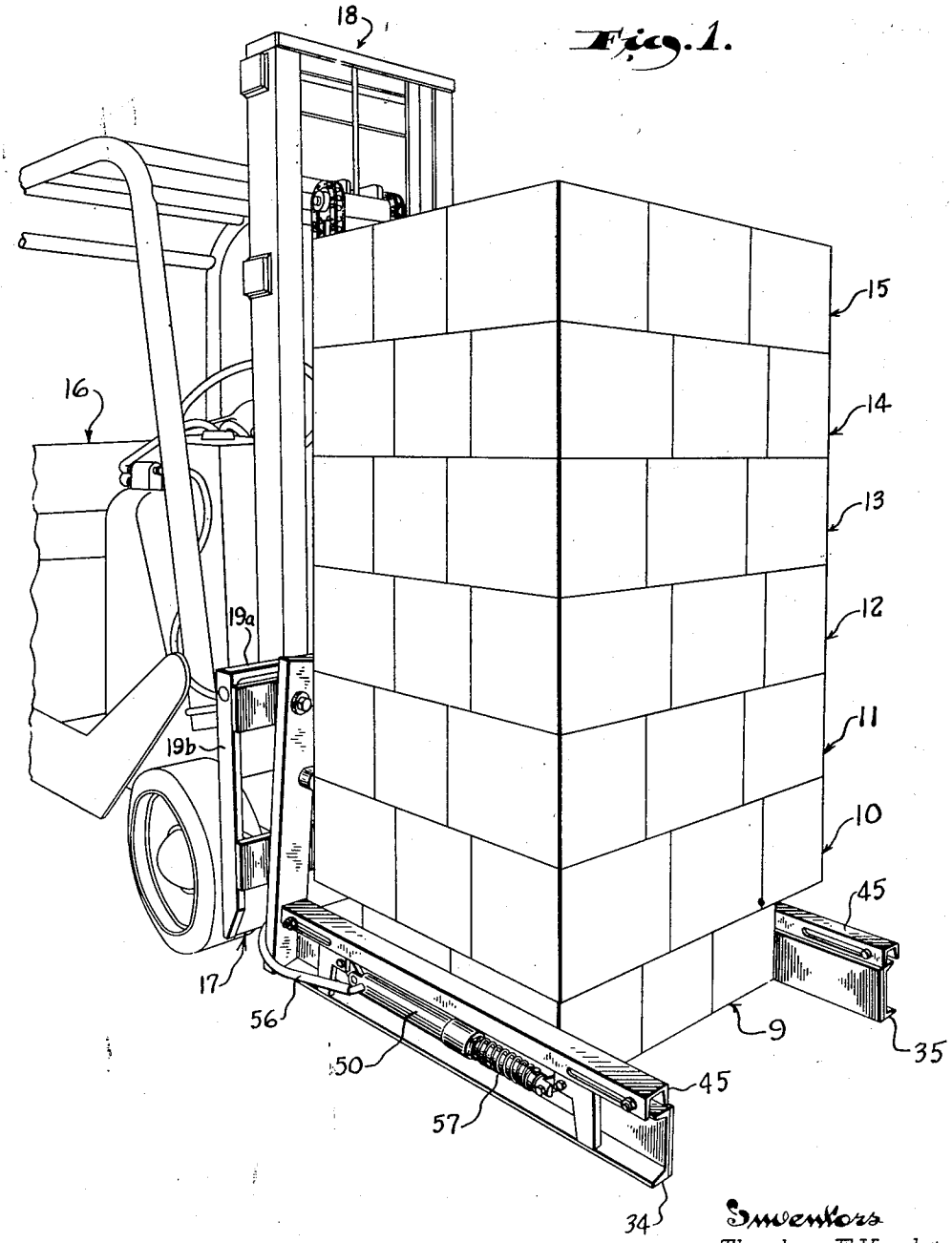
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APPARATUS FOR HANDLING UNIT LOADS

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Fig. 1.



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Fig. 3.

