Oct. 29, 1946. J. R. WESTERVELT, JR 2,410,373

REVOLVING CRANE ACCESSORY FOR FORK TRUCKS

Filed April 7, 1944 2 Sheets-Sheet 1

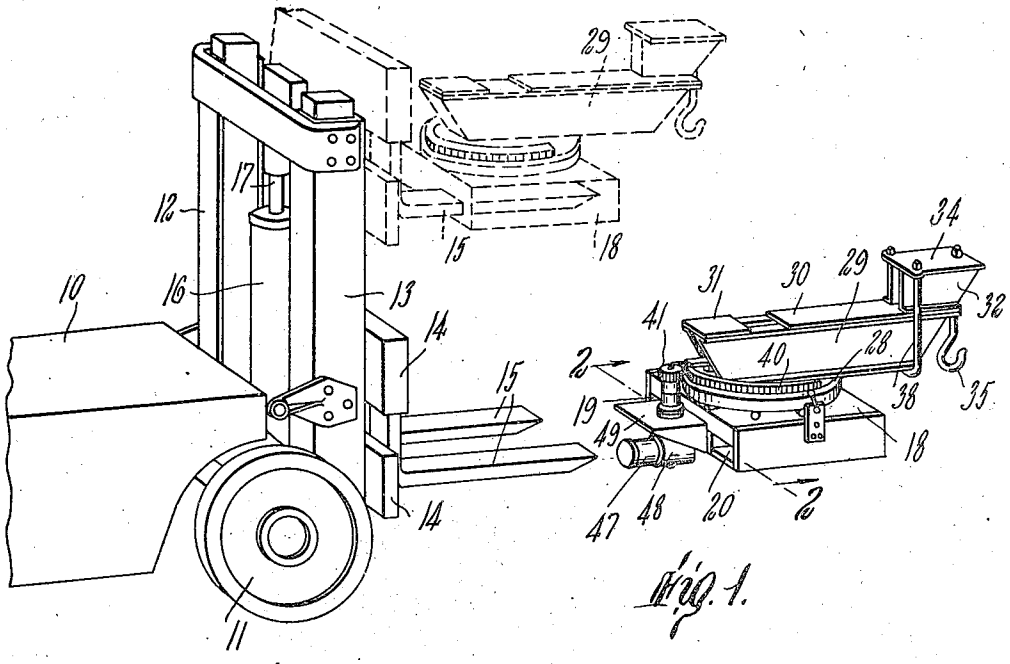


Fig. 1.

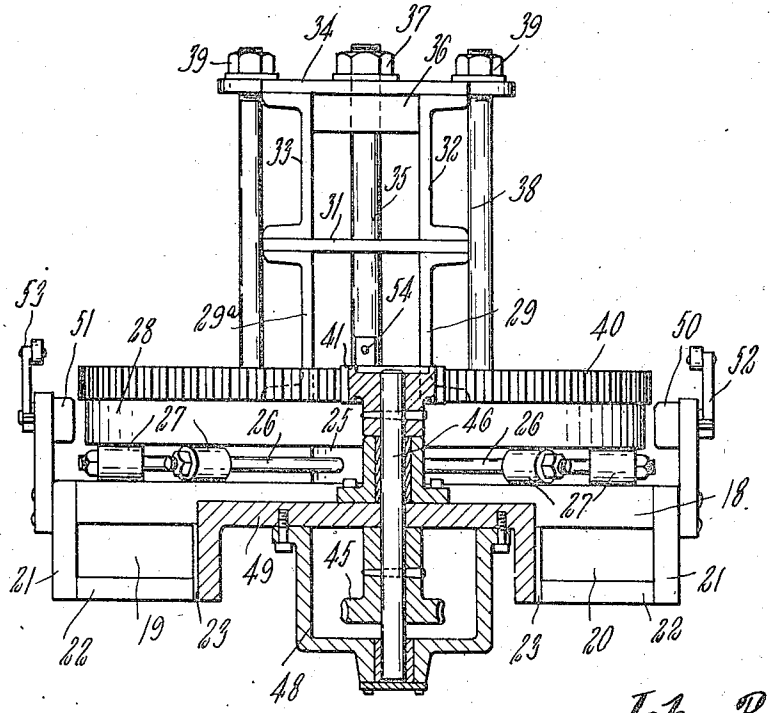


Fig. 2.

