Feb. 25, 1969 M. D. ROBINSON 3,429,464

LOAD LIFT APPARATUS WITH LOW LOADING LEVEL

Filed Oct. 3, 1967 Sheet 1 of 2

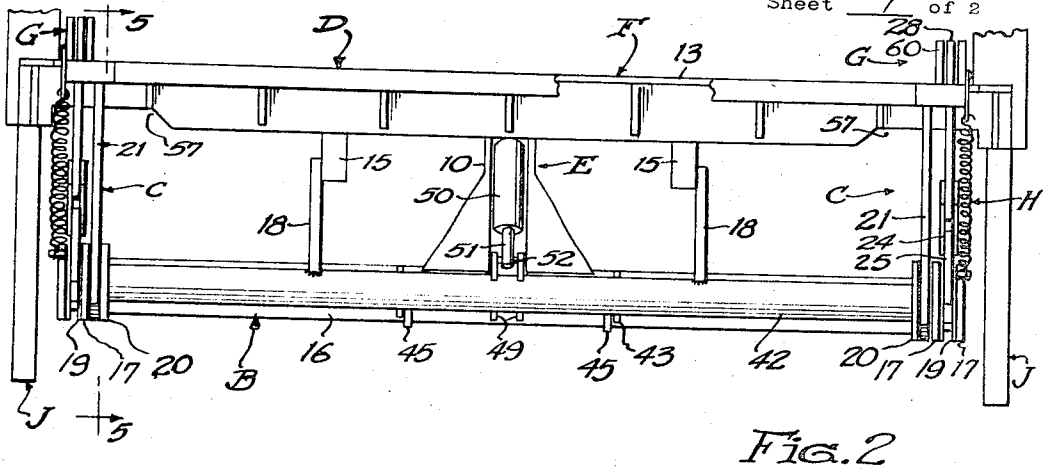
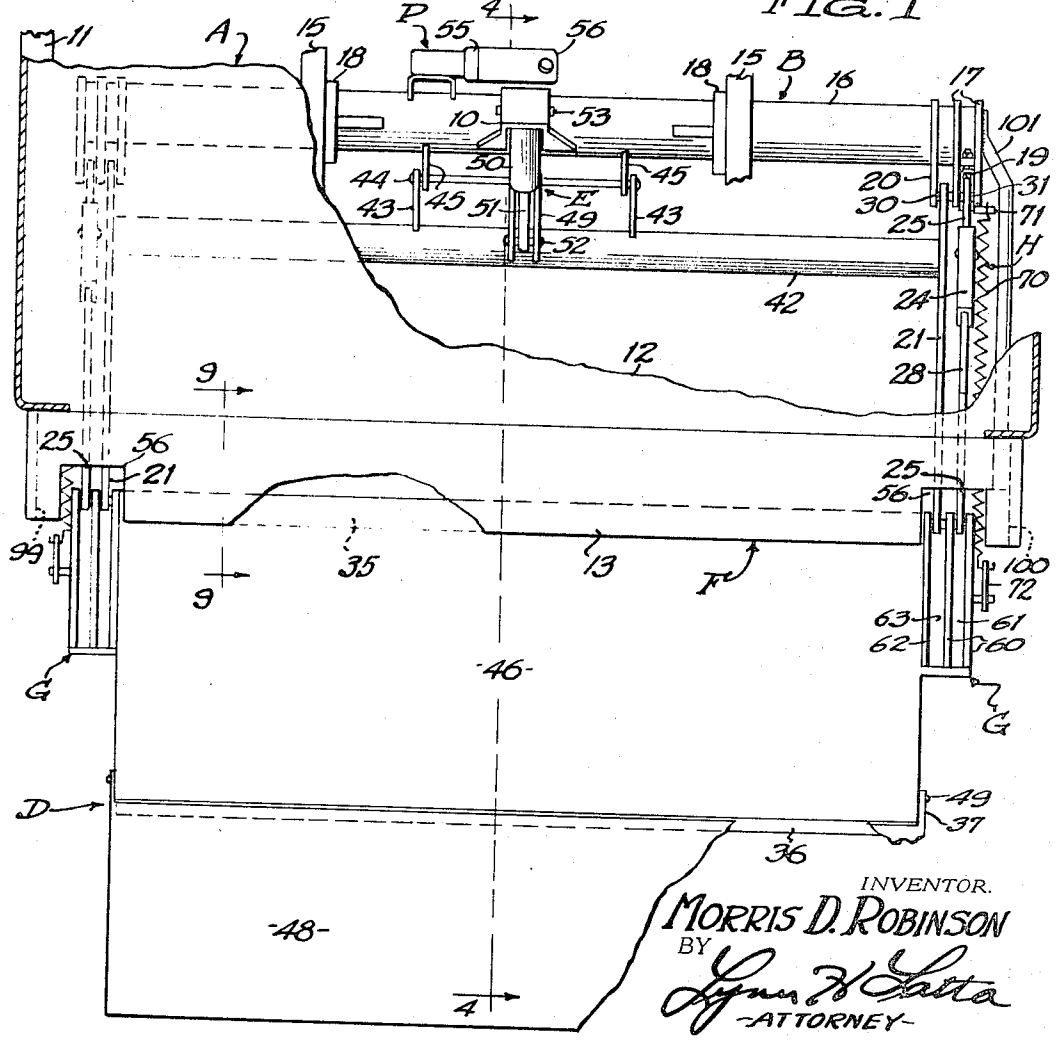