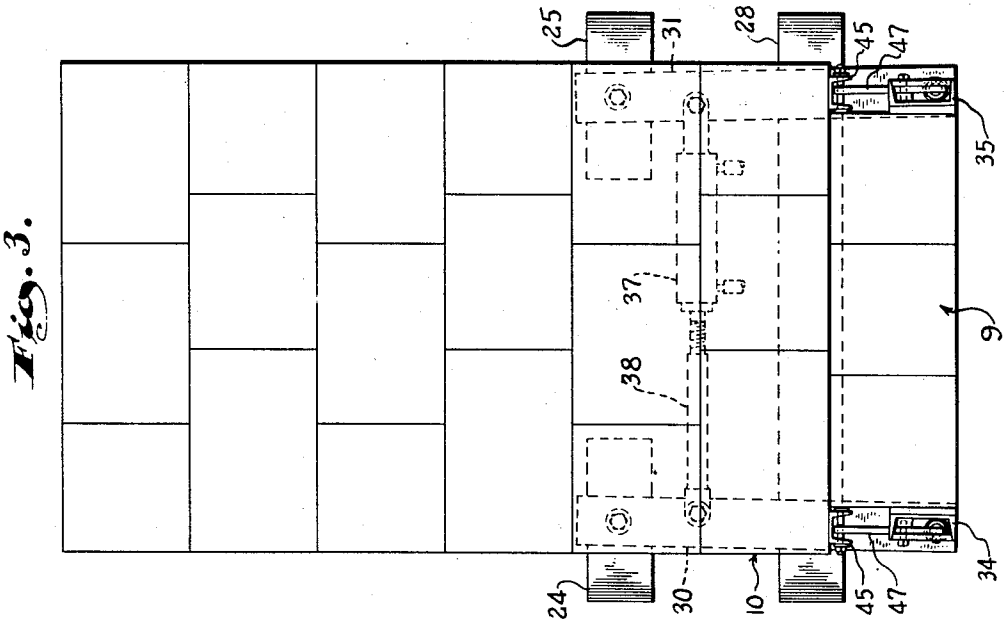
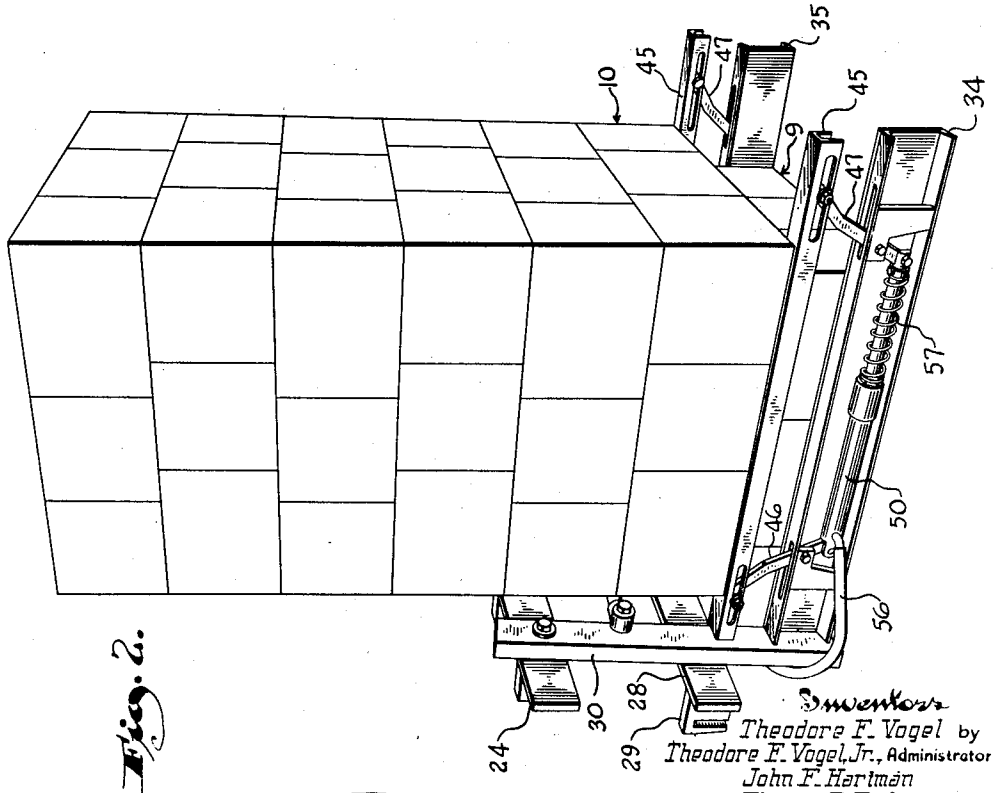


Fig. 2.



