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Bushnell, Jr.

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[54] **MULTI-STAGE LIFT**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 889,235, Oct. 30, 1969, abandoned.

[52] **U.S. Cl.** **182/17,** 182/63, 182/113, 182/115, 182/141

[51] **Int. Cl.** **E04g 1/22**

[58] **Field of Search** ..... 182/17, 16, 63, 141, 182/148, 115; 52/632, 115, 637, 638, 648; 280/150 C; 187/9

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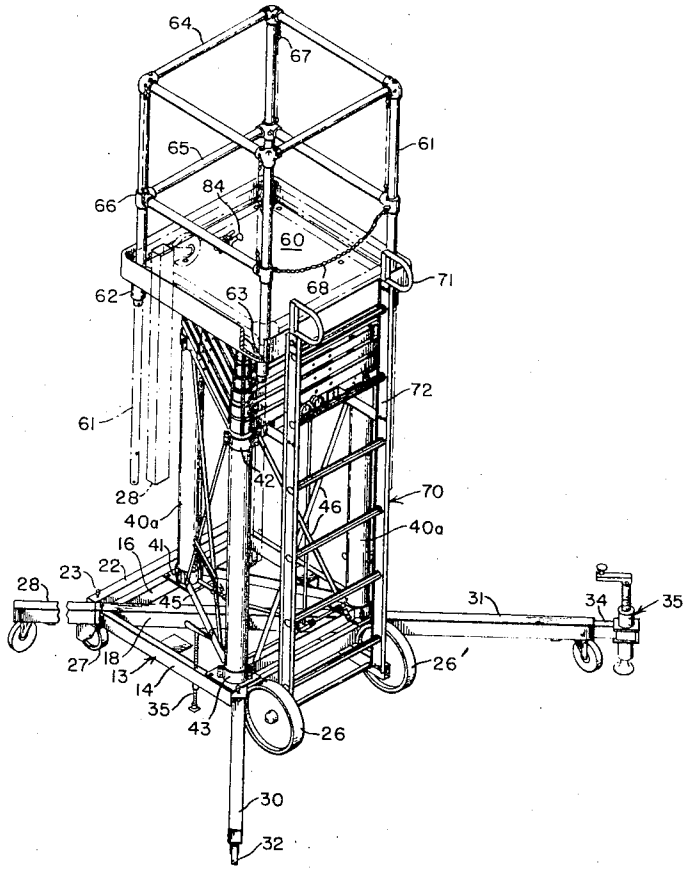
[57] **ABSTRACT**

A multi-stage lift that is portable, compact, lightweight and easily handled like a hand truck, and yet is stable at relatively high extensions by virtue of a special outrigger system, three multi-stage telescopic cylinder units arranged and interconnected in a unique manner to operate in unison, and a working platform with a drop-down guard rail assembly.