FIG. 2

FIG. 1



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Filed Oct. 3, 1967 Sheet 2 of 2

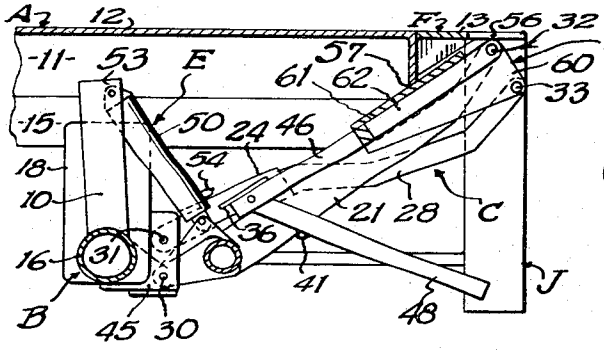


FIG. 5

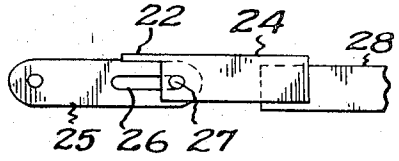


FIG. 8

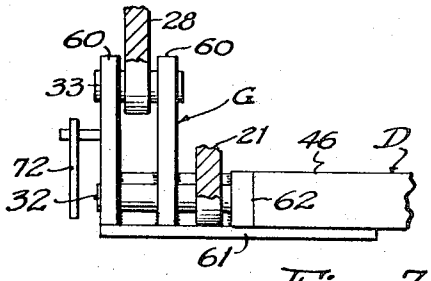


FIG. 7

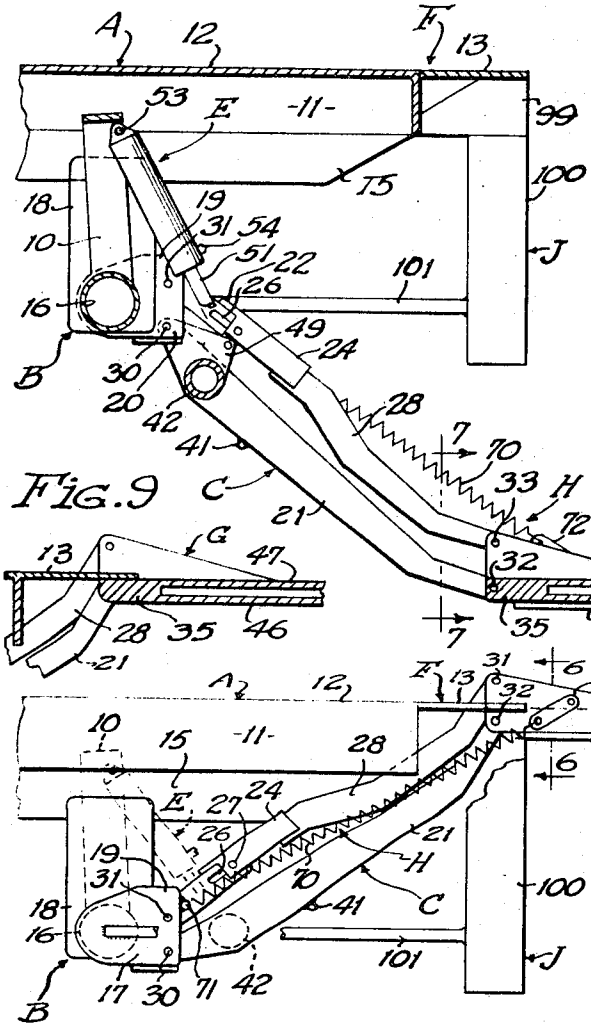


FIG. 9

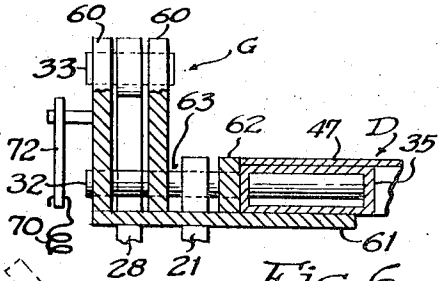


FIG. 6

FIG. 3

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LOAD LIFT APPARATUS WITH LOW LOADING LEVEL

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Continuation-in-part of applications Ser. No. 499,627, Oct. 21, 1965, and Ser. No. 515,504, Nov. 19, 1965.
This application Oct. 3, 1967, Ser. No. 672,492
U.S. Cl. 214—77 11 Claims
Int. Cl. B60p 1/48

ABSTRACT OF THE DISCLOSURE

Disclosed herein is a hydraulic lift for vehicles such as trucks, wherein a lift platform or deck is carried by parallel arm linkage in a leveled position during elevation from ground level to truck bed level by a hydraulic cylinder exerting an upward pull against the lift arms at a point located outwardly of a transverse horizontal fulcrum axis on which they are pivotally attached to the vehicle for vertical swinging movements. The parallel arms of the linkage are sectional, articulated and foreshortenable in a manner such as to provide for manually-operated folding of the deck over and into the linkage for stowing it in a non-use position. The platform is thin so as to provide low-level loading. When in the folded, stowed position, its heel is tucked beneath a plate which provides a rearward