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APPARATUS FOR HANDLING UNIT LOADS

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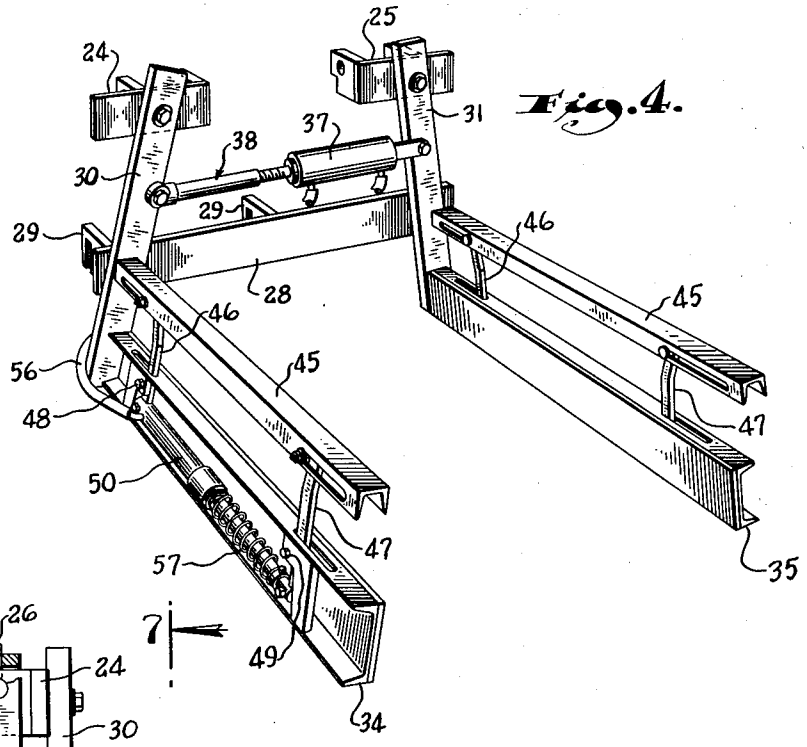


Fig. 4.

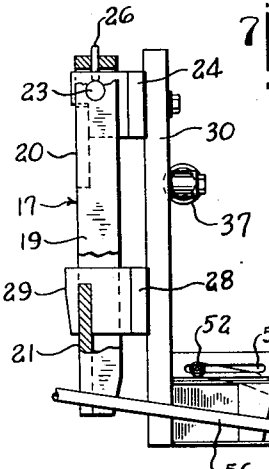


Fig. 5.

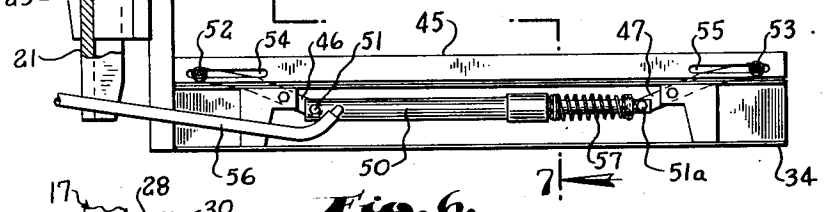
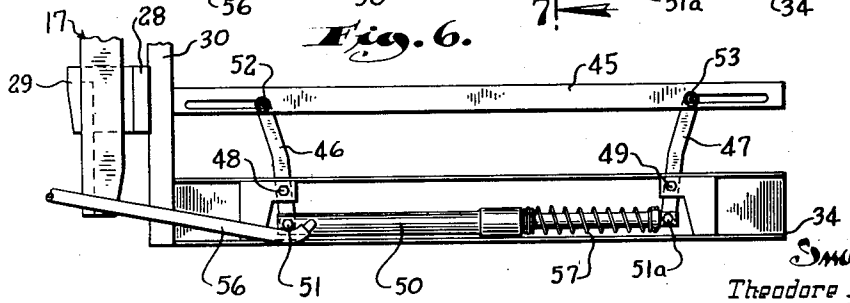


Fig. 6.



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APPARATUS FOR HANDLING UNIT LOADS