24 Claims, 4 Drawing Figures



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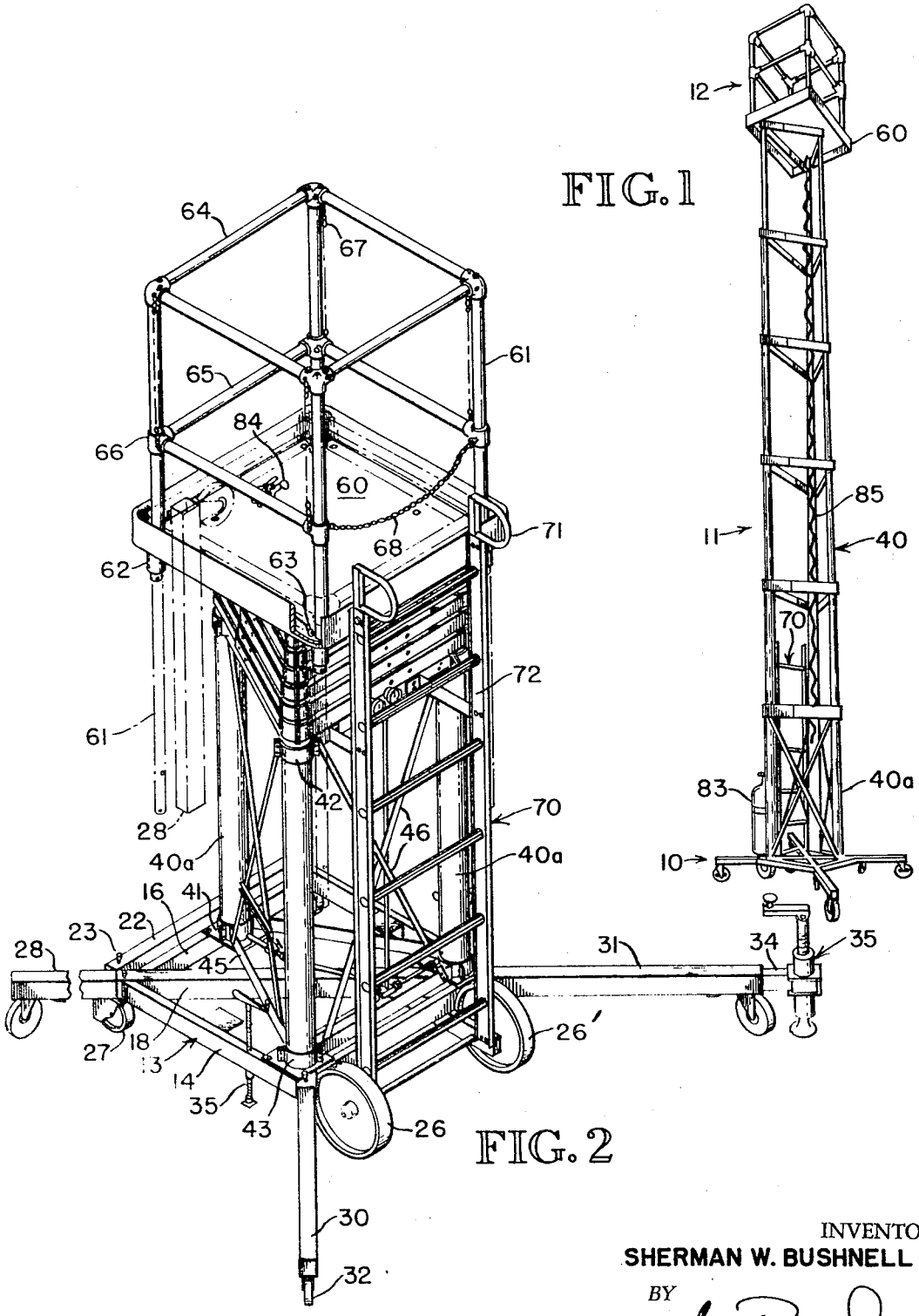