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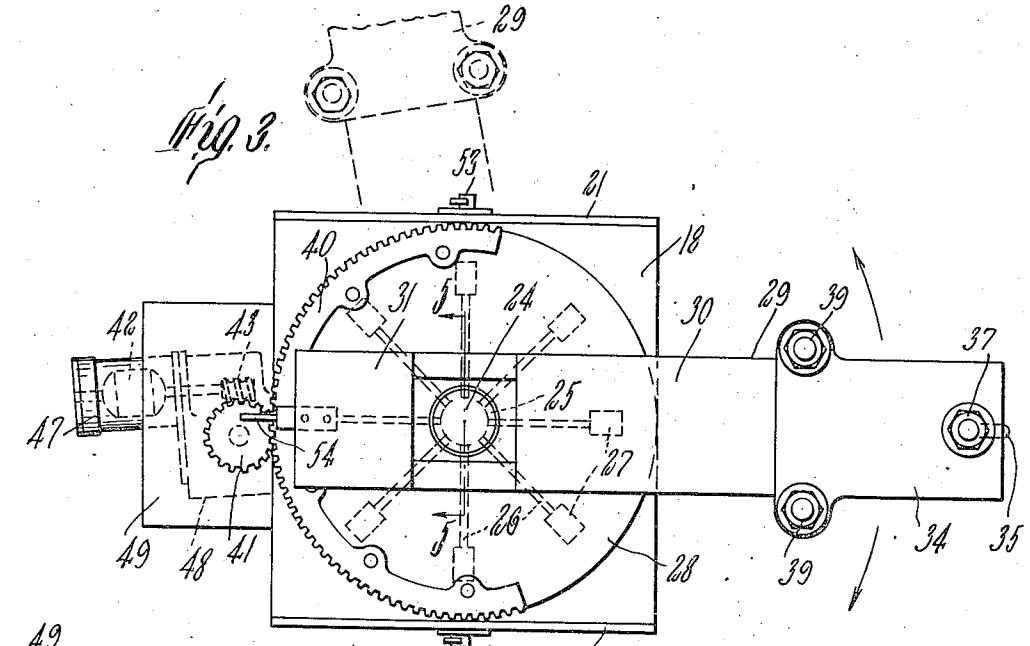


Fig. 3.

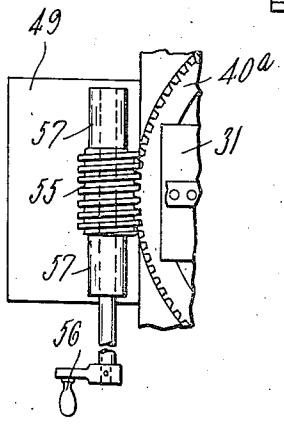


Fig. 6.

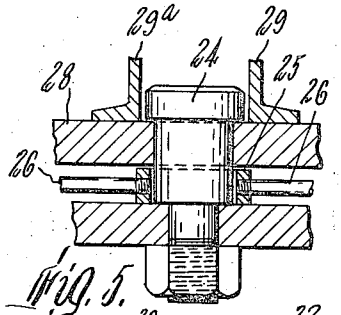


Fig. 5.