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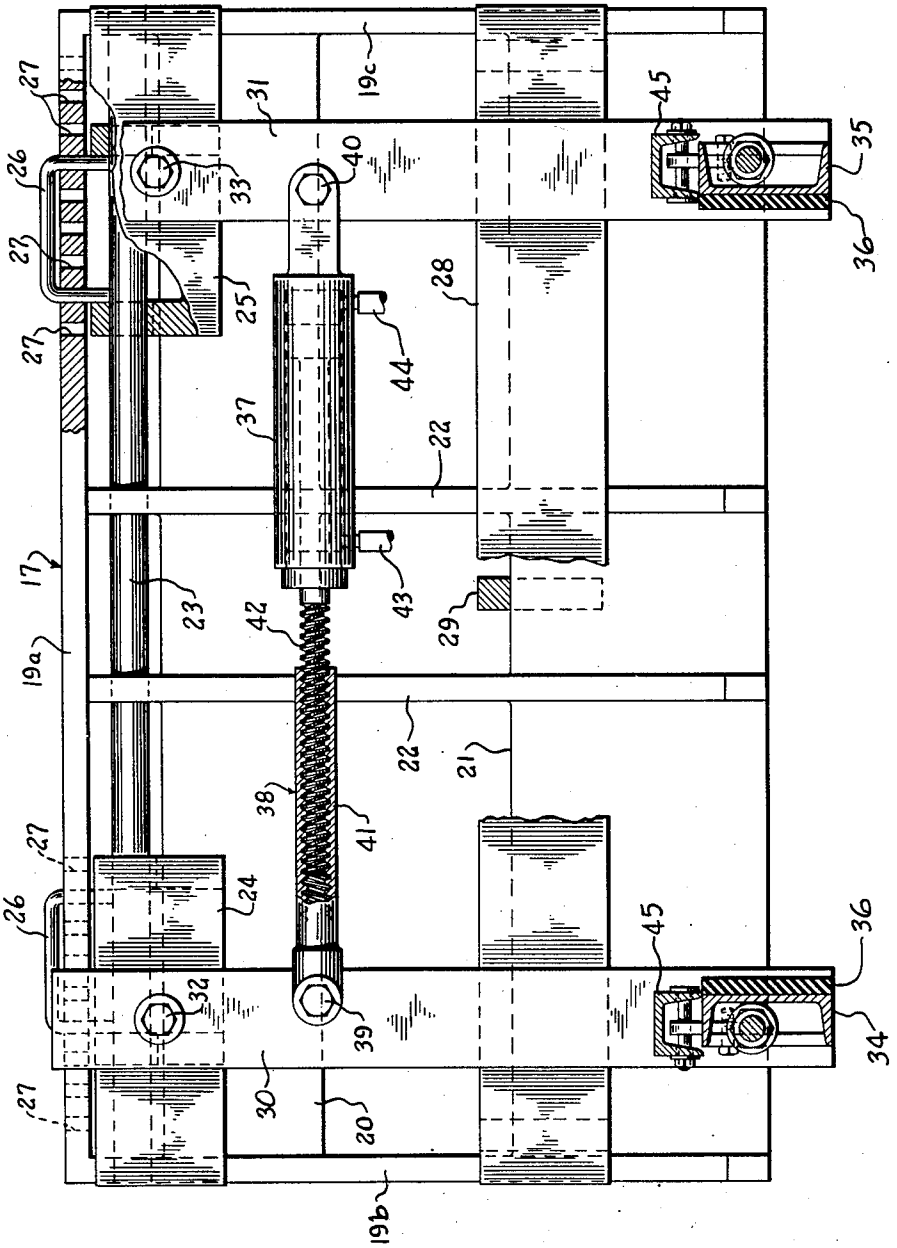


Fig. 7.

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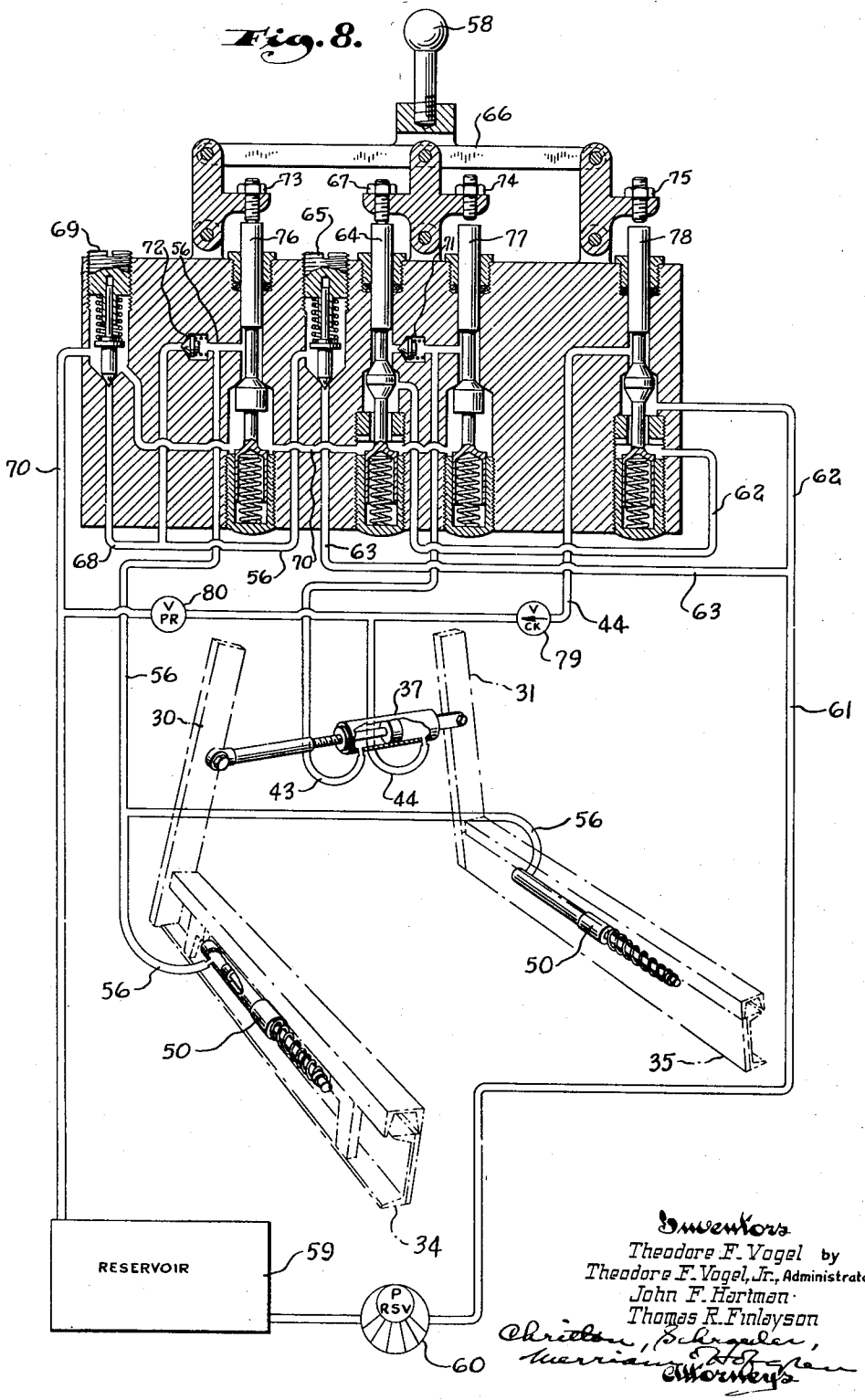
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Fig. 8.