FIG. 1

FIG. 2

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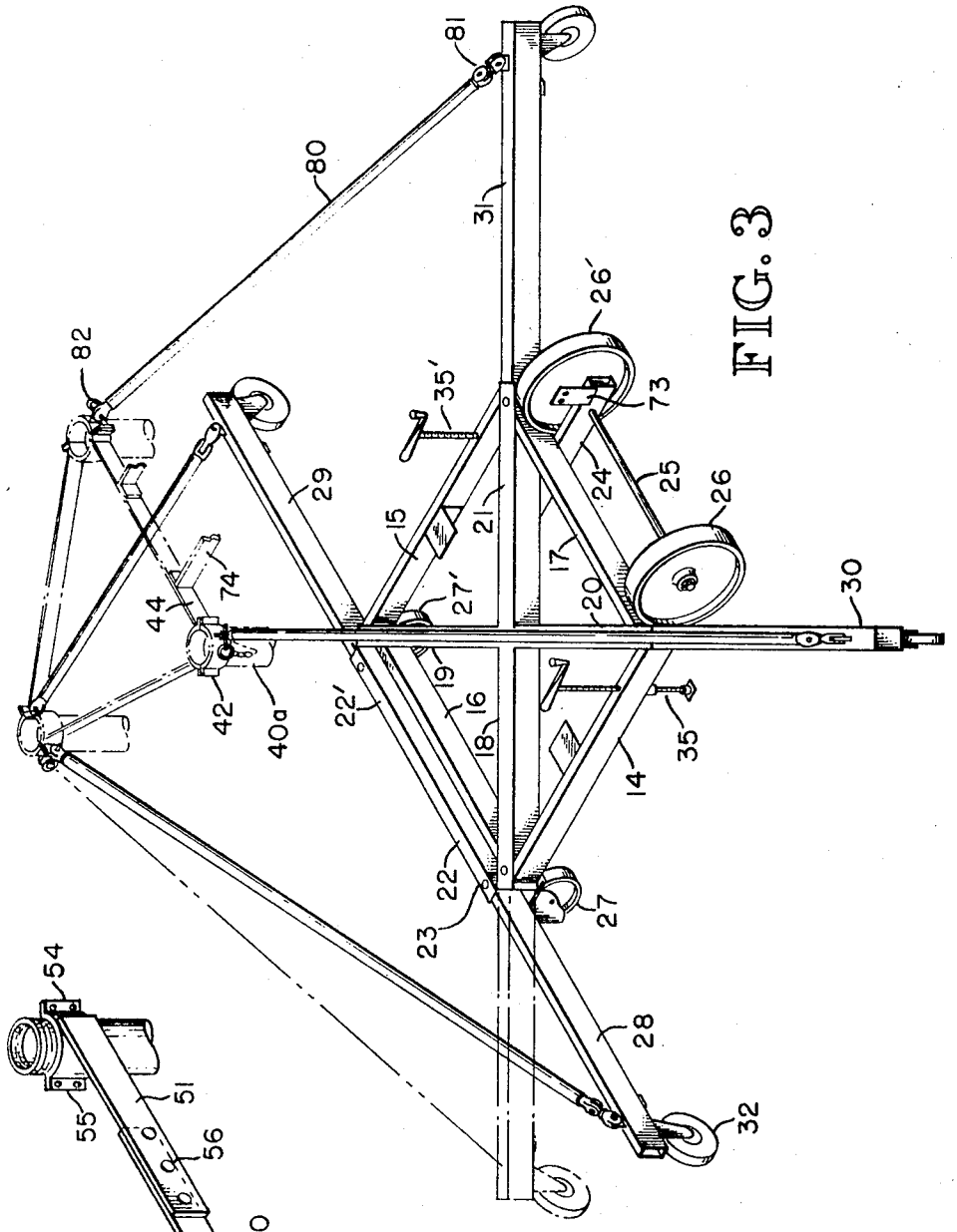

FIG. 3

FIG. 4

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MULTI-STAGE LIFT

This application is a continuation-in-part of my co-pending application, Ser. No. 889,235; filed Dec. 30, 1969 and now abandoned.

This invention relates to lightweight portable multi-stage telescopic lifts, particularly the type powered by a compressible fluid such as carbon dioxide or air, and aims as an overall object to provide an improved such lift whereby a worker can be hoisted under stable safe conditions at greater heights than heretofore considered feasible with such a device.

With respect to portability, the invention aims to provide a lift which has a base of unusually small horizontal extent when the lift is in collapsed storage position. In this regard the invention further aims to provide an improved outrigger system which will lend substantial stability when the lift is extended, has provision for easy adjustment to contend with uneven floor conditions, will permit the lift to be used close to walls or obstructions, can be stowed with the rest of the lift in a compact manner, and can be readily placed into either operating or storage position.

Concerning safety, an important object is to provide a safe working platform with a guard rail assembly which can be easily transferred when desired from a guarding position into an unusually compact storage position.

Another object is to provide an arrangement by which the lift, when in storage position, can be easily wheeled about and handled in the manner of a hand truck.

Still a further object is to provide such a lift in which the telescopic cylinders are of unsually inexpensive lightweight construction and yet do not bind even though operated by a compressible fluid.