extension of the bed of the truck to which the lift is attached (where the lift is attached to the rear end of a truck). Outboard brackets, attached to the deck heel to transmit support to the deck from the parallel arm elevating linkage, project above the level of the deck so as to provide adequate cantilever support, and project upwardly through notches in the bed extension plate when the deck is leveled with the truck bed.

This application is a continuation-in-part, of my two prior applications: Ser. No. 499,627, filed Oct. 21, 1965, now Patent No. 3,369,678 for Stowable Lift Apparatus, and Ser. No. 515,504, filed Nov. 19, 1965, now Patent No. 3,369,679 for Stowable Lift Apparatus.

Background of invention

Lifts having decks elevated by parallel arm linkage and adapted to be folded forwardly upon, into or beneath the linkage, but which do not provide a thin deck which can bring the loading level close to the ground, are common, and are disclosed in the following patents: McCarty 3,138,270; Appleman 3,258,140; Lugash 2,989,196; Lugash 2,837,227.

The use of supporting pivots above deck level at the heel of a lift deck, for cantilever support, is likewise common in prior art lifts which, however, do not provide for folding the deck completely beneath the truck bed and its extension plate. The following prior patents discloses such cantilever supports: Lugash 3,263,835; Hansen 2,088,648; Ives 2,527,818; Marcus 2,715,470; Vogel 2,820,554; Wise 3,077,275; Richards 2,298,166; Wood 2,683,540; Penney 2,390,268; Mullin 2,542,047.