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UNITED STATES PATENT OFFICE

2,509,023

APPARATUS FOR HANDLING UNIT LOADS

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Application July 5, 1947, Serial No. 759,124

8 Claims. (Cl. 214—65.2)

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This invention relates to an improved apparatus for and method of handling unit loads, and in particular it relates to a fork for industrial trucks which may be used to handle a self-palletized unit load.

The principal object of the invention is to provide a fork for handling self-palletized unit loads, that is, unit loads which have a second course which overhangs the base course on two opposite sides so that they may be handled without the use of a separate pallet, such a self-palletized load being shown in Figs. 1, 2 and 3 hereof.

A further object is to provide such a fork in which the base course of a self-palletized load is gripped by the tines of the fork and the superposed courses are supported from below by vertically movable shelf-like load rest bars associated with the tines.

A further object is to provide such a fork which may be installed on present power lift trucks without substantial modification of the truck itself, or which may be incorporated in a hand truck.

A further object is to provide such a fork in which a single control commences sequential operation of the gripping element and the supporting element, either to support or release a load.

A further object is to provide such a fork in which gripping force is provided by a floating hydraulic ram which permits the gripping of a base course which is not precisely in the center of the spaced tines.

A further object is to provide such a fork in which floatingly mounted hydraulic rams provide the lifting force for the load rest bars so as to permit even support on the oppositely overhanging bottoms of the first superposed course when either the load or the truck is not precisely horizontal.

A further object is to provide such a fork in which the gripping force of the spaced tines is regulated so as to squeeze the containers in the base course into an arched support for the superposed courses; but in which gripping force is insufficient to crush the containers or their contents.

A further object is to provide such a fork in which the maximum lifting force exerted by the vertically movable load rest bars is insufficient to break the glue bond between the base course and the second course.

Other objects will become readily apparent from the following detailed description taken in

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connection with the accompanying drawings. The invention is illustrated in conjunction with the previously mentioned self-palletized unit load.

Fig. 1 is a perspective of our improved fork attached to a known type of industrial lift truck, the fork being in position to engage a self-palletized unit load;

Fig. 2 is a perspective of the fork engaging the load preparatory to lifting it;

Fig. 3 is a front elevation of the fork engaging the load preparatory to lifting it;

Fig. 4 is a perspective of the fork with the load rest bars in their raised, or supporting position;

Fig. 5 is a side elevation thereof with part of the truck front frame broken away to show the manner in which the fork is secured to the truck, and with the load rest bars in their retracted position;

Fig. 6 is a partial side elevation with the load rest bars in their raised position;

Fig. 7 is a section taken as indicated at 7—7 of Fig. 5, with parts of the fork support and bottom spacer bar broken away to show the manner in which the fork is secured to the truck; and

Fig. 8 is a schematic section of the hydraulic controls for the fork, the fork being partially shown in perspective.