For carrying out the above objects the invention provides an improved bracing system whereby a group of parallel columns of thin-walled aluminum telescoping cylinder can be cross-connected to operate in unison for lifting a working platform.

In carrying out the aforesaid objects the present invention comprises a novel base assembly, hoist assembly and work platform assembly. The base assembly includes a carriage unit into which outriggers are conveniently plugged in diagonal directions at the rear and in optional diagonal or lateral directions at the front. Jacks for levelling are provided which plug into the outriggers. The carriage unit together with a ladder having handles at the top and arranged for access to the work platform when the lift is retracted, make it convenient to move the lift in the manner of a hand truck. The hoist assembly includes three multi-stage cylinder units on the base assembly which are braced in a novel manner to move in unison without binding. A guard rail assembly for the work platform is arranged to contract from guarding position to a compact storage position in which supporting posts drop alongside the hoist assembly and guard rails rest on the work platform.

The compactness, versatility and light weight of the lift unit of this invention are attested to by the fact that embodiments thereof have been constructed and used which have a platform height of 36 feet when extended, and yet are only 30 inches wide and 28-½ inches long when in retracted storage position with the outriggers stowed and can be handled by only one man.

In the accompanying drawings:

FIG. 1 is a perspective view of a lift made in accordance with this invention and with its hoist assembly shown extended to full operating height and its outriggers in normal position;

FIG. 2 is a perspective view of the lift with the hoist assembly retracted and as viewed from the rear left corner;

FIG. 3 is a perspective view of the carriage assembly of the lift with the front outriggers illustrated in an alternate position for working against a wall, and showing the manner of use of additional stabilizing braces to the outriggers; and

FIG. 4 is a detail perspective view of the bracing for the hoist cylinders.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to the drawings, it is seen that in general the lift of the present invention comprises a base assembly **10**, a multi-stage telescopic hoist assembly **11**, and a work platform assembly **12**. The base assembly comprises a rectangular carriage **13** defined by a pair of side rails **14–15** and front and rear rails **16–17** which are welded at the corners to tubular diagonal members forming a pair of front diagonal sockets **18–19** and a pair of rear diagonal sockets **20–21**. At its forward end the carriage also has a front tubular member providing left and right sockets **21, 22** by its open ends. Near their mouths the sockets **18–22** each have a respective set screw or spring-loaded locking pin **23**.

At the rear the carriage has a pair of struts **24** projecting rearwardly from weld connections at the underside of the rear diagonal sockets **20–21** and the rear rail **17**. An axle **25** is journaled in these struts and receives a pair of rear wheels **26–26'** which are complemented at the front corners of the carriage by a pair of swivel casters **27–27'**.

Four tubular outriggers **28–31** are provided, each having a swivel caster **32** near one end and a detent (not shown) at the top near the outer end for receiving a locking pin **23**. The caster ends of the outriggers are open to serve as sockets to selectively receive the arm extension **34** of one or more levelling jacks **35** while the other ends are adapted to plug into selected of the various sockets **18–22** as shown in the drawings. The casters **32** track at a level lower than that of the casters **27–27'** and wheels **26–26'** when the outriggers are in use. In other words, when the outriggers are plugged into the carriage sockets the carriage casters and wheels are lifted out of ground contact.

Accordingly, for ease of installation of the outriggers the side rails **14–15** are provided with jack screws **35–35'**. When, for example, it is desired to first insert the outriggers **28** and **30** in the left side of the carriage, the jack screw **35** is turned such as to raise the wheel **26** and caster **27** sufficiently above the ground to permit the outrigger **32** to be inserted into the left rear diagonal socket **20** and the outrigger **28** to be plugged into the left front diagonal socket **18** or the left socket **22**. During that operation, the right wheel **26'** and caster **27'** remain in ground contact. Then jack **35** is raised to lower the casters on the left outriggers **28, 32** into ground engagement and the wheel **26'** and caster **27'** are raised by the jack **35'**. This jack and the casters on the left outriggers then support the carriage while the right outriggers **29, 31** are being inserted in right rear diagonal socket **21** and in right front diagonal socket **19** or the right socket **22'**. Then jack **35'** is

screwed up so that the casters on the outriggers **29** and **31** also engage the ground. At that point the four outriggers completely support the unit. The front sockets **22, 22'** are used for the front outringgers **28–29** when it is desired to move the carriage closer to a wall than permitted when the front outriggers extend diagonally from the sockets **18–19.** It is preferred that the casters **27** and **32** be provided with side brakes.

