STACKER CRANE ATTACHMENT

Inventors: Gordon A. Bust, 2340 116th Ave., Allegan, Mich. 49010; Dean A. Polzin, 12055 Elm St., Birch Run, Mich. 48415

Filed: Oct. 24, 1972

Appl. No.: 300,070

U.S. Cl. 212/135, 212/128
Int. Cl. B66C 19/00

References Cited

OTHER PUBLICATIONS

Primary Examiner—Evon C. Blank
Assistant Examiner—James L. Rowland
Attorney, Agent, or Firm—Fisher, Krass, Young & Gerhardt

ABSTRACT

An overhead cable crane adapted to be moved in the horizontal plane along rails may be converted into a stacker crane through use of a horizontal platform supported below the crane carriage and adapted to engage a stacker attachment. The attachment includes a pