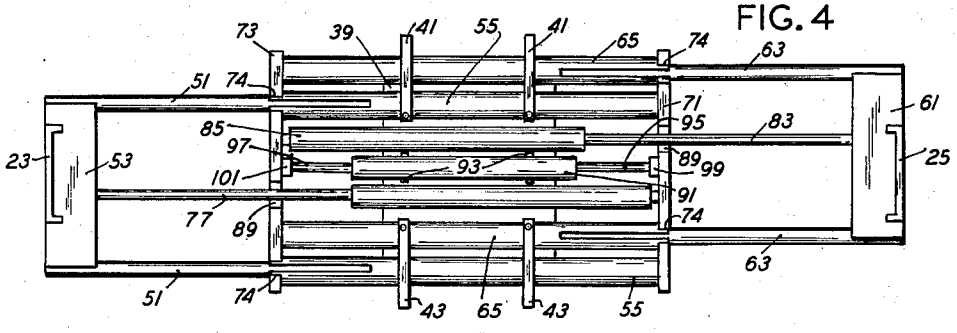
FIG. 4



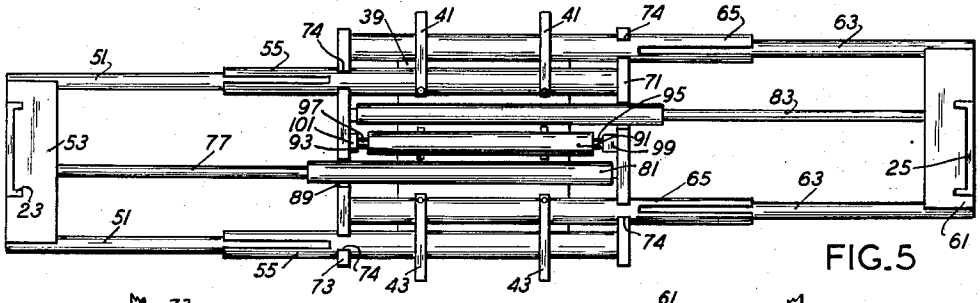


FIG. 5

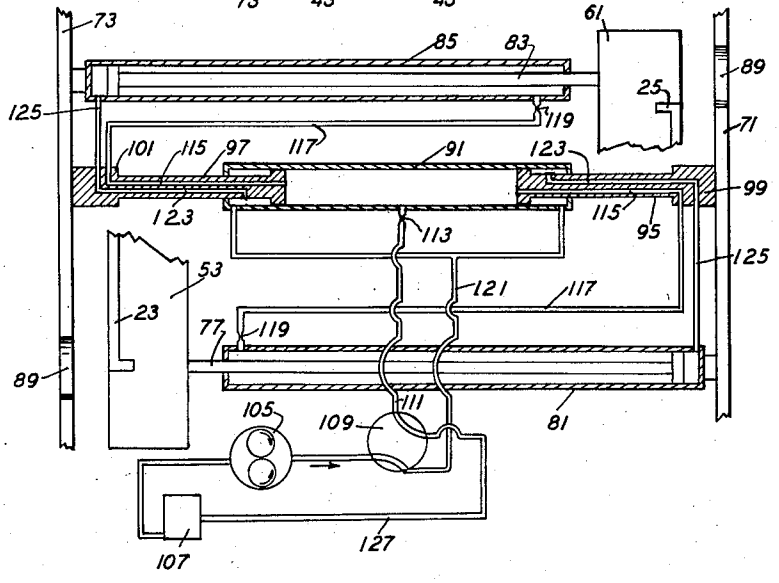


FIG. 6

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United States Patent Office 2,886,197 Patented May 12, 1959

2,886,197

WIDE SPREAD LOAD CLAMP

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Application August 18, 1955, Serial No. 529,141

11 Claims. (Cl. 214—653)

This invention relates to an improved load clamp for an industrial lift truck, and particularly to a wide spread load clamp.

The Patent to Ehmann Re. 23,694 shows an industrial lift truck having a load clamp including a pair of load clamp arms operated by a pair of cylinder units for gripping and releasing a load. The cylinder units are overlapped and oppositely directed to obtain a wide range of movement of the arms without increasing the width of the clamp, when in its contracted position, beyond that of the lift truck. Thus, when the clamp is contracted, the operator is assured that he can travel down any passage of a width to pass the lift truck.

There has been an increasing demand for a load clamp which, when contracted, is no wider than the truck, but which can handle wider loads than prior clamps. It is a main object of the present invention to provide such a clamp.

It is another object of the present invention to provide a load clamp in which the arms have a wider range of movement relative to the contracted width of the clamp than heretofore has been provided.

Another object of the invention is to provide a simple arrangement for spreading and retracting the arms of a wide spread load clamp.

The clamp of the present invention is characterized by having power units for moving the load clamp arms, such units being movably mounted with respect to the frame of the clamp to obtain a greater range of movement of the load clamp arms than is possible by operation of such power units alone, and being moved by other power means for obtaining such wide range of movement.

Various other objects of the present invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a front elevational view of a lift truck having a clamp in accordance with the present invention provided thereon, the clamp being in its fully contracted condition;

Fig. 2 is a top view of the clamp and the mast of the truck;

Fig. 3 is a side view of the clamp;

Fig. 4 is a front view of the clamp, showing the arms partly extended and the guard plate being removed;

Fig. 5 is a view similar to Fig. 4 but showing the arms fully extended; and

Fig. 6 is a schematic view of the hydraulic system for the attachment.

Referring to the drawings, Fig. 1 discloses a lift truck 11 supported by wheels 13 and having a tiltable mast 15 at its front end. The clamp 17 of the present invention is mounted on the mast for movement therealong, and the mast is extended and the clamp is elevated in a conventional manner by the ram 19 and the chain 21. The clamp includes a pair of opposed load clamp arms 23 and 25 movable relatively toward and away from one another for gripping and releasing a load.

More in detail, the clamp 17 has a frame including a

pair of rearwardly extending roller supports 31 (Figs. 2 and 3) carrying rollers 33 which ride within the channels 35 of the inner upright, these channels being slidably received within the channels 37 of the outer upright. The roller supports 31 are connected by a frame member 39 to which is rigidly attached an upper pair of separated, forwardly extending guide plates 41 (Fig. 4) and a lower pair of guide plates 43. A guard plate 44 is secured to the guide plates.

The load clamp arm 23 is supported on the frame of the clamp by a pair of guide units including slides 51 (Fig. 4) to the outer ends of which the load clamp arm is connected by a channel-shaped piece 53, the slides being slidably received within guide tubes 55 which in turn slidably extend through aligned openings formed in the guide plates 41 and 43. The load clamp arm 25 is similarly supported by a channel piece 61, slides 63 and guide tubes 65. All of the guide tubes are slotted at their ends closest to the associated load clamp arm to accommodate the ends of the channel pieces and permit the load clamp arms to be moved inwardly of the adjacent ends of the guide tubes for a purpose to presently appear.

The ends of the guide tubes 55 remote from the load clamp arm 23 are secured to a subframe 71, and the ends of the guide tubes 65 remote from the load clamp arm 25 are fixedly secured to a subframe 73. Each subframe has openings through which slidably extend the guide tubes associated with the other subframe. It is further pointed out that the subframes 73 and 71 have slots at 74 communicating with the just-mentioned openings to allow movement of the channel pieces 53 and 61 therepast.

The guide units 51, 55 are oppositely directed from the guide units 63, 65 and are arranged in parallel overlapping relation, as shown, to provide a compact unit with a wide range of movement of the load arm.

The slides 51 and the load arm 23 are adapted to be extended relative to the frame of the clamp by a cylinder and piston unit, the piston of which is connected to the channel piece 53 carrying the load clamp arm 23 by a piston rod 77 and lug 79 (Fig. 3), and the cylinder 81 of which is connected at its right-hand end, as the parts are shown in Fig. 4, to the subframe 71. The load clamp arm 25 is adapted to be similarly extended relative to the frame in a direction opposite from that of the arm 23 by another cylinder unit which includes a piston rod 83 connected by a lug (not shown) to the arm 25 and a cylinder 85 which is fixed at its left-hand end to the subframe 73. Each subframe is recessed or notched at 89 to accommodate movement therethrough of the piston rod, lug and cylinder of the opposite subframe when the subframes are retracted, as presently will be described.

Since the cylinders 81 and 85 are carried by the subframe 71 and 73, respectively, the cylinder units are mounted for movement relative to the frame of the clamp in directions to extend or retract the load arms 23 and 25. Also, the cylinder units are overlapped and parallel to achieve a long range of movement of the load arms 23 and 25 and, further, are oppositely directed. The units may be considered as constituting motor units for operating the arms 23 and 25.

A piston and cylinder means is provided on the frame for extending the range of movement of the load arms 23 and 25 over that which the cylinder units 81 and 85 alone are capable of causing. This cylinder and piston means includes a cylinder 91 fixed by mounting pieces 93 to the frame of the clamp. Within the cylinder are a pair of pistons (Fig. 6) connected by piston rods 95 and 97 and fittings 99 and 101 to subframes 71 and 73, respectively. Thus cylinder units 81 and 85 and piston and cylinder means 91, 95, 97 provide a multiple stage piston and cylinder means affording a first range of movement

and also a second range of movement to achieve an overall range of movement exceeding that afforded by a single stage piston and cylinder means, such as for instance one of units 81 or 85. Also, the fact that the guide tubes 65 and 55 are slidably mounted on the carriage frame instead of being fixed to the frame provides a multiple stage guide means providing a range of movement exceeding that afforded by a single stage guide means of comparable size.

The hydraulic system for the clamp is best shown in Fig. 6 and includes a pump 105 supplying fluid from a reservoir 107 to a four-way valve 109, the valve being connected by a hose 111 to the center of the fixed cylinder 91, there being an orifice 113 in the hose 111 for a purpose to presently appear.

The piston rods 95 and 97 and the fittings 99 and 101 are formed with passages 115 communicating at their inner ends with the central portion of the cylinder 91, and at their outer ends with hoses 117 which are connected to the ends of the cylinders 81 and 85 located adjacent the respective load grip arms. The connections of the hoses 117 to the cylinders are made through orifices 119.

A branching hose 121 connects the valve 109 to the ends of the cylinder 91. Communicating with such ends are passages 123 formed in the piston rods 95 and 97, and the fittings 99 and 101, the passages communicating by means of hoses 125 with the ends of the cylinders 81 and 85 remote from their respective load grab arms. The valve 109 is also connected by a return flow conduit 127 to the reservoir 107.

In operation, it may be assumed that the attachment is in its contracted position, in which case the load arms 23 and 25 are in their innermost positions whereas the subframes 71 and 73 are in their outermost positions (Fig. 1). It may be seen from Fig. 1 that the width of the attachment is no greater than that of the truck.

Referring again to Fig. 6, to extend the arms the valve 109 is operated to supply fluid through the hose 121 to the ends of the cylinder 91 from whence it flows through the passages 123 and the hose 125 to the ends of the cylinders 85 and 81 which are remote from their load arms. Outward movement of the pistons within the cylinders 81 and 85 is resisted by the orifices 119, and inward movement of the pistons within the cylinder 92 is resisted by the orifice 113. Inasmuch as the orifices 119 are in parallel with one another but in series with the orifice 113, they offer less resistance to fluid flow than does the restriction 113, and thus the pistons in the cylinders 81 and 85 first are moved outwardly, that is, to the left and right, respectively, as the parts are depicted in Fig. 6, to extend the arms so that they are separated and spread apart to the Fig. 4 position. It is also pointed out that the difference in the areas between the inner and outer ends of the pistons in cylinder 91 contributes to causing the sequence of movement just described. When the pistons of cylinders 81 and 85 reach the end of their strokes, pressure will be built up in the ends of cylinder 91, causing the pistons of cylinder 91 to move inwardly, thus shifting the cylinders 81 and 85 in directions toward their arms to further separate or spread apart the load arms 23 and 25 to the positions shown in Fig. 5.

To close the arms, the valve 109 is operated to supply fluid through the hose 111 to the center of the cylinder 91. Because of the restrictions 119, the pistons of the cylinder 91 first will move outwardly and thereafter the pistons of the cylinders 81 and 85 will be forced to return to their initial position to fully retract the load arms.

Although the particular hydraulic circuit shown is believed to be novel in itself, the invention is not intended to be limited thereto, since other actuating arrangements could be provided.

With the load clamp of the present invention, a wide load, such as three bales of cotton arranged side by side, can be handled. When the load is released, the clamp can be contracted to a position where it is no wider than the truck so that the truck can thereafter be driven along aisles or passages just wide enough to pass the truck.

It is further pointed out that the clamp of the invention is capable of handling loads narrower than the truck, as is evident from the position of the arms 23 and 25 in Fig. 1. In fact, the clamp is capable of handling loads as narrow as those which can be handled by conventional load clamps.

Having described the invention in what is considered to be the preferred embodiment thereof, it is desired that it be understood that the invention is not to be limited other than by the provisions of the following claims.

I claim:

1. A load clamp for a lift truck comprising a frame, a pair of opposed load grip arms movable relative to said frame in directions toward and away from each other for gripping or releasing a load, a pair of overlapping cylinder and piston units connected one to each of said arms for moving said arms toward and away from each other, said units being oppositely directed and parallel, said units being movable relative to said frame in said directions also to provide for movement of said arms toward and away from each other thus increasing the range of movement of the arms over that afforded by the operation of the units alone, and cylinder and piston means for moving said units in said directions, said cylinder and piston means being arranged in parallel overlapping relations with said units.

2. A load clamp for a lift truck comprising a frame, a pair of opposed load grip arms, an elongated guide device for each arm, said devices being oppositely directed and parallel and overlapping one another, each device including a slide connected at one end to the associated arm and a guide slidably receiving said slide and being slidably mounted on said frame for movement in a longitudinal direction, and means connected to said arms independently of the guide devices for separating said arms and thus extending the slides and for then further separating said arms and also moving said guides in directions toward their respective arms to extend the range of movement of said arms to permit them to embrace a wide load, said means being operable to retract said arms and to contract said guide devices for gripping the load.

3. A load clamp for a lift truck comprising a main frame adapted to be secured to the elevator of a lift truck, a pair of subframes mounted on the main frame for movement transversely thereof toward and away from one another, a first load arm guide extending transversely from one subframe past the other subframe, a first slide mounted on said first load arm guide for movement therealong, a load arm carried by said first slide, a second load arm guide extending transversely from said other subframe past said one subframe, a second slide mounted on said second load arm guide for movement therealong, a load arm carried by said second slide, and means connected to said arms independently of said slides and guides and connected to said subframes for shifting the subframes toward and away from one another and for shifting said arms relative to said subframes to thereby shift the slides along the load arm guides to locate the arms in the desired position.

4. A load clamp for a lift truck comprising a frame, a pair of opposed load grip arms, an elongated guide device for each arm, said devices being oppositely directed and parallel and overlapping one another, each device including a slide connected at one end to the associated arm and a guide slidably mounted on said frame for longitudinal movement, a pair of oppositely directed cylinder and piston units for extending said slides relative to said guides to separate said arms, said units being oppositely directed and parallel and overlapping one another for long range movement, one unit being connected at one end to one arm and the other unit being connected at one end to the

other arm, and cylinder and piston means fixed to said frame in overlapping relation to said guide devices and said units and operatively connected to said units and said guides for shifting them relative to said frame in directions toward their corresponding arms to further separate said arms to permit said arms to embrace a wide load.

5. A load clamp for a lift truck comprising a frame, a pair of opposed load grip arms movable relative to said frame in directions toward and away from each other for gripping or releasing a load, multiple stage piston and cylinder means for each arm for moving said arms toward and away from each other, each multiple stage piston and cylinder means affording a first range of movement for its arm and also a second range of movement for its arm to achieve an overall range of movement exceeding that afforded by a single stage piston and cylinder means, the elements of said multiple stage piston and cylinder means being arranged in overlapping relation so that while said means provide a large range of movement of the arms, they are compact in the direction of such movement when retracted.