Continuing to the hoist assembly **11,** such preferably comprises three or more multi-stage fluid-operated telescopic cylinder units **40** which are interconnected to move in unison. For purposes of example three cylinder units **40** have been illustrated which are arranged as the vertices of an equilateral triangle having two of its apexes at the rear corners of the carriage **13** and the third adjoining the center of the front rail **16.** The cylinder units are identical and are fixed to respective pads **41** secured on the base assembly.

Respective two-piece upper and lower flanged clamping collars **42–43** are mounted on the ends of the bottom cylinders **40***a* of the cylinder units **40.** These collars are interconnected by three top braces **44** and three bottom braces **45** welded to the collar halves, and these braces are reinforced by three pairs of crossed struts **46.** These struts are bolted or riveted in position after the three cylinders **40a** have been carefully preset in parallel relation. By this arrangement the cylinders **40a,** collars **42–43,** braces **44–45,** and struts **46** form a rigid precision base unit for the hoist assembly **11.**

The respective three telescopic cylinders in each stage of the hoist assembly **11** above the bottom stage are interconnected to move in unison by three sets of two-piece horizontal braces extending from respective halves of two-piece collars clamped around the necked top portion of the cylinders. As shown in FIG. **4** each such set comprises overlapping arms **50–51** of flat bar stock extending from weld connections to half-collars **52–53,** respectively, each having flange extensions **54** formed with pairs of holes to receive clamping bolts **55.** Preferably the portions of the brace components **50 – 51** are drilled to provide registering holes for bolts or rivets **56** after the hoist assembly **11** has been mounted on the carriage **13,** the three bottom stages **40***a* have been cross-braced, and the half-collars **52–53** have been clamped in position. substantially perfect cylinder alignment is achieved without introducing warping stresses during the assembly operation. This is very important in the preventing of binding of the cylinders, particularly when thin-walled drawn aluminum tubing is used for forming the cylinders. Such tubing helps make possible an economical light-weight structure.

The work platform assembly **12** comprises a dielectric platform in the form of a glass-reinforced plastic pan **60** and a guard rail assembly adapted to drop into a lowered storage position relative to the platform. The pan **60** is secured to the top of the uppermost cylinders and also rests on the uppermost of the bracing arms **50–51.** As shown in FIG. **2** the guard rail assembly has four corner posts **61** slidably mounted in corner guides **62** projected through the pan **60.** The posts **61** are horizontally pierced a relatively short distance above their lower ends to provide holes to receive removable keeper pins **63** which bear as stops against the floor of the pan to keep the posts in raised guarding position.

An upper set of four guard rails **64** interconnects the top of the corner posts and a second set comprising three intermediate guard rails **65** is slidably mounted by end collars **66** on the corner posts. These intermediate rails are located at the front and two sides of the unit and are prevented from dropping below the desired intermediate level relative to the top rails **64,** when the guard rail assembly is in raised position, by chains **67** hanging from the upper corners. The rear side of the platform is guarded at the intermediate level by a chain **68** which has a releasable hook at one end.

The storage position of the guard rail assembly **12** is shown in phantom lines in FIG. **2.** When the keeper pins **63** are removed the corner posts **61** are free to slide downwardly through the corner guides **62** on the outer sides of the hoist assembly **11.** First, the intermediate rails **65** engage the pan **60** and then as the posts continue to drop the chains **67** slacken. Finally, the upper rails **64** drop onto the intermediate rails within the side walls of the pan and stop further downward movement.

For ease of access to the work platform when it is in its lowered position shown in FIG. **2,** a ladder **70** is provided having top handles **71.** The two side racks **72** of the ladder are connected at the bottom to a pair of mounting brackets **73** extending upwardly from the free ends of the struts **24,** and are connected toward the top to a pair of brackets **74** projecting rearwardly from the adjoining brace **44.** As shown by the phantom position of outrigger **28** in FIG. **2,** the outriggers **28–31** may be conveniently stowed hanging by their caster ends from the work platform **60.** With the outriggers removed from their sockets and the guard rail **12** lowered to its storage position, and entire lift unit can be tilted back and conveniently manually wheeled about like a hand truck on the rear wheels **26–26'** while gripping the handles **71.** The ladder rails **72** also act as glides which are useful, for example, in sliding the unit over the edge of a truck bed on which it was being transported to a work site.

For particularly high models of the lift, stabilizing braces **80** are provided which extend from the outer ends of the outriggers upwardly to the collars **42** at the top of the base unit of the hoist assembly **11.** These braces have a swivel **81** at the bottom and may be locked in place by ball keeper pins **82** passing through registering clevises and ears on the braces, the collars **42** and the outriggers.

It is preferred that the hoist assembly be operated by a compressible fluid be such that a lower group of the cylinders can be charged, when extended, to a pressure higher than that required to lift the load. In this manner the telescopic tower is made more rigid when operated near its upper extent than would otherwise be the case. This can be accomplished, for example, by charging and dumping a lower group of the cylinders in each assembly through the bottom cylinders and the remaining top groups of cylinders through the top cylinders of the assembly, while keeping the two groups internally isolated from one another. As a further example, such can also be accomplished in the manner disclosed in the aforesaid copending application, Ser. No. 889,235.

It is preferred to fabricate substantially all of the structural parts of the lift as well as the hoist cylinders from aluminum in order to make it feasible for one man to handle the unit. The illustrated embodiment is particularly well adapted for aluminum fabrication.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A portable hoisting device comprising;
a base assembly having ground support wheels collectively defining a first ground support contact plane,
a plurality of outrigger mounting means spaced about the periphery of said base assembly,
a plurality of outriggers operatively associated with said mounting means and having ground support wheels near their outer ends collectively defining a second ground support contact plane lower than said first plane when the outriggers are in operative position whereby said wheels on the base assembly are raised out of ground contact when the outriggers are in operation, said outriggers being adapted to be selectively moved out of said operative position to move their ground support wheels above said first plane whereby the hoisting device is then supported by the ground support wheels of the base assembly,
a hoist assembly mounted on the base assembly,
and a work platform carried by the hoist assembly to be raised and lowered thereby.

2. A portable hoisting device according to claim 1 in which leveling jack means are selectively operatively associated with the outer end portions of said outriggers.

3. A portable hoisting device according to claim 1 in which jack means are operatively associated with opposite sides of said base asembly for selectively raising the respective side to a height whereat adjacent outriggers can be placed in operative position.

4. A lift device according to claim 3 in which said guard rail assembly includes top guard rails fixed to the upper ends of said posts and arranged to rest on said intermediate guard rails when the posts are in lowered storage position.

5. A portable hoisting device according to claim 1 in which said mounting means comprises elongated slide sockets and said outriggers are adapted to be slidably plugged into said sockets.

6. A portable hoisting device according to claim 1 in which said base assembly is generally rectangular in plan view and said mounting means comprises four elongated slide sockets extending in generally diagonal directions inwardly from the corners of the base assembly, and in which said outriggers are adapted to be slidably plugged into said sockets.

7. A portable hoisting device according to claim 6 in which a pair of elongated slide sockets are located at one end of said base assembly and extend in opposite lateral directions whereby said one end can be placed against a wall or obstruction with the outriggers at that end fitted in said pair of sockets rather than in the diagonal sockets at that end.