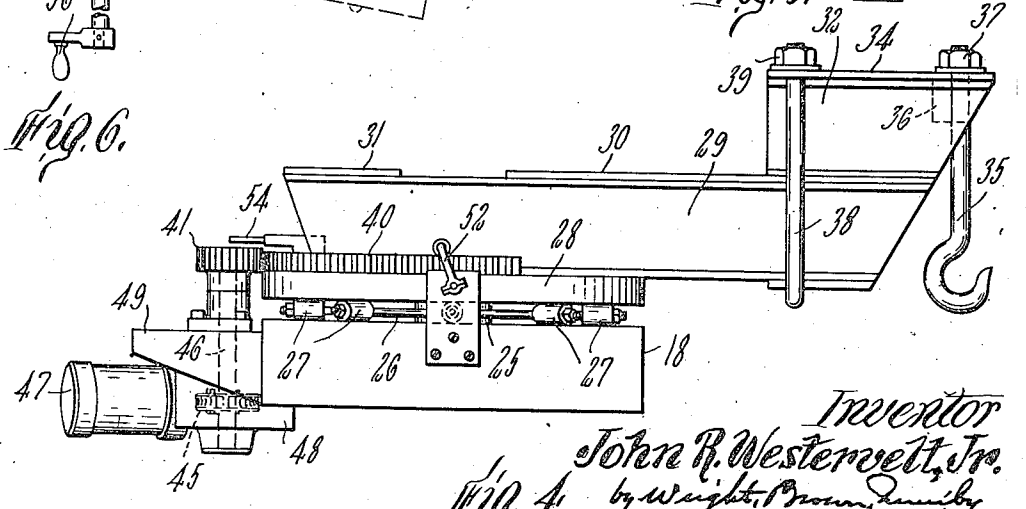


Fig. 4.

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UNITED STATES PATENT OFFICE

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REVOLVING CRANE ACCESSORY FOR FORK TRUCKS

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Application April 7, 1944, Serial No. 529,924

14 Claims. (Cl. 214—112)

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The subject-matter of the present invention is an accessory or attachment for fork trucks adapted for use to suspend a load from the elevator of the truck and swing the load to either side from a position in front of the truck.

Trucks of the character designated by the title "fork trucks" are distinguished by an elevator guided to travel up and down on upright guides suitably mounted on the truck, and provided with horizontal outwardly projecting fingers or arms constituting a fork on which a load may be placed for transportation. Such trucks are self-propelled, some types being provided with electric motors and storage batteries and others with internal combustion engines, all suitably connected with driving wheels. These trucks also have mechanisms under control of the driver by which the elevator may be raised and lowered.

Trucks of this class are restricted in their scope of operations in that they are able to pick up and deposit loads only in locations which can be reached by maneuvering the entire truck. Loads such as large cases, boxes and crates cannot be placed by any type of fork truck in narrow spaces where there is not sufficient room to enable the truck to withdraw its fork from under the load by backing out. For instance, the spaces adjacent to the doorways of box cars cannot be fully loaded by the use of fork trucks alone, even those trucks which have a comparatively short turning radius.

The purpose of this invention is to provide an accessory for trucks of the character described by means of which loads may be swung to either side of the truck from a position in front of the truck, or vice versa. The novel features of the invention are embodied in a crane having a base which can be placed removably on the fork of a truck, an arm or boom supported on the base with capability of revolving through a large angle, such arm being adapted to suspend a load, and motive means, manual or automatically driven under control of an operator, for swinging the boom throughout its arc of movement. The invention comprises a crane having the characteristics last mentioned, together with auxiliary features described in the following specification; and it further comprises the combination of such a crane with a fork truck and the elevator and fork thereof.

Drawings illustrating the invention are furnished herewith and in these drawings

Figure 1 is a perspective view showing the forward end of a truck and one embodiment of my novel crane separated from the fork of the truck

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but in position to be engaged therewith; and it shows by broken lines the elevator in a raised position with the crane supported by the fork.

Figure 2 is a a rear elevation of the crane showing the driving mechanism in section on line 2—2 of Figure 1.

Figure 3 is a plan view of the crane showing by broken lines the extreme positions of its revoluble arm or boom.

Figure 4 is a side elevation of the crane.

Figure 5 is a detail cross section taken on line 5—5 of Figure 3.

Figure 6 is a fragmentary view showing an alternative type of driving mechanism for swinging the arm.

Like reference characters designate the same parts wherever they occur in all of the figures.

In Figure 1 the forward end of a fork truck is shown sufficiently to illustrate the salient characteristics of the elevator and fork thereof, without showing the operating details thereof. 10 represents the forward end of the truck body and 11 represents one of the two wheels which support the forward end of the body. The truck here represented is a standard electrically driven model carrying a storage electric battery and having an electric driving motor. The battery box, driver's seat, steering wheel and control levers, by which the operation of the truck and of its elevator are controlled, have been omitted.

The forward end of the truck frame supports two upright guides 12 and 13 with which a frame 14, constituting the elevator, is suitably engaged for sliding movement up and down. The frame 14 carries massive forwardly projecting arms or fingers 15 which constitute the fork. An upright cylinder 16 and piston rod 17 constitute part of the means for raising and lowering the elevator. This and the balance of the means for this purpose are all part of the standard equipment of fork trucks and need no further illustration here.

