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Lund et al.

[11] **3,841,603**

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[54] **LIFTING APPARATUS**

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[52] **U.S. Cl.** ..... **254/4 R**, 254/47

[51] **Int. Cl.** **B66f 9/06**

[58] **Field of Search** ..... 254/4 R, 4 B, 4 C, 47, 254/139.1, 145; 214/1 S, 1 SW; 187/9; 5/81, 86

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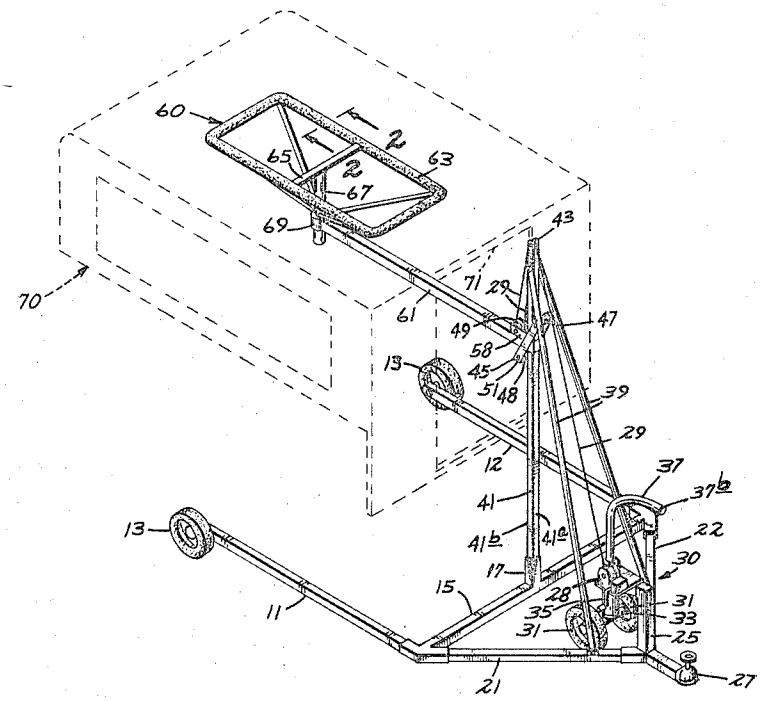
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Assistant Examiner—Robert C. Watson

[57] **ABSTRACT**

The disclosed mobile crane or lifting apparatus is suitable for raising, positioning, and lowering bulky objects generally, and is particularly well suited for use by dealers in recreational products and vehicle modifying equipment (such as enclosures for attachment to truck beds). The crane comprises a base frame, a boom or lifting arm particularly suited for supporting a lifting platform, a mast-like guide or track member supported by the base frame, which member includes a specially designed tracking means for guiding the up and down movement of the lift arm, and, preferably, a set of steerable wheels and a winch located at the end of the base frame farthest removed from the lifting platform. The lifting platform is designed to fit inside hollow, shell-like objects such as toppers for pickup trucks, the outer shell of a camper, or the like.