8. A portable hoisting device comprising,
a hand truck including a ladder with handles near the top thereof and ground support wheels near the bottom thereof providing ground support when the hand truck is tilted rearwardly,
a base frame assembly supported at the forward side of the hand truck and having ground support means arranged to be raised from ground contact when the hand truck is tilted rearwardly,
three upright multi-stage gas-operated telescopic cylinder hoists mounted on the base frame assembly in a triangular arrangement in plan view with two of said hoists located adjacent opposite lateral sides of the hand truck and having their bottom stages partly braced by the ladder and with the third hoist spaced directly forward from the lateral center of the hand truck and having its bottom stage rigidly interconnected with the bottom stages of said two hoists,
a work platform carried by said three hoists to be raised and lowered thereby, said platform having a lowered position adjacent the top of said ladder when the hoists are retracted,
means for selectively extending and retracting said hoists in unison,
and a plurality of outrigger means spaced about the periphery of the base frame assembly and arranged to be selectively moved into and out of ground engaging position.

9. A portable hoisting device according to claim 8 in which said three hoists each have a plurality of telescopic stages intermediate a bottom stationary stage mounted on the base frame assembly and a top stage connected to the work platform, said means for selectively extending and retracting said hoists in unison comprising respective horizontal coplanar brace means interconnecting the upper end of the three cylinders of each said intermediate stage, said horizontal brace means being the sole means interconnecting said intermediate stages between the top of the bottom stationary stage and the work platform.

10. A portable hoisting device according to claim 8 in which said outrigger means have ground support wheels near their outer ends which take the entire load of the hoisting device when such wheels are in ground engaging position.

11. A portable hoisting device comprising,
a portable base assembly,
three upright parallel multi-stage gas-operated telescopic cylinder hoist units in equally spaced relationship from one another and having their bottom stages rigidly interconnected and mounted on the base assembly,
a work platform mounted on the top stages of the hoist units, said hoists each having a respective plurality of telescopic cylinder stages intermediate said bottom stages and said work platform, said intermediate stages and said top stages being arranged and adapted to be extended solely by compressed gas,
a respective collar on the upper end of each such intermediate cylinder stage,
respective brace means at each intermediate stage interconnecting the respective collars, said brace means for the intermediate stages being arranged to stack between the bottom stages and the working platform when the hoisting device is in lowered position and to provide the bracing for the intermediate stages when the hoisting device is in raised position, the brace means for each intermediate stage comprises three braces arranged generally in an equilateral triangle in plan view with each such brace having two longitudinal overlapping parts and means for fastening said overlapping parts together whereby the overall length of said braces can be set during assembly so that the brace means will not exert lateral forces on the intermediate cylinder stages when they are extended without the work platform being loaded.

12. A portable hoisting device according to claim 11 in which said three telescopic cylinder hoist units have their extending cylinders formed of lightweight thin-walled tubing on the upper end of which the respective collar is mounted, said braces providing the sole lateral support for said intermediate stages between their telescopic connections with the top and bottom stages.

13. A portable hoisting device comprising a portable base assembly including a base frame of generally rectangular outline in plan view having four slide socket members extending inwardly in generally diagonal directions from open outer ends at the corners of the base frame and having frame members rigidly interconnecting said socket members adjacent their said open ends, said socket members also being rigidly interconnected in inwardly spaced relation from said frame members for giving added support to the socket members and contributing to rigidity of the base frame,

four elongated outriggers adapted to be slidably plugged into the open ends of said socket members,

an upright hoist assembly mounted on the base frame,

a work platform carried by the hoist assembly to be raised and lowered thereby,

and ground support wheels on the base assembly for transporting the hoisting device when the outriggers are not plugged into the socket members.