The crane comprises a massive and rigid base 18, preferably a heavy flat steel plate, provided at the under side with channels 19 and 20 to receive the arms of the fork; said channels being conveniently made by plates 21, 22 and 23 welded to the base 18 and to each other. The plates 23, forming the under boundaries of the channels, are designed to underlie the fork arms while the base rests on the fork, whereby to prevent the crane from tilting when a heavy load is lifted. In other words, the bounding walls of the channels center and secure the crane base on the fork.

A pivot or king bolt 24 is secured to the center

of the base 18. A spider consisting of a hub 25 and arms 26 surrounds and is rotatable about the pivot 24. The arms 26 carry on their outer ends hardened rollers 27 which rest on the flat upper surface of the base and on which in turn rests a turntable 28 which is centered by the pivot 24. The rollers 27 provide an antifriction bearing for the turntable.

It will be noted that the turntable is of disk form having a diameter more or less closely approximating the length and width dimensions of the base, that it is low in height and has plane upper and lower surfaces, and that the rollers on the ends of the spider arms are relatively near the circumference of the turntable. These characteristics have a number of advantages. They afford a stable and substantially frictionless support for the turntable, permit the use of a simple and inexpensive antifriction bearing which needs no accurately made and accurately centered ball races, affords a broad support for the arm or boom, hereinafter described, and an extended surface for welded union with the boom, and its low height enables it, when elevated, to pass through openings and into spaces bounded by low overhead structures.

An arm or boom 29 is secured to the turntable. This boom is conveniently made of I beams 29 and 29a of which the flanges at one edge are welded to the upper surface of the turntable in lines parallel to and at equal distances from a diameter of the turntable. The upper edges and flanges are braced and tied together by plates 30 and 31 which are welded to them. On the outer end of the arm is secured a hook support composed of I beam sections 32 and 33 and a top plate 34, welded to each other and to the upper side of the plate 30. A hook 35 is suspended from the hook support just described, its shank being passed through the plate 34 and a block 36 which bridges across between the members 32 and is welded to them, and a nut 37 being threaded on the end of the shank and resting on the plate 34. The extremity of the arm and of the hook support thereon are beveled, as shown in Figures 1 and 4, and the rear end of the hook support is additionally secured to the arm by a U-shaped rod 38 constituting a strap which passes under the arm and the extremities of which pass through the plate 34 and carry nuts 39 bearing on the upper surface of the plate. By reason of the beveled formation, the hook is clear of the arm and may be turned with its entrance facing outward, as shown in the drawings, or in the opposite direction. The length of the crane boom and distance of the hook from the pivot are governed by the capacity of the truck and the ability of the elevating mechanism to raise a heavy load supported from the end of the boom. By way of illustration, I may say that in the particular model illustrated here, the distance is 28 inches. It may be more or less in other models.

Mechanism is provided for rotating the turntable 28 and thereby swinging the boom. One embodiment of this mechanism comprises a spur gear segment 40 secured to the upper side of the turntable concentric with the pivot 24, a pinion 41 meshing therewith, a reversible electric motor 42, a worm 43 on the armature shaft of the motor, and a worm gear 45 secured to the shaft 46, to which the pinion 41 is also secured, and meshing with worm 43. The motor is contained in a housing 47 secured to a gear case 48 in which the worm and wheel gearing are contained, and

the gear case is secured to the under side of a bracket 49 made fast, preferably by welding, to the base structure of the crane. The gear segment 40 is symmetrically disposed with respect to the boom and extends far enough to swing the boom more than 90° to either side from its mid position; that is, substantially as far as permitted by the guides 12 and 13 of the truck when the crane is operatively mounted on the fork of the truck. The approximate limits of angular movement are indicated by the broken line positions of the boom in Figure 3.

Fork trucks are commonly made with provisions for adjustment of the fork arms toward and from each other, and the guide channels are located at a distance apart which is within the range of such adjustment and they are also located as near as possible to the outside edges of the base plate to afford stability without undue strain. These guide channels are also made with dimensions closely approximating the cross section of the fork arms, but with sufficient clearance to permit easy entrance and withdrawal of the arms. The bracket 49 is secured between the guideways, and the gear case and motor housing structure is suspended from the bracket in a position where it will not interfere with the fork arms when entered into the guide channels. When not in use, the crane base is supported from the floor on blocks or any other convenient standard with the channels at a height between the limits of upward and downward travel of the fork. It may then be mounted on the fork by advancing the truck so that the fork arms are entered into the guide channels and by raising the elevator. Conversely the crane is disengaged from the truck by the action of lowering the raised elevator until the base of the crane rests on its supporting blocks or standard, and backing off the truck.