6. A load clamp for a lift truck comprising a frame, a pair of opposed load grip arms, multiple stage guide means mounting said arms for a range of movement exceeding that afforded by a single stage guide means of comparable size, multiple stage piston and cylinder means for each arm for moving said arms toward and away from each other, each multiple stage piston and cylinder means being connected to its arm independently of the multiple stage guide means, each multiple stage piston and cylinder means affording a first range of movement for its arm and also a second range of movement for its arm to achieve an overall range of movement exceeding that afforded by a single stage piston and cylinder means.

7. A load clamp for an industrial lift truck comprising a frame of narrower width than that of the lift truck, a pair of tubular guides slidably extending through the frame in opposite directions, said guides being disposed in overlapping relation, a slide slidably received by each guide, the slides being projectable from the guide in opposite directions, a clamp arm secured to the outer end of each slide, a piston and cylinder unit for each arm connected thereto and arranged in overlapping relation with respect to said guide, connecting means for the guide and cylinder of each arm, each connecting means connecting the ends of the associated guide and cylinder remote from the associated arm, and power means between said frame and said connecting means to move said connecting means from outward positions near the lateral confines of the lift truck to inward positions toward said frame to thereby bodily move said guides in directions to separate said arms.

8. A load clamp for an industrial lift truck comprising a frame of narrower width than that of the lift truck, a pair of tubular guides slidably extending through the frame in one direction and a second pair of tubular guides extending through said frame in the opposite direction, said guides being disposed in overlapping relation, one of the first-mentioned guides being disposed between the second guides, a slide for each guide, the slides for said first-mentioned guides being projectable therefrom in a direction opposite to that in which the slides of the second guides are projectable, a first clamp arm secured to the outer ends of the slides for the first-mentioned guides and a second clamp arm secured to the outer ends of the slides for said second guides, a piston and cylinder unit for each arm connected thereto and arranged in overlapping relation with respect to said guides, a connecting member for the guides and cylinder of each arm, each connecting means being secured to the ends of the associated guides and cylinder remote from the associated arm, and other hydraulic piston and cylinder means for moving said connecting means from outer positions near the lateral confines of the lift truck to inward positions toward said frame to thereby bodily project said guides and cylinders in directions to separate said arms.

9. A load clamp for an industrial lift truck comprising a frame, a pair of tubular guides slidably supported by said frame and arranged to extend in opposite directions and being arranged in parallel overlapping relation, a slide slidably received by each guide, the slides being projectable from the guide in opposite directions, a clamp arm secured to the outer end of each slide, a piston and cylinder unit for each arm connected thereto and arranged in overlapping relation with respect to said guides, connecting means for the guide and cylinder of each arm, each connecting means connecting the ends of the associated guide and cylinder remote from the associated arm, and a single cylinder arranged in parallel, overlapping relation with respect to the above-mentioned guides and piston and cylinder units and having a pair of oppositely moving pistons connected respectively to said connecting means for moving said connecting means inwardly toward one another to thereby separate said clamp arms.

10. A load clamp as defined in claim 7 in which the power means comprises a cylinder means arranged in parallel, overlapping relation with respect to the guides and piston and cylinder units previously referred to and having a pair of oppositely moving in-line pistons connected respectively to said connecting means for moving said connecting means inwardly toward one another to thereby separate said clamp arms.

11. A load clamp for an industrial lift truck comprising a frame, a pair of tubular guides slidably supported by said frame and arranged to extend in opposite directions and being arranged in parallel overlapping relation, a slide slidably received by each guide, the slides being projectable from the guide in opposite directions, a clamp arm secured to the outer end of each slide, a piston and cylinder unit for each arm connected thereto and arranged in overlapping relation with respect to said guides, connecting means for the guide and cylinder of each arm, each connecting means connecting the ends of the associated guide and cylinder remote from the associated arm, and a cylinder means arranged in parallel, overlapping relation with respect to the above-mentioned guide and piston and cylinder units and having a pair of oppositely moving in-line pistons connected respectively to said connecting means for moving said connecting means inwardly toward one another to thereby separate the clamp arms.

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