Resumé of invention

The present invention is particularly characterized by a combination of the following features:

(1) A thin deck having a load-supporting surface that can be brought close to the ground for low-level ground loading;

(2) Provision of adequate cantilever support of the deck from parallel arm elevating linkage through rugged, durable brackets which:

(a) Provide outboard support for the outer ends of the pivot pins linking the arms to the deck heel, thus imparting ruggedness and durability;

(b) Extend above the deck level to provide adequate vertical spacing between pivots while allowing the deck to lie close to the ground in loading position;

(3) Arranging for the outboard brackets to intersect the outer margin of the bed extension so as to bring the pivots inwardly of such margin and so as to bring the heel of the deck beneath and into supporting engagement with the bed extension, when the deck is leveled with the truck bed;

(4) Projection of the outer margin of the deck extension outwardly of the deck heel pivots when the deck is in its elevated, folded position, whereby the deck is stowed beneath the bed extension without projecting substantially beyond its outer margin. This permits docking in which the outer margin of the bed extension can come up against a loading dock without damaging the lift mechanism.

The general object of the invention is to combine all of the foregoing desirable features in a lift apparatus adapted for attachment to a truck or equivalent freight vehicle.

Description

Other objects will become apparent in the ensuing specifications and appended drawings, wherein:

FIG. 1 is a plan view of my load lift apparatus in the elevated, extended position, parts being broken away to better illustrate the invention;

FIG. 2 is a rear elevational view of the same with parts broken away;

FIG. 3 is a side elevational view of the same, with portions broken away;

FIG. 4 is a sectional view of the apparatus in lowered, ground-loading position, taken in the vertical longitudinal planes indicated by line 4—4 of FIG. 1;

FIG. 5 is a vertical longitudinal sectional view of the apparatus in the elevated, folded, stowed position, taken in the plane of line 5—5 of FIG. 2.

FIG. 6 is a detail vertical transverse sectional view of one side of the deck heel, looking forwardly on line 6—6 of FIG. 3, illustrating the outboard bracket;

FIG. 7 is a vertical transverse sectional view through a pair of elevating linkage arms, looking rearwardly on line 7—7 of FIG. 4, viewing the other side of the deck heel and the other bracket;

FIG. 8 is a fragmentary detail side view of one of the foreshortenable, deck-leveling parallel arms of the elevating linkage; and

FIG. 9 is a fragmentary detail taken on line 9—9 of FIG. 1;

Referring now to the drawings in detail, I have shown therein as an example of one form in which the invention may be embodied, a lift apparatus comprising, in general, a mount frame B adapted for installation beneath the bed of a truck A; a parallel arm linkage C fulcrumed upon the mount frame B; a sectional deck D carried by the outer ends of the arms comprising the parallel arm linkage C; a hydraulic actuator E operating between the mount from B and the parallel arm linkage C for elevating the linkage C and the deck D; a floor level extension F for the rear end of the bed of truck A; a pair of docking bumpers J; outboard bracket units G connecting the linkage C to the deck D; spring-loading means H acting in tension between sections of linkage C for assisting in the upward folding of the deck; a hydraulic power package (pump and valve assembly) indicated generally at P (FIG. 1); and a control assembly (not shown).

The essential parts of truck A to which the invention is particularly related are the bed 11, which provides

an elevated floor 12 onto which loads are transferred from the lift deck D when elevated so as to be leveled with the floor; and frame 15 to which the mount frame B is attached. The invention deals with the specific problem of folding the lift apparatus into a sufficiently compact condition to bring substantially all portions thereof beneath the floor area including the area of extension F, as well as the problem of bringing the heel of deck D snugly close to the extended floor margin in the elevated, load-transfer position of the deck shown in FIG. 3. Extension F, of yoke shape (FIG. 6) is secured by suitable means (e.g., welding) to the rear end of bed 11. It includes a floor plate 13 which can be installed flush with truck floor 12, or at a different level, as may be required.

Mount frame B comprises a torque tube 16 having a plurality of mount plates 18 (FIG. 2) secured to its upper side, projecting upwardly and providing for attachment of the mount frame to truck frame 15; pairs of spaced mount ears 17 and associated mount ears 20 for pivotal support of the ends of the arms of linkage C; stop-block clevises 19 adjustably mounted between ears 17 for adjustable support of the inner ends of one set of arms of linkage C; an actuator bracket 10 secured to and rising from the center of the torque tube 16; and a pair of inboard mount ears 45 aligned with ears 20.