4 Claims, 5 Drawing Figures



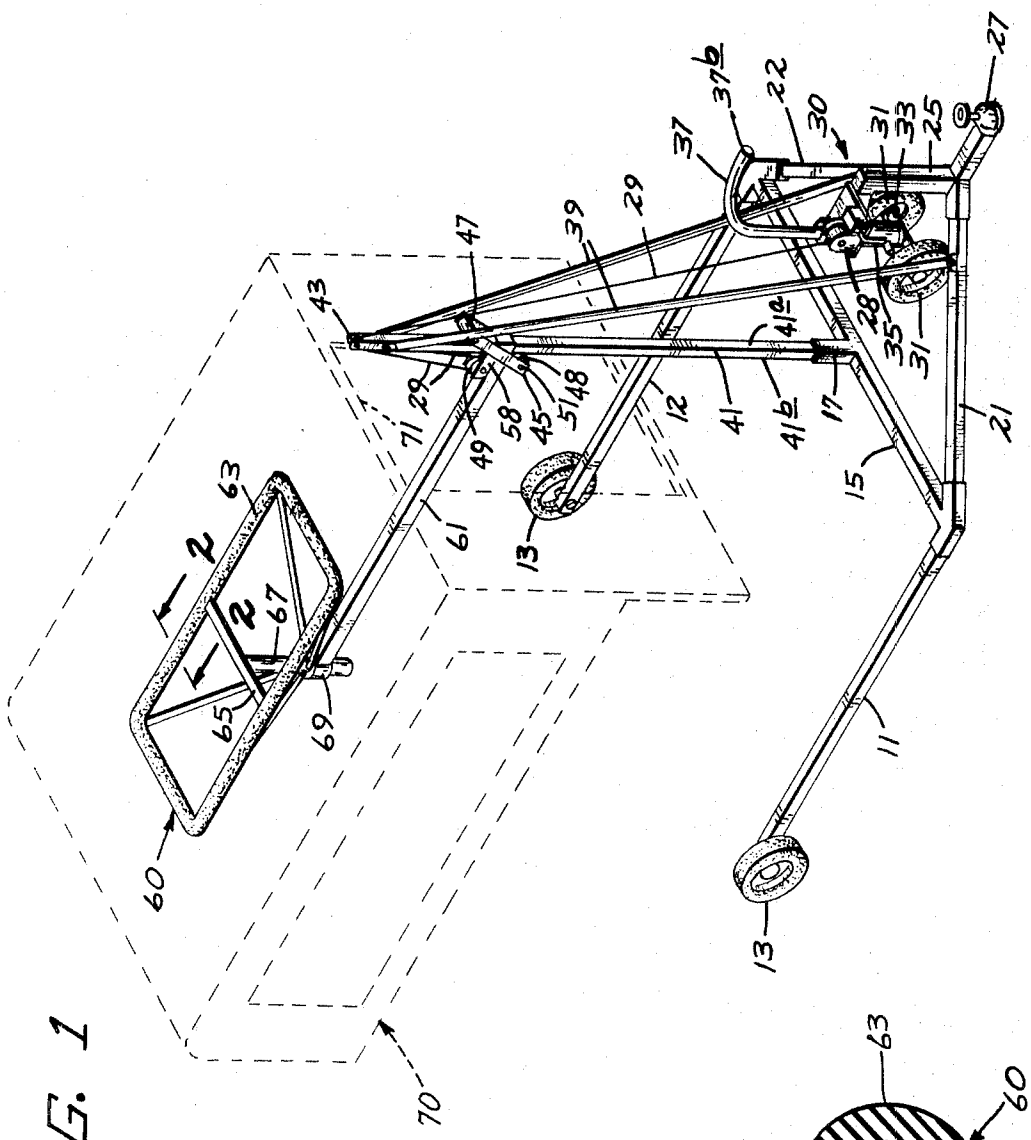

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FIG. 1

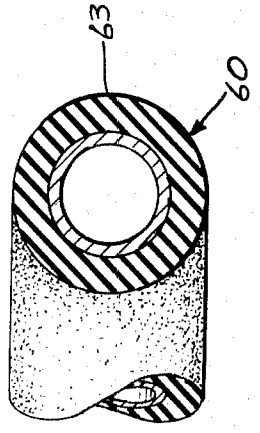

63
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FIG. 2

FIG. 3

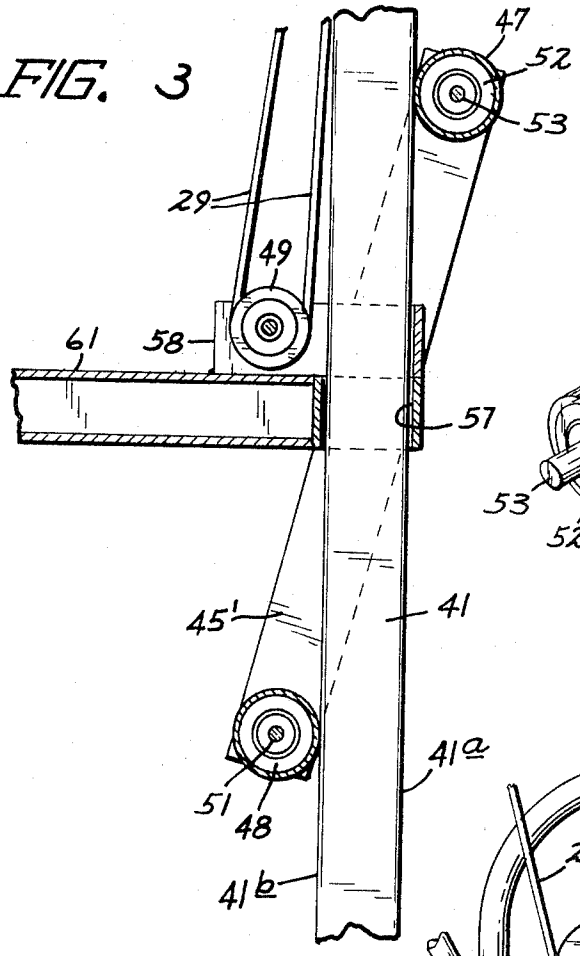


FIG. 4

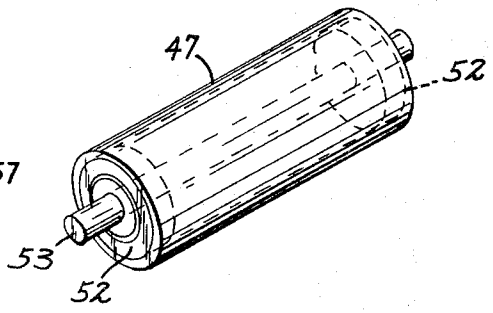
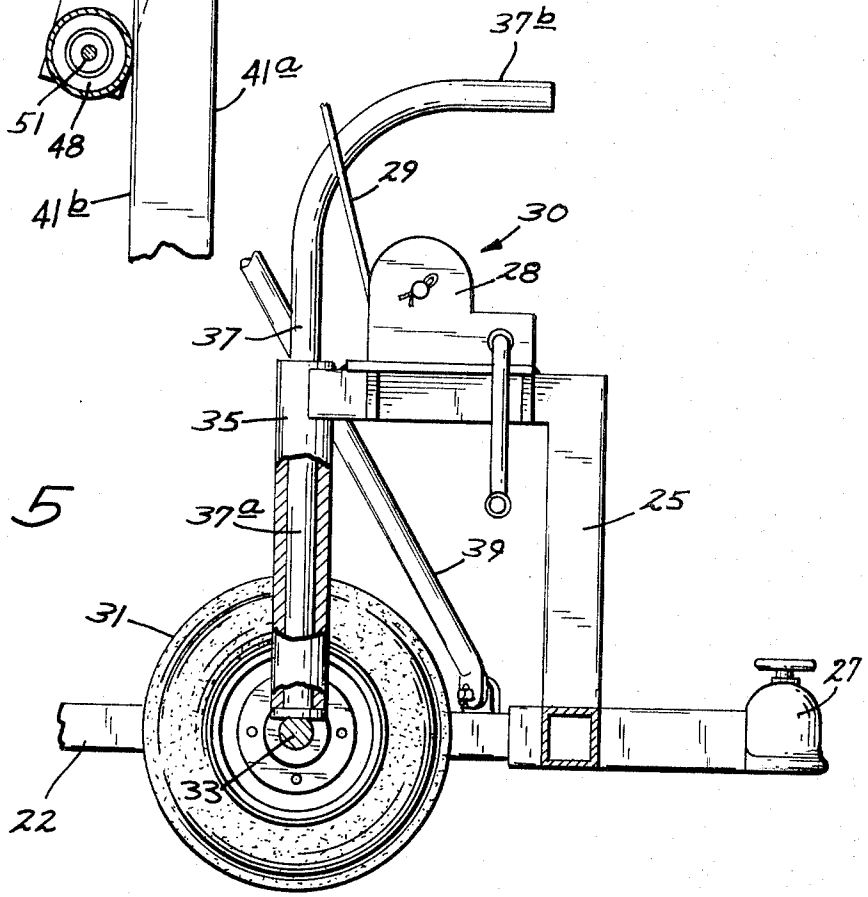


FIG. 5



LIFTING APPARATUS

FIELD OF THE INVENTION

This invention relates to cranes, lifting apparatus or devices, and the like. An aspect of this invention relates to mobile cranes particularly suited for use by dealers in certain types of recreational or vehicle-modifying equipment and products such as enclosures for truck beds. A further aspect of this invention relates to mobile, steerable cranes for lifting a topper on or off a truck bed such as the rear end of a conventional-sized pickup truck. Still another aspect of this invention relates to a mechanically operated lifting apparatus wherein the lifting force can be provided by a relatively small hand- or motor-operated winch. Still another aspect of this invention relates to a relatively small crane for lifting hollow, bulky objects generally weighing about 100 to about 1,000 pounds onto the bed of a small truck, the crane being designed to facilitate control over lifting, lowering, positioning, and other maneuvering steps by a single operator standing at one end of the crane.