When the crane is thus assembled with an electric fork truck, the motor 42 is connected with the battery of the truck and with a reversing relay and control switches by a 4-wire cable and detachable connectors. The controlling circuits of the motor include limit switches 50 and 51, mounted on the base at opposite sides of the turntable and having operating arms 52 and 53 respectively. The turntable carries, in the longitudinal middle line of the boom, a switch-operating finger 54 adapted to operate the limit switches. The arrangement of the switch arms and operating finger is such that the circuit of the motor is opened when the boom has swung to nearly the limit of its rotary movement to either side, their purpose of course being to prevent overrunning of the boom and causing the motor to stall or be damaged. The turntable may coast a few degrees after the motor circuit has been interrupted by either limit switch before the boom brings up against a positive stop.

All of the electrical equipment, including the limit switches, is or may be of standard make connected in circuits of character well known and understood by electricians and needs no further illustration here. It is sufficient for the purpose of this disclosure that it be understood that the crane boom may be revolved by automatic means and is provided with means to prevent overrunning and consequent injury to the driving mechanism.

In situations where electric power is not available, the turntable and boom may be rotated by manual power. An alternative driving means so operable is shown in Figure 6, where a worm gear

segment **40***a* is substituted for the spur gear segment **40** and a worm **55** is arranged to mesh with the segment and is rotatable by a hand crank **56** secured to its shaft. The shaft of the worm may be supported by bearings **57** secured to the bracket **49**, or otherwise, as desired. Moreover the worm **55** may be driven by an electric motor instead of by the hand crank **56**, which motor may be supported on the base by any suitable means clear of the fork guide channels.

When the crane is assembled with the fork, as shown by broken lines in Figure 1, it is used in a raised position of the elevator to carry boxes, crates, or any other load suspended by slings engaged with the hook **35** and passing thence around and under the load, or by any other suitable means; it being only necessary that the height of the load and its suspender be less collectively than the height to which the crane hook may be lifted by the elevator of the truck. The load can be carried by the truck into a box car and deposited in a location at either side of the path of the truck, as well as in other locations which could not be reached by the fork, owing to obstructions limiting the maneuverability of the truck. Conversely loads in similar positions can be picked up with the aid of the crane and carried away by the truck.

What I claim and desire to secure by Letters Patent is:

1. The combination with a truck having an elevator and a fork carried by the elevator, of a crane comprising a base separably engaged with and supported by said fork, a disk-form turntable mounted rotatably on top of said base and supported by the upper surface thereof and a carrier arm or boom secured rigidly to the turntable and projecting beyond the periphery thereof.

2. The combination with a truck having an elevator and a fork comprising separated parallel arms projecting from the elevator, of a crane comprising a base having guide channels in which said fork arms are removably contained and by which the base is stably connected to the fork, a turntable supported on said base and adapted to rotate thereon about a substantially vertical axis, an arm or boom secured to the turntable and protruding beyond the periphery thereon, and mechanism associated with and reacting between said base and turntable for rotating the latter, constructed to prevent accidental rotation of the turntable.

3. A revolving crane for use with a fork truck, comprising a base having means for separable interengaging connection with the fork of such a truck, a turntable mounted on top of said base and coupled therewith for rotary movement, and an arm or boom secured to said turntable in rigid union therewith and projecting beyond the periphery thereof.

4. A revolving crane for use with a fork truck, comprising a base having means for interengaging connection with the fork of such a truck, a turntable mounted on top of said base and coupled therewith for rotary movement, an antifriction bearing interposed between the turntable and base, comprising a spider having arms radiating from the axis of the turntable and rollers on said arms resting on the flat top surface of the base and on which the flat under surface of the turntable rests, and an arm or boom secured to the turntable and projecting therefrom.

5. A revolving crane of the character and for the purpose set forth, comprising a base having guide channels for receiving the arms of a truck fork, a pivot member carried by said base and rising therefrom, a spider centered on said pivot having arms and rollers on its respective arms resting on the top surface of the base, a turntable centered by said pivot member resting on said rollers, and an arm or boom secured to the turntable and projecting laterally therefrom.