14. A portable hoisting device comprising,

a base assembly presenting a plurality of outwardly opening slide sockets spaced about its periphery and having transport wheels,

a hoist assembly mounted on the base assembly,

a work platform carried by the hoist assembly to be raised and lowered thereby,

and a plurality of outriggers adapted to be slidably plugged into said sockets, said base assembly having a plurality of ground support means collectively defining a first ground support contact plane, and said outriggers having ground support wheels near their outer ends collectively defining a second ground support contact plane lower than said first plane when the outriggers are in operative position whereby said ground wheels support means on the base assembly are raised out of ground contact when the outriggers are in operation.

15. A hoisting device according to claim 14 in which said base assembly has jack means for selectively raising the sockets of said base assembly and said ground support means sufficiently to permit the outriggers to be installed.

16. A hoisting device according to claim 14 in which said base assembly has a generally rectangular frame in plan view and four of said slide sockets extend inwardly in generally diagonal directions from the corners of the frame.

17. A hoisting device according to claim 16 in which a pair of slide sockets are located at one end of said frame and extend in opposite lateral directions whereby said one end can be placed against a wall or obstruction with outriggers at the end fitted in said pair of sockets rather than in the diagonal sockets at that end.

18. A hoisting device according to claim 14 in which said base assembly has a generally rectangular frame in plan view and in which said hoist assembly comprises,

three multi-stage fluid-operated cylinders which rest, two on adjoining corners of the frame and the third at the center of the side of the frame opposite from said adjoining corners, and in which said work platform is also generally rectangular and has approximately the same horizontal extent and orientation as said frame.

19. A hoisting device according to claim 18 in which said work platform has corner posts slidably mounted to project downwardly and be outwardly of said hoist assembly when in a storage position and to project upwardly when in an operating position, and guard rails mounted on the corner posts.

20. A portable hoisting device comprising,

a carriage,

a hoist assembly mounted on the carriage,

a work platform carried by the hoist assembly to be selectively raised and lowered thereby between retracted and extended positions,

a ladder supported by the carriage and extending to the work platform when the hoist assembly is in retracted position,

handle grips near the top of the ladder,

a pair of ground support wheels adjacent the foot of the ladder whereby the hoisting device can be handled like a hand truck by use of said wheels and handle grips, said carriage having a pair of horizontal slide sockets diverging on opposite sides of said ladder outwardly of said pair of wheels and having a pair of horizontal slide sockets at the opposite end of the carriage from the ladder,

and four outriggers adapted to be slidably plugged into said pairs of sockets and provide the ground support for the carriage.

21. A hoisting device according to claim 20 in which said carriage has a pair of jacks located between said pairs of slide sockets.

22. A hoisting device according to claim 20 in which said outriggers each comprise an elongated tube fitting by one of its ends into a respective said socket and having its opposite end open to form a socket for selectively receiving a leveling jack assembly.

23. A portable hoisting device comprising,

a base assembly presenting a plurality of horizontally opening slide sockets spaced about its periphery,

a hoist assembly mounted in the base assembly,

a work platform carried by the hoist assembly to be raised and lowered thereby,

and a plurality of outriggers adapted to be plugged into said sockets, said base assembly having a generally rectangular frame in plan view with one end of said frame having a pair of oppositely extending lateral slide sockets for outriggers and the four corners of the frame having diagonally extending slide sockets for outriggers, said hoist assembly comprising three multi-stage fluid-operated cylinders which rest, two on adjoining corners of the frame opposite from said adjoining corners, and said work platform also being generally rectangular and having approximately the same horizontal extent and orientation as said frame.

24. A lift device comprising a base support, upwardly extending hoisting means on the base support, a work platform mounted on the hoisting means to be raised and lowered thereby, a guard rail assembly on the platform including a plurality of interconnected, spaced posts vertically slidable relative to the platform between the raised, guarding position in which a major longitudinal portion of each post projects above the

platform and a storage position in which a major longitudinal portion of each post is suspended below the platform, intermediate guard rails slidably mounted on the posts, flexible means extending from the top of the posts to said intermediate rails whereby the latter are held at a predetermined height relative to the posts when the posts are in raised, guarding position and rest on the work platform when the posts are in lowered, storage position, and locking means for selectively holding the posts in said guarding position.

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