While the invention is susceptible of various modifications and alternative constructions, it is shown in the drawings and will hereinafter be described in a preferred embodiment. It is not intended, however, that the invention is to be limited thereby to the specific construction disclosed, but it is intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention as defined in the appended claims.

The improved unit load will be described herein insofar as its structure is essential to the understanding of the operation of the fork. As seen in Figs. 1, 2 and 3, our self-palletized load comprises a base course 9, of predetermined dimensions, and a plurality of courses 10, 11, 12, 13, 14, and 15 superposed thereon, the superposed courses being of such dimensions as to project beyond the sides of the base course 9. The several courses are secured together by means of strips or spots of adhesive (not shown) so as to increase the strength of the unit load and prevent individual containers from being accidentally dislodged. The base course 9, being smaller than the superposed courses 10, etc., permits the spaced tines of a lift fork to span the base course and make engagement with the overhanging bot-

tom surfaces of the containers forming the second, or first superposed course 10.

Our improved fork is shown attached to a common type of industrial lift truck, indicated generally at 16, the truck being furnished with a front frame 17 which may be raised and lowered upon a mast 18 by means which are well known in the art. As best seen in Fig. 7, the front frame 17 has a rectangular main portion 19 consisting of a top bar 19a and side bars 19b and 19c, and upper and lower face bars 20 and 21. For the sake of additional rigidity, the front frame may be provided with central vertical stringers 22.

Our improved fork is adapted to be secured to the front frame 17. A hanger bar 23 is passed through suitable registering openings in the side bars 19b and 19c, and in the vertical stringers 22. Supported on the hanger bar is a supporting element, consisting preferably of a pair of independent U-shaped hanger members 24 and 25 which are slidably mounted on the hanger bar 23. The use of independent hanger members makes the fork readily adaptable to trucks having front frames of varying widths. Each of the hanger members has associated with it a U-shaped locking member, as 26, which is dropped through a pair of suitably spaced apertures 27 in the top bar 19a of the front frame so as to prevent sliding of the hanger member on the hanger bar 23. In order to permit a general adjustment of the span of the fork to adapt it to use with shipping containers of varying sizes, a plurality of spaced apertures 27 are preferably provided so as to permit some adjustment of the hanger members with respect to the front frame and to one another. A spacer bar 28, provided with a plurality of mounting hooks 29, is hung on the lower face bar 20 of the front frame so as to provide a guide surface in the same vertical plane with the forward faces of the hanger members 24.

The hanger members 24 and 25 provide the supporting element for the movable portions of the lift fork. Tine supporting members 30 and 31 are pivotally secured by their upper ends to the hanger members 24 and 25, at 32 and 33 respectively, so that their lower ends are free to swing toward and away from each other. Horizontal tines 34 and 35 are secured, respectively, to the lower ends of the members 30 and 31. The tines 34 and 35 have a channel shaped cross section with an inner surface of substantial height, preferably having a rubber pad 36 secured thereto. Spaced between the pivotal mountings 32 and 33 and the tines 34 and 35 is a hydraulic clamp ram 37 having a piston rod 38, the clamp ram being floatingly mounted between the members 30 and 31 by bolting the piston rod to the member 30 at 39 and bolting the clamp ram cylinder to the member 31 at 40. In order to accommodate the variation in spacing of the hanger members 24, as was discussed above, the piston rod 38 is in the form of a threaded sleeve 41 and a screw 42. The clamp ram 37 is of the type in which the piston is moved in both directions by hydraulic pressure, and the cylinder is thus provided with a pull side hydraulic line 43 and a push side hydraulic line 44 which will be discussed further in connection with the hydraulic control system.

It is plain that the lift fork may be brought into position, as shown in Figs. 1 to 3, with the tines spanning the base course 9 of a self-palletized load, and that by admitting fluid to the pull side of the cylinder 37, the tines 34 and 35 will squeeze the base course 9 so as to permit it to be picked up between the tines. The rubber inner surfaces 36 provide a good gripping surface, and accommodate the tines to any slight irregularity in the size of the containers forming the base course 9.

Each of the tines 34 and 35 is provided with a long shelf-like load rest bar 45 which is normally in a retracted position, as in Fig. 5, and which is adapted to be raised to an extended supporting position, as in Figs. 4 and 6, beneath the overhanging bottom surface of the second course 10 so as to furnish a considerable part of the support for the superposed courses 10, etc. Since the elevating mechanism for the two load rest bars is identical, one will be described and similar numbers will be used on both.