Linkage C comprises a set of lift arms 21 operable in compression; and a set of "parallel" arms, operable in tension and of foreshortenable telescoping construction (FIG. 8) each comprising a scabbard 24 of flat rectangular channel cross-section and a blade 25 (FIG. 4) of flat bar stock having a longitudinal slot 26 pierced by a pin 27 bridging between and anchored in the sides of scabbard 24. Each scabbard 24 has an integral stop lip 12 projecting over blade 25 at its one end, and a tail 28 secured therein and extending therefrom in the plane of blade 25. The slots 26 are of such a length and so positioned that engagement of the pins 27 against their outer ends will provide connections between the arm sections 24 and 25 such as to provide a tension load-carrying function in which they will hold the deck in a level or horizontal position at any height to which the deck is lifted by the lift arms 21. This function is indicated by the term "leveling" hereinafter applied to arms 24–28. This involves the full extension of the parallel arms. In the various foreshortened positions of the parallel arms, they function as guide arms without any load-carrying function. The linkage arms are arranged in adjacent paired relation, one pair at each side of the linkage, each pair comprising a lift arm 21 and a parallel arm 24, 25, 28 located laterally outwardly of the lift arm 21.

The lift arms 21 (FIG. 3) have their ends fulcrumed on pivots 30 each supported in a respective pair of mount ears 17, 20 (FIG. 1). The parallel arm blades 25 have their corresponding ends mounted on pivots 31 spaced substantially vertically above the respective pivots 30 and carried by the clevises 19. The linkage arms have outer, swinging ends provided with respective pivots correspondingly spaced vertically during lift operation, said outer end pivots consisting of lower pivots 32 connecting the ends of lift arms 21 to the heel of deck D at the lower side thereof when leveled, and upper pivots 33 connecting the ends of scabbard tails 28 to the heel near the upper level of the deck. Thus the linkage arms are mounted to frame B for upward swinging in parallel relationship so as to maintain their outer end pivots parallel to pivots 30, 31. The lift arms 21 are provided with rests 41 projecting inwardly from the respective sides of the linkage sufficiently to engage the deck D and to support it with reference to the linkage when folded to stowed position as hereinafter described.

The lift arms 21 are integrally joined by a cross bar 42, preferably in the form of a cylindrical tube for maximum strength. The lift linkage further includes a pair of short arms 43 (FIGS. 1 and 5) which are secured to cross bar 42, and spaced so as to embracingly engage the mount ears 45, and are connected thereto by a hinge pin 44 which is aligned with the linkage pivots 30. The cross bar 42 is also provided, at its center, with a pair of upwardly projecting spaced clevis ears 49. The arms 43 and ears 49 are secured to the cross bar 42 by any suitable means such as welding.

At this point it may be noted that the lift operation of this apparatus in elevating a load from a ground-loading position of the deck D shown in FIG. 4, upwardly to the unloading position shown in FIG. 3 (lift being applied to the linkage C by the actuator E) is essentially the same as that of well known lift apparatus now in extensive use, and in this respect, the invention provides a combination of means for applying lifting power and for simultaneously maintaining the deck D in a leveled position, equivalent to and fully as satisfactory and durable as that of the known lift mechanisms. In addition, the invention provides improved stability and ruggedness in the linkage connections, and improved means to place the deck in a position stowed beneath the truck bed when not in use, with the deck folded over into the arms of the linkage, including the tension loading assist means which will be described hereinafter.

It may also be noted that the sectional construction of parallel arms 24, 25 provides a lost-motion connection between the pairs of pivots 31, 33 which are the upper pivots of the linkage when in load-lifting positions, permitting the upper deck pivots 33 to approach the upper mount pivots 31 in an orbiting movement of pivots 33 around lower deck pivots 32 to accommodate upward folding of deck D toward the mount pivots 30, 31. Other lost-motion linkage connections known in the art (e.g., as provided by articulation of the parallel arm section for jackknifing foreshortening) can be employed in lieu of the slidable telescoping foreshortening connections; or lost-motion connections between pivots 33 and outboard brackets G can be substituted for those shown.