6. A self-contained crane comprising a base adapted to be mounted on the fork of a fork truck, having members secured to its under part arranged to embrace and underlie the arms of such fork, a turntable supported on said base for rotary movement about a substantially vertical axis, an arm secured to said turntable and projecting laterally therefrom and a gearing between the base and turntable comprising a gear segment secured to one of them concentric with the axis of rotation and a gear element carried by the other in mesh with said segment and adapted to be rotated.

7. A self-contained revolving crane comprising a base having provisions for interconnection with the fork of a fork truck, a turntable mounted on said base to turn about a substantially vertical axis, an arm secured to the turntable and projecting laterally therefrom, a gear segment secured to the turntable concentric with the axis of rotation, a gear element rotatably supported by the turntable in mesh with the gear segment, and means mounted on said base for rotating said gear element.

8. A revolving crane comprising a base having provisions for interconnection with the fork of a fork truck, a turntable mounted on said base to turn about a substantially vertical axis, an arm secured to the turntable and projecting laterally therefrom, a gear segment secured to the turntable concentric with the axis of rotation, a gear element rotatably supported by the turntable in mesh with the gear segment, and an electric motor mounted on the base and operatively connected with said gear element to impart rotation thereto.

9. A revolving crane comprising a base having provisions for interconnection with the fork of a fork truck, a turntable mounted on said base to turn about a substantially vertical axis, an arm secured to the turntable and projecting laterally therefrom, a gear segment secured to the turntable concentric with the axis of rotation, a gear element rotatably supported by the turntable in mesh with the gear segment, an electric motor mounted on the base and operatively connected with said gear element to impart rotation thereto, and automatic means for stopping the motor when the turntable is rotated a predetermined distance from a prescribed zero position.

10. A revolving crane comprising a massive base, members connected with the under part of said base and with each other to form walls enclosing an open ended channel arranged to embrace and underlie an arm projecting from the elevator of a fork truck, a pivot rising from said base, a turntable having an extended upper surface engaged rotatably with said pivot and supported on the base, an arm lying on the upper surface of the turntable in rigid union therewith projecting laterally from the circumference thereof, and load sustaining means on said arm.

11. A revolving crane comprising a massive base, members connected with the under side of said base arranged to form separate parallel channels open at one end and disposed to embrace and underlie parallel arms projecting from the elevator of a fork truck, a bracket secured to the

base at one boundary thereof between said channels, a driving gear element supported by said bracket, a turntable supported on top of the base in central pivotal connection therewith, an arm secured to said turntable projecting laterally from the circumference thereof, load sustaining means on said arm, and a gear segment secured to the turntable concentric with its pivotal axis in mesh with said driving gear element.

12. A revolving crane comprising a base, a turntable in central pivotal connection with the base having lateral dimensions substantially coextensive with those of the base and overlying the upper side thereof, an anti friction bearing resting on the top surface of the base and on which the turntable rests, a load supporting arm secured immovably to the turntable and projecting laterally therefrom, and members secured to the under side of the base forming the lateral and bottom walls of channels adapted to receive the fork of a fork truck and to serve as a footing to support the crane on a floor or standard when the crane is clear of the truck fork.

13. A revolving crane for use with trucks of the fork truck type comprising a base adapted to rest detachably on the fork of a fork truck and having channels on its under side bounded by walls arranged to embrace and extend beneath the fork, a turntable supported on the top of said base in central pivotal connection therewith, a gear segment secured to said turntable coaxial with its pivot, driving means for the turntable supported by the base and including a gear element in mesh with said segment, and a load supporting arm secured to said turntable and projecting beyond the circumference thereof.

14. The combination with a truck having an elevator and a fork comprising separated parallel arms projecting from the elevator, of a crane comprising a base having guide channels open at one end in which said fork arms are removably contained and by which the base is stably connected to the fork, the walls of said channels embracing the fork arms with clearance sufficient to permit easy entrance and withdrawal of the arms, a turntable supported on the top surface of said base and adapted to rotate thereon about a substantially vertical axis, said turntable having a wide upper surface at a low level relatively to the top surface of the base, and an arm or boom lying on the upper surface of the turntable in welded union therewith and protruding beyond the periphery thereof.

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