DESCRIPTION OF THE PRIOR ART

A wide variety of lifting devices or apparatus, cranes, etc. are presently available. These devices can be mechanical, hydraulic, hydraulic-mechanical, manually operated, electrically operated, etc. and can have various sizes and lifting capacities. Some of the available cranes lift an object from above, e.g., hoist type and windlass-type devices, while some lift from below by means of a lifting platform on which a heavy or bulky object rests during the lifting operation.

Dealers in sports and recreational products and equipment and/or motor vehicle-modifying structures (such as enclosures for truck beds, shells for converting trucks to campers, etc.) have encountered a peculiar set of problems relating to handling of their line of products. For example, pickup truck toppers are normally stored in lots or garages in stacks or as individual elements resting on the floor or the ground. These toppers can weigh as much as 450 pounds and rarely weigh less than 150 pounds. Several men may be needed to move, lift, or position even the smallest toppers, due to their great weight and bulky shape. Furthermore, any time a topper is to be mounted on a pickup truck, it must be lifted several feet off the ground and accurately positioned on the truck bed.

At the present time, a hydraulic lift or hoist is available for lifting and positioning toppers. In using this device, the topper is suspended from the lifting element and hoisted from above. Although the hydraulic lift provides adequate lifting force, it is difficult to position the topper properly unless it is carefully strapped to the lifting element. Strapping of the topper is time consuming and inconvenient and often requires the efforts of more than one operator.

Accordingly, this invention seeks to provide a crane or lifting device for toppers or similar bulky, heavy, shell-like objects wherein the crane can be mechanically operated or manipulated with safety and convenience by a single operator.

SUMMARY OF THE INVENTION

In the present invention, the bulky, generally hollow object is lifted from below by a lifting platform attached to a boom or lifting arm. The boom moves up and down on a generally vertical track or guide member. Since the boom/platform combination lifts or holds a heavy object at one unsupported or free end and is supported at the other end (which supported end is therefore more or less in a position of a fulcrum), a substantial moment of force can be exerted on the supported end of the boom. For this reason, a special tracking means has been devised, so that the free end of the boom can move a load up or down without resulting in binding at the point where the boom engages the vertical guide member. The up and down movement of the boom is controlled by a suitable device, preferably a winch. The winch and the vertical guide member are supported by a base frame. The base frame includes wheels for mobility and has an open end so that the vertical guide member can be brought up close to the back end of a truck or tailgate or the like, and the lifting platform can be positioned over a truck bed or the like. The winch and a steering means connected to a set of steerable wheels are positioned at the end of the base frame opposite this open end. This positioning provides a control end for the base frame where a single operator can stand and control the lifting, lowering, and steering operations needed to lift and properly position a topper or the like with respect to a truck bed.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a completely assembled crane or lifting apparatus of this invention, with an object being lifted or positioned shown in phantom;

FIG. 2 is a cross sectional view taken along line 2—2 of FIG. 1 on an enlarged scale;

FIG. 3 is an enlarged fragmentary detailed view of a portion of FIG. 1 with portions broken away and portions shown in section to illustrate the special tracking device of this invention;

FIG. 4 is an enlarged perspective view of a roller element of FIG. 3; and

FIG. 5 is an enlarged fragmentary detail view of a portion of FIG. 1 with portions broken away and portions shown in section to illustrate the steering and lifting control end of the apparatus of FIG. 1.

In the following detailed description of the Drawing, like reference numerals denote like elements in the various views of the apparatus illustrated in perspective in FIG. 1.

DETAILED DESCRIPTION OF THE DRAWING

As will be readily apparent from the description which follows, a crane or lifting apparatus of this invention includes a base frame rendered mobile and held off the ground a few inches by wheels, the base frame having an open (preferably U-shaped) end for accommodating three sides of the back end of a truck or the like, thus making the truck bed available for loading. At the end of the base frame opposite to this open end is a lifting and steering control end which includes a mechanical lifting and lifting control device (e.g., a winch), at least one steerable wheel provided with a steering means such as a tiller, and any other devices which facilitate operation and control of the crane. The base frame supports a generally vertical, mast-like guide member or track which guides the up and down movement of a boom or lift arm. This guide member is operably associated with a non-binding, rollable tracking

means of special design which keeps the boom on the track and helps to counter a portion of the moment of force resulting from the lifting of a heavy object by the unsupported end of the boom. This unsupported end includes a lifting platform which easily fits into the hollow, shell-like objects such as toppers for pickup trucks. The lift platform is, however, of sufficient size to support the topper in a stable fashion, so that the topper can be raised and lowered smoothly in a well-controlled fashion. The winch, which operates the lifting arm or boom, should have a lifting capacity of at least 100 pounds, preferably at least 450 pounds. A lifting capacity in excess of 1,500 pounds would, however, be unnecessary for most dealers in recreational equipment and would merely add to the size and weight of the crane. Thus, for example, good results have been obtained with a winch rated at 1,200 pounds lifting capacity. Typically, the lift arm, guide member, etc. are provided with sheaves, pulleys, or like means for changing the direction of force exerted by the lifting cable and increasing, if necessary, the mechanical advantage of the winch.

As will be clear from the following description, cranes of this invention have a low profile ideally suited for use with toppers, pickup trucks, and the like; furthermore, these relatively small, lightweight cranes are easily packaged in disassembled form for shipment and easily reassembled on the job.

Turning now to the Drawing, the fully assembled crane or lifting apparatus is illustrated in FIG. 1 and is designated generally by the numeral **10**. Crane **10** is provided with a particular type of base frame. The base frame comprises generally parallel, horizontally extending frame members **11** and **12**, a cross member **15**, and converging horizontal frame members **21** and **22**. Frame members **11**, **12**, and **15** form a U with an open end wide enough to accommodate the rear end of a truck or the like. Members **11** and **12** are typically spaced apart slightly wider than the track width of a pickup truck, e.g., 5 to 10 feet. Rubber-tired wheels **13** are mounted on frame member **11** and **12** at the open end of the U. Wheels **13** are preferably small (e.g., less than 15 inches in outside diameter), so that the frame members **11** and **12** are raised only a few inches off the ground. An inverted L-shaped member **25** is attached at the vertex of the V formed by frame members **21** and **22**. Member **25** supports a conventional, manual crank-operated winch **28** having a rating of 1,200 pounds lifting capacity. Cross member **15** is provided with a mounting means **17** for a mast-like guide member **41**, described subsequently. To permit convenient towing of crane **10**, a hitch **27** is provided at the vertex of the V formed by members **21** and **22**.

Base frame members **21** and **22**, and member **25** define an end of the base frame, opposite the aforementioned open end, which is hereinafter referred to as the "control end," and is generally designated by reference numeral **30** (see also FIG. 5). Control end **30** includes the winch **28** for lifting control and a steering assembly comprising wheels **31** mounted on a steerable axle **33**, a tiller-like steering element **37** operably associated with steerable axle **33**, and a housing **35** in which the steering element **37** can be rotated about its vertical axis. For simplicity of construction, vertical housing **35** is integral with L-shaped member **25**, thus forming an inverted U which firmly supports winch **28**. The horizontal portion of member **25** can be wide enough to permit offsetting of winch **28** to one side of the inverted U. Such offsetting can reduce the chance of fouling element **37** on cable **29**. As will be apparent to those skilled in the art, however, other arrangements of structural, lifting, and steering elements could be provided without departing from the principles of this invention. Mechanical lifting or lift control devices such as winches are, however, generally preferred over hydraulic lifting means. In the context of this invention, a simple conventional winch is reliable and entirely adequate. The risk of losing hydraulic fluid or breaking hydraulic cylinders is avoided.

The control end **30** of the crane **10** is illustrated in more detail in FIG. **5**, wherein frame member **21** has been removed for ease of illustration and portions of housing **35** and member **25** have been broken away to show the internal structure. It will be noted that steering element **37** has a generally vertical portion **37***a* and a curved, upper, tiller-like portion **37***b*. Winch **28** is of a conventional design which includes a hand-operated crank and a rotating drum on or from which cable **29** can be wound or unwound. Frame member **25** is, for example, a tubular steel element with a square cross section.

The combination of the lifting and tracking elements of crane **10** are most completely illustrated in FIGS. **1**, **3**, and **4**. Winch **28** controls the height of a boom-like lift arm **61**; see FIGS. **1** and **3**. The boom or lift arm **61** moves up and down the mast-like guide member **41**. To provide proper tracking of lift arm **61** along guide member **41**, a specially designed tracking means is operably associated with the lift arm **61** and the guide member **41**. The structure of the tracking means is shown in FIG. **1** and is illustrated in greater detail in FIG. **3**. This tracking means includes two cylindrical rollers **47** and **48** journalled in strap-like retaining members **45** (FIG. **1**) and **45'** (FIG. **3**). Rollers **47** and **48** rotate on spindle-like axles **53** and **51**, respectively. The upper roller **47** is shown in greater detail in FIG. **4**.

As is apparent from FIG. **4**, cylindrical roller **47** rotates freely about an axle or spindle **53** which is slightly greater in length than roller **47** and is coincident with its longitudinal axis. Spindle **53** rotates in bearings **52**, located at opposite ends of roller **47**.

As shown in FIG. **3**, guide member **41** has oppositely disposed guide surfaces, i.e., a first guide surface **41***a* and a second guide surface **41***b*. Roller **47** rests on guide surface **41***a*, while roller **48** rests on guide surface **41**b. A square hole **57** in lift arm **61** permits vertical guide member **41** to be inserted therethrough. Cable **29** from winch **28** passes over sheave **43** adjacent the upper end of guide member **41** thereby substantially reversing a pulling force applied to cable **29** and converting it to a lifting force. Cable **29** also passes once around sheave **49** mounted on element **58** of lift arm **61** and helps to support lift arm **61**. However, a moment of force exerted by a heavy object resting on the lifting platform **60** attached to lift arm **61** can result in significant forces being applied approximately at the location of the square hole **57**. Accordingly, a considerable amount of force is exerted on rollers **47** and **48**, which force is transmitted through strap-like retaining elements **45** (FIG. **1**) and **45'** (FIG. **3**). Nevertheless, roller **47** rotates freely about spindle **53** and roller **48** rotates freely about spindle **51** with little, if any, binding. This permits lift arm **61** to be raised and lowered

smoothly in a well-controlled fashion. Preferably, the retaining elements 45 and 45' are welded to the end of lift arm 61, so that the tracking assembly is integral with the lift arm. Thus, rollers 47 and 48 are constructed and arranged in a fixed relative position which remains constant whatever the position of lift arm 61, and smooth and even tracking of the lift arm is obtained.

The vertical guide member 41 should be at least a few feet tall (e.g., at least 5 feet), but a height in excess of 10 or 15 feet would ordinarily be unnecessary for most of the uses contemplated for crane 10. Typically, the height of guide member 41 is 8 feet, and the relative size of other major elements of crane 10 can be seen at least in perspective by referring to FIG. 1.

As shown in FIG. 1, the length of lift arm 61 is generally similar to that of base members 11 and 12; the arm 61 could be slightly longer or shorter than members 11 and 12, depending on the desired use of crane 10. Telescoping elements in the base frame or the lift arm 61 can be provided, if desired, to provide adjustable lengths. Typically, the end of lifting platform 60 most remote from guide member 41 need not project significantly beyond wheels 13. The length of lift arm 61 and platform 60 is generally commensurate with typical conventional truck beds, e.g., pickup truck beds, at least in the situation where member 41 has been brought up close behind the truck. Platform 60 can be conveniently made from a tubular frame element 63 and a cross member 65. The details of the tubular element 63 can be seen more clearly by referring to FIG. 2. Cross member 65 of platform 60 is supported on a short shaft 67 which engages the free or unsupported end of lift arm 61 at fitting 69.

For extra strength and support, struts or stays 39 (FIG. 1) transmit some of the moment of force applied to guide member 41 by lift arm 61 down to base frame members 21 and 22.

Operation of the Lifting Device

For purposes of illustration, the operation of a crane or lifting apparatus of this invention will be described in connection with lifting a topper onto the bed of a conventional pickup truck for semi-permanent attachment of the topper to the truck. The size and shape of a typical topper (i.e., enclosure for the back end or bed of a truck) is illustrated in phantom in FIG. 1 and generally designated by reference numeral 70.