A pair of elevating levers 46 and 47 is pivotally mounted in the channel portion of the tine, at 48 and 49. A hydraulic elevating ram 50 for raising the load rest bar 45 is floatingly mounted by having its cylinder pivotally secured to the lower end of the lever 46 at 51 and its piston rod pivotally secured to the lower end of the lever 47 at 51a. Studs 52 and 53, on the levers 46 and 47 respectively, engage a pair of horizontal slots 54 and 55 in the load rest bar 45. The elevating ram 50 is provided with an elevating ram line 56 which will be discussed further in connection with the hydraulic circuit. When fluid is admitted through line 56 to the cylinder of the ram 50, it drives the piston outwardly, to the position shown in Figs. 4 and 6, thus pivoting the levers 46 and 47 to raise the load rest bar 45. When fluid is released from the cylinder of the ram 50, the tension spring 57 serves to return the piston to the position shown in Fig. 5, thus returning the load rest bar 45 to its retracted position.

The hydraulic circuit for controlling the operation of the clamp ram 37 and the elevating rams 50 is schematically illustrated in Fig. 8. A single control handle 58 is shown in its neutral position. Moving the control handle 58 to the left as seen in Fig. 8, admits fluid to the pull side line 43 of clamp ram 37 so as to cause the tines 34 and 35 to grip the base course 9, and subsequently admits fluid to the elevating ram 56 to move the load rest bars 45 to their extended position. Moving the control handle 58 to the right as seen in Fig. 8, produces a sequential operation in which fluid is first released from the rams 50 so as to permit the return springs 57 to bring the load rest bars 45 to their retracted position, and thereafter fluid is simultaneously released from the pull side line 43 and admitted to the push side line 44 of the clamp ram 37 so as to move the tines 34 and 35 to their released position.

A reservoir 59 is connected through a pump 60 to a main fluid line 61. The line 61 divides into a clamp ram line 62 and a feed line 63. When the control handle 58 is at its neutral position, fluid in the line 62 is held in check by a pull side valve 64, and fluid in the line 63 is held in check by a pull side relief valve 65. When the control handle 58 is moved to the left as seen in Fig. 8, the lever 66 at the bottom end thereof acts through the valve actuator 67 to open the pull side valve 64. Fluid from the clamp ram line 62 may then pass by the pull side valve 64 into the pull side line 43 so as to drive the piston of the clamp ram 37 to the right and produce the desired gripping action by the tines 34 and 35. When the pressure in the line 43 has reached 200

pounds to the square inch, the pull side relief valve 65 opens and permits fluid to pass from the feed line 63 into the lines 56 of the elevating rams 50, to raise the load rest bars 45. The line 56 is provided with a by-pass line 68 which leads to an elevating ram release valve 69. When pressure in the line 56 reaches 200 pounds to the square inch, the release valve 69 opens and permits fluid from the load rest bar circuit to pass into a return line 70 and return to the reservoir. In order to hold the tines in their gripping position, a check valve 71 is provided in the pull side line 43; and in order to hold the load rest bars in their elevated position, a check valve 72 is provided in the elevating ram line 56. When the sequential gripping and raising operations are completed, the check valves 71 and 72 retain the ram pistons in position, and the control handle 58 may be returned to its neutral position as shown in Fig. 8.

When it is wished to release a load, the control handle 58 is moved to the right as seen in Fig. 8, and the lever 66 acting through the valve activators 73, 74, and 75 opens the elevator ram release valve 76, the pull side release valve 77, and the push side valve 78. As shown, the valve activator 73 is adjusted so as to open the release valve 76 before the activators 74 and 75 open the pull side release valve 77 and push side valve 78. Thus the fluid from the lines 56 is first released to enter the return line 70 and return to the reservoir, permitting the return springs 57 to lower the load rest bars 45. Thereafter, the push side valve 78 is opened to permit fluid from the clamp ram line 62 to enter the push side line 44 of the clamp ram 37, and simultaneously the pull side release valve 77 is opened to permit the thrust of the clamp ram piston to drive the fluid out of the pull side line 43 and into the return line 70. When the tines have been moved to their most open position, a back pressure is set up in the line 44 which closes a check valve 79 and opens a low pressure relief valve 80 in the line 44, the valve 80 being adjusted to open at a pressure of 50 pounds per square inch to release fluid from the line 44 and permit it to enter the return line 70. During the gripping operation, the thrust of the clamp ram piston simply drives the fluid from the push side line 44 through the low pressure relief valve 80, so that no other release valve is needed for the line 44.

We claim:

1. A fork for a lift truck comprising: a pair of spaced tines mounted for movement selectively toward or away from each other so as to grip or release the base course of a unit load; a hydraulic clamp ram for moving said tines, said clamp ram being floated between said tines; a vertically movable load rest bar associated with each of said tines; a hydraulic elevating ram for raising each of said bars, said elevating rams being floatingly mounted beneath said bars; and a spring for lowering each of said bars.