The clevises 19 are mounted at their lower ends on the pivots 30 for limited horizontally swinging adjustment of their upper ends for the purpose of shifting the upper mount pivots 31 with reference to the lower mount pivots 30. This will effect a corresponding adjustment of the linkage-to-deck pivots 33, 32. Such adjustment may be effected by the adjustment means disclosed in my above-identified application Ser. No. 515,504.

Deck D is composed of an inward section 46 and an outward section 48, both of which may be of metal plate 47 on frame 35 construction, suggested in FIGS. 4 and 6. Outer section 48 has a pair of hinge arms 37 (FIG. 3) projecting from its inward margin, embracing and attached by pivots 49 to the outward corners of inner deck section 46, and resting, when extended, upon a projecting marginal portion of a step plate 36 carried by the outer end of inner section 46 at its under face. In the elevated, load-transfer position of FIG. 3, the heel portion of deck section 46 projects beneath the outer marginal portion of deck extension plate 13 (FIG. 9) and engages the same with a supporting engagement.

The invention is particularly characterized as follows: The lift linkage C is so positioned beneath the truck bed A, that deck heel pivots 32, 33 will be spaced a substantial distance inwardly of the outer margin of bed extension F when the deck is brought up to the extension in its load-transfer position of FIG. 3. Notches 56 in the extension plate 13, extending inwardly from its outer margin, are positioned to receive the outboard brackets G in this load-transfer position, the brackets G projecting upwardly through the notches to a substantial height above the level of bed A and deck D. Notches 57 in the rear end apron of truck bed A are positioned to receive the parallel arm tails 28 in this load transfer position, and to receive the brackets G in the stowed position of FIG. 5. With the deck-heel pivots 32, 33 located in-

wardly of the outer margin of extension F in the elevated position of lift linkage C, the heel of the deck, in the folded, stowed position of FIG. 5, is disposed substantially completely beneath the extension F and inwardly of the outer margins of dock bumpers J, whereby the lift apparatus is fully protected against damage that might occur from backing up to a loading dock.

Hydraulic actuator E is a conventional unit comprising a cylinder **50** having a piston (not shown) slidable therein and attached to one end of a piston rod **51** the other end of which is connected by a pivot pin **52** between clevis ears **49**. At its upper end, cylinder **50** is anchored on a pivot pin **53** carried by the upper end of actuator bracket **10**. A manually-operable valve, built into a suitable power-operated pump **55** (FIG. 1) embodied in power package P, connects the cylinder at **54** to the pump for delivering hydraulic fluid under pressure from a reservoir **56** to actuator E. Power package P is mounted on mount tube **16** as shown.

Outboard brackets G provide an important improvement in connecting the lift linkage C to the deck heel, where the lift linkage arms are located outwardly of the side extremities of the deck to permit the deck to be folded into the linkage (between the lift arms). Hitherto it has been considered necessary to arrange the compression arms of the linkage outwardly of the tension arms in order to avoid interference between the deck and the linkage during folding of the deck into the linkage and the elbow-hinging or telescoping foreshortening of one pair of arms for achieving such folding by orbiting one set of the linkage-to-deck pivots (**32**, **33** in the present construction) about one another. In the present invention, the outboard brackets G make it possible to locate the parallel arms **24**, **28** outwardly of the lift arms, a desirable arrangement to facilitate application of lift directly to the lift arms by actuator E; and at the same time, provide a very sturdy anchorage for the deck pivots, and an arrangement in which the deck pivots can orbit without interference. Each of the outboard brackets G (FIG. 6) comprises a pair of spaced parallel vertical bracket fingers **60** of triangular plate form having base margins secured to the outward end portion of an outboard bracket arm **61** in the form of a rectangular plate. The bracket arm **61** is secured to the lower margin of an attachment plate **62**, the inner face of which is secured to a respective side of deck section **46** adjacent its heel. Bracket arm **61** is extended beyond plate **62** and secured (e.g., by welding) to the underside of deck frame **35**. The bracket arm **61** functions as a cantilever support for the pair of bracket fingers **60** which are separated from the attachment plate **62** by a space **63** in which the outer end of lift arm **21** is received as the deck is folded toward stowed position (FIG. 5). Arms **21** are pivoted in the lower extremities of spaces **63** upon the pivot pins **32** which bridge between the attachment plates **62** and the nearest outboard bracket plates **60** and have their ends mounted in these respective plates so as to transmit bracing support to the plates **60**. The end of each scabbard tail **28** of the parallel arms is received between the upper corners of a respective pair of outboard bracket fingers **60**, and its pivot **33** consists of a pin bridging between those corners and having its ends moutned therein. Thus it is possible for the lift arms **21** to enter the spaces **63** without interference from the pivots **33**, during the folding movement of the deck from its extended position shown in FIG. 4 to its position shown in FIG. 4 to its position completely folded into the linkage as shown in FIG. 5. In this folding movement, when (or before) the deck has reached the position shown in FIG. 5 the deck section **48** will establish contact with rests **41** of lift arms **21** to support the deck in the linkage.