Typically, the topper 70 is part of a stack of toppers or is resting on the ground or on blocks or the like. A conventional topper 70 is a hollow shell with an opening 71 at its rear end. To engage the topper initially, lift arm 61 is lowered to the appropriate height with winch 28. Platform 60 is inserted into the topper up close to its front end. The horizontal as well as vertical position of platform 60 can be controlled by steering crane 10 in any desired horizontal direction with steering element 37. Once platform 60 has been lined up properly it can be raised tight against the underside of the roof of the topper 70, thus establishing the desired level position of the load, i.e., the topper. The topper can then be raised to, for example, the position shown in FIG. 1. Since the topper 70 is supported by lift platform 60 in a stable fashion, crane 10 can be moved to any desired location with the topper 70 maintained in the desired raised horizontal position. The open end of the U defined by the base frame of the crane can, for example, be wheeled up to the rear end of a pickup truck and advanced to the point where wheels 13 are slightly in front of the rear wheels of the truck. Topper 70 is then approximately in the position it should be in for semi-permanent installation on the pickup truck bed. After lowering the topper a foot or so with winch 28, topper 70 is resting on the sides of the truck bed, and the crane 10 can be wheeled out from behind the truck for another lifting job.

As will be apparent from the foregoing description of the operation of crane 10, a single operator can conveniently and safely perform all the steering, lifting, and lowering steps.

The person skilled in the art will readily recognize that many modifications of the present invention are possible without departing from the general tenor of the invention. For example, a single steerable wheel could be used at the control end of the base frame and still provide adequate steering capabilities for the crane. The steering element need not be a tiller bar, but can be a small wheel or any similar steering mechanism. Although a handoperated winch is preferred, a small motor can be mounted at the control end of the base frame to operate the winch automatically. Other modifications will be apparent from the foregoing disclosure.

What is claimed is:

1. A mobile crane for lifting or lowering bulky objects, comprising:

a. a generally horizontally extending, generally planar base frame means having a lifting and steering control end and a second end, generally opposite said control end, said base frame being mounted on wheels and including a generally horizontal cross member intermediate said control end and said second end;

b. a generally vertically extending, mast-like guide member supported by said cross member;

c. a tracking means associated with said guide member for generally up and down movement therealong;

d. a generally horizontally extending, raisable and lowerable lift arm having a free end and a supported end, said supported end being operably associated with said tracking means and guided in its up and down movement by said tracking means and said guide member;

e. a lifting platform attached to said free end of said lift arm;

f. a support means, integral with said control end and extending upwardly from the plane of said base frame means and including a generally horizontal portion for supporting a lifting control means above the plane of said base frame means;

g. a lifting control means mounted on said horizontal portion of said support means;

h. a housing means for the vertical portion of a tiller-like steering element, said housing means extending generally vertically downwardly from said horizontal portion of said support means;

i. a moveable tiller-like steering element having a generally vertically extending portion enclosed within said housing means and including at least one steerable wheel operably associated with the lower end of said vertically extending portion; and

j. an elongated lifting element extending from said lifting control means to said lift arm.

2. A mobile crane according to claim **1** wherein the lower end of said steering element includes an axle and a pair of wheels mounted at opposite ends of said axle.

3. A mobile crane according to claim **1** wherein said lifting control means comprises a winch to which said elongated lifting element is attached; wherein said guide member includes a sheave journalled adjacent the upper end of said guide member; and wherein said elongated lifting element is a cable attached to said winch and passing at least once over said sheave.

4. A mobile crane according to claim **1** wherein said guide means is a single vertical member including a first guide surface facing toward said control end of said base frame means and a second guide surface facing toward said second end, wherein said single vertical member passes through a space defined by said tracking means, and wherein said tracking means comprises:

a. a parallel, spaced apart pair of strap members, normal to said first and second guide surfaces for defining said space in said tracking means, for maintaining first and second cylindrical rollers in a fixed relative position, and for enabling the rollers to rotate and move up and down the guide member while maintaining the fixed relative position;

b. a first cylindrical roller resting on said first guide surface and extending between and journalled in said pair of strap members,

c. a second cylindrical roller resting on said second guide surface and extending between and journalled in said pair of strap members.

* * * * *