2. A fork for a lift truck comprising: a supporting element; a pair of spaced bars supported on said element so that their lower ends are free to swing toward and away from one another; a pair of parallel tines projecting substantially horizontally from the lower ends of said bars; a pair of spaced levers pivoted on each of said tines, said levers having studs at their upper ends; a pair of load rest bars, each having slotted portions by which it is mounted on the studs on one of said pairs of levers; and a hydraulic elevating ram floated between the lower ends of each of said pairs of spaced levers.

3. A fork for a lift truck comprising: a pair of spaced tines adapted to selectively grip or release the base course of a unit load; means for selectively moving said tines to a gripping or a releasing position; means for locking said tines in the selected position; a normally retracted vertically movable load rest bar associated with each of said tines; means for effecting vertical movement of said rest bars to an extended supporting position contacting the bottom of a second course which overhangs said base course; means for locking said rest bars in their extended position; and means for releasing said rest bars for return to their retracted position.

4. A fork for a lift truck comprising: a pair of spaced tines mounted for movement selectively toward or away from each other so as to grip or release the base course of a unit load; a normally retracted vertically movable load rest bar associated with each of said tines; a hydraulic circuit including a reservoir and pump; a clamp ram in said hydraulic circuit for effecting the movement of said spaced tines; a pair of elevating rams in said circuit for effecting vertical movement of said rest bars to an extended load supporting position; means for controlling the flow of fluid to and from said rams; and means for returning said rest bars to their retracted position.

5. A fork for a lift truck comprising: a pair of spaced tines mounted for movement selectively toward or away from each other so as to grip or release the base course of a unit load; a normally retracted vertically movable load rest bar associated with each of said tines; a hydraulic circuit including a reservoir and pump; a clamp ram in said hydraulic circuit for effecting the movement of said spaced tines; means associated with said clamp ram for locking the tines in their gripping position; a pair of elevating rams in said circuit for effecting vertical movement of said rest bars to an extended load supporting position; means associated with said elevating rams for locking the rest bars in their extended position; means for causing sequential activation of the clamp ram and the elevating rams to first move the tines to gripping position and then move the rest bars to extended position; means for first releasing the rest bars for movement to their retracted position and for then releasing the tines for movement to their released position; means for returning the rest bars to their retracted position; and means for returning the tines to their release position.

6. A fork for a lift truck comprising: a pair of spaced tines adapted to grip the base course of a unit load; a normally retracted vertically movable load rest bar associated with each of said tines; a hydraulic circuit including a reservoir and a pump; a clamp ram in said hydraulic circuit mounted between said tines, said clamp ram having a pull side fluid line for admitting fluid to cause the tines to be moved to a gripping position and a push side line for admitting fluid to cause the tines to be moved to a releasing position; a check valve associated with said pull side fluid line to retain the tines in their gripping position; a pair of elevating rams in said hydraulic circuit, each of said elevating rams being mounted to effect the elevation of one of said rest bars; a check valve associated with said elevating rams to retain the rest bars in their elevated position; means for sequentially admitting

fluid to said pull side line and then to said elevating rams; means for releasing fluid from said elevating rams and thereafter simultaneously releasing fluid from said pull side line and admitting fluid to said push side line; and means for moving said rest bars to their retracted position.

7. A fork for a lift truck comprising: a supporting element; a pair of spaced bars supported on said element so that their lower ends are free to swing toward and away from one another; a pair of parallel tines projecting substantially horizontally from the lower ends of said bars; a normally retracted vertically movable load rest bar associated with each of said tines; a hydraulic circuit including a reservoir and pump; a hydraulic clamp ram in said hydraulic circuit floatingly mounted between said spaced bars, said clamp ram having a pull side fluid line for admitting fluid to cause the spaced bars to swing toward each other and a push side fluid line for admitting fluid to cause the spaced bars to swing away from each other; a check valve associated with said pull side fluid line to retain the spaced bars at their position of closest approach; a pair of elevating rams in said hydraulic circuit, each of said elevating rams being mounted to effect the elevation of one of said rest bars; a check valve associated with said elevating rams to retain the

rest bars in their elevated position; means for sequentially admitting fluid to said pull side line and then to said elevating rams; means for releasing fluid from said elevating rams and thereafter simultaneously releasing fluid from said pull side line and admitting fluid to said push side line; and means for moving said rest bars to their retracted position.

8. A device of the character described in claim 7 in which each rest bar is mounted at the upper end of a pair of pivotally mounted levers by a pin and slot connection, and each elevating ram is floatingly mounted between the lower ends of said levers.

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