Tension loading units H are disposed above the respective tension arms **24**, **25** (FIGS. 1 and 3) each loading unit comprises a coil spring **70** having one end anchored to a pin **71** secured to the side of a respective mount ear **17** and having its other end attached, by means of a link **72**, to the side of a respective bracket G. Springs **70** have as their main function to assist the upward folding of the deck D into the linkage after the extension section **48** has been flipped upwardly and forwardly to the position indicated in broken lines in FIG. 4. The springs **70**, which are stretched under tension between the anchorage elements **71**, **73**, preload the sections of the parallel arms for contraction to foreshortened condition in which the parallel arm-deck pivots **33** are moved toward the mount frame B around deck heel pivots **32**. Also, in exerting a pull between deck section **46**, above the deck heel pivots **32**, **33**, and the parallel arm blades **25** near the mount frame B, they exert a preload lift upon the deck which assists the operator in lifting it (e.g., from the lowered position of FIG. 4) toward its position folded into lift linkage C preparatory to power elevation to the stowed position of FIG. 5. In this operation, the extension section **48** of the deck is first flipped inwardly to its dotted line position of FIG. 4. Thus the tension units H provide a spring-assist to the operator, who by lifting with a force less than fifty pounds against the outer extremity of the main deck section **46** (after having flipped the extension **48** over the main deck section) will be able to move the deck D to a folded position in which the extension section **48** extends downwardly into the linkage C. A substantial portion of the lifting force required for swinging the deck upwardly to this position is provided by the tension units H. The tension units H further function, in the elevated, load-transfer position of FIG. 3, to steady the elevated deck by exerting a downward pull against the deck below the deck-heel pivots **32**, **33**, as can be seen in FIG. 3, the springs **70** passing "dead center" during elevation from ground-loading position to load-transfer position.

Bumpers J comprise heavy bars **100** secured at their upper ends to side frame members **99** of extension F and projecting vertically downwardly therefrom, and brace rods **101** secured to and bridging between the lower ends of bars **100** and the ends of mount tube **16** (FIG. 1).

Control mechanism (not shown) and control operation may be the same as that disclosed in said pending application, the disclosure of which is incorporated herein by reference for those features as to which cross reference is made above.

In operating the lift to the stowed position, after having manually lifted the deck to the folded-in position, the operator then operates the hydraulic actuator **50** to raise the linkage in an elevating movement in which the deck will drop further into the lift linkage C until the extension section **48** comes to rest against the rests **41**. The linkage and deck are then elevated further and may optionally be secured by latch mechanism which may be the same as that disclosed in my pending application, Ser. No. 515,504.

I claim:

1. Lift apparatus comprising:

a mount frame attachable to a vehicle;

parallel arm lift linkage comprising a pair of laterally-spaced lift arms and a pair of laterally-spaced parallel leveling arms,

vertically-spaced fulcrum pivots carried by said mount frame, on which inner ends of said arms are fulcrumed;

a pair of deck-mounting brackets having correspondingly vertically-spaced pivots mounted therein and pivotally carried by the outer ends of said arms;

a thin deck having a heel portion mounted on and extending between said brackets, said heel portion having a thickness equal to only a fraction of the height of said brackets, said brackets projecting above the level of the deck surface at said heel portion when the deck is extended;

said linkage being such as to permit folding of said deck with reference to said lift linkage to a position

projecting inwardly from its heel toward said mount frame;

power means for applying a lift to said linkage to swing the same upwardly around said fulcrum pivots so as to move said deck either in a leveled condition into a load-transfer position level with said bed surface, or in folded condition into a position stowed beneath said vehicle;

and means providing a marginal portion of the bed surface of said vehicle beneath which said heel portion is receivable in said stowed position, said marginal portion having notches in which said brackets are receivable so as to project upwardly therethrough to a substantial height above said bed surface in said load-transfer position;

said bracket pivots being positioned inwardly of the outer margin of said marginal portion when said brackets are thus received in said notches, and said deck heel portion and brackets when in said stowed position, being disposed inwardly of the outer margin of said marginal portion.

2. Lift apparatus as defined in claim **1**, wherein said leveling arms included telescoping sections operable to provide a foreshortening characteristic.

3. Lift apparatus as defined in claim **2**, including assist springs exerting a foreshortening pull on said linkage and operable to spring-load said deck so as to facilitate folding thereof into said linkage.

4. Lift apparatus as defined in claim **3**, wherein said assist springs are each anchored at one end to a respective deck-mounting bracket and at its other end to said mount frame near respective fulcrum pivots.

5. Lift apparatus as defined in claim **1**, wherein said brackets are disposed outboard of the side margins of said deck, said lift arms are pivoted in the lower areas of said outboard brackets immediately outwardly of the sides of said deck, and said leveling arms are pivoted to the upper extremities of said brackets outwardly of and normally above said lift arms.

6. Lift apparatus as defined in claim **1**, wherein brackets are disposed outboard of the side margins of said deck, and wherein each outboard bracket comprises a broad bracket arm secured to the deck near the underside thereof and projecting laterally from the sides thereof, and a bracket finger projecting upwardly from an outer portion of said bracket arm and supporting the respective parallel arm pivot, said bracket finger being spaced outwardly from a respective lift arm and outwardly from the side of the deck to provide a clearance space in which the associated end portion of the respective lift arm is receivable in the folded position of the deck.

7. Lift apparatus as defined in claim **1**, wherein brackets are disposed outboard of the side margins of said deck, and wherein each outboard bracket comprises a broad bracket arm secured to the deck near the underside thereof and projecting laterally from the sides thereof, and a pair of bracket fingers projecting upwardly from an outer portion of said bracket arm and supporting both ends of the respective parallel arm pivot, said bracket fingers being spaced outwardly from a respective lift arm and outwardly from the side of the deck to provide a clearance space in which the associated end portion of the respective lift arm is receivable in the folded position of the deck.

8. Lift apparatus as defined in claim **1**, wherein said marginal portion comprises an extension plate extending the original vehicle bed surface outwardly.

9. Lift appartus as defined in claim **1**, wherein said marginal portion comprises an extension plate extending the original vehicle bed surface outwardly and wherein said deck heel portion has a downwardly-stepped marginal shoulder engageable beneath and lending suppor to said extension plate in said load-transfer position of the deck.

10. Lift apparatus as defined in claim **1**, wherein said marginal portion comprises an extension plate extending the original vehicle bed surface outwardly and wherein said deck heel is engageable beneath and lends support to said extension plate in said stowed position of the deck.

11. The lift apparatus defined in claim **1**, one pair of said arms being foreshortenable to permit said folding of said deck into said lift linkage to a position projecting inwardly from its heel toward said mount frame.

References Cited

UNITED STATES PATENTS

2,194,403	3/1940	Novotney	214—77
2,715,470	8/1955	Marcus et al.	214—77 X
3,138,270	6/1964	McCarty	214—77
3,172,549	3/1965	Novotney	214—77
3,269,567	8/1966	Lugash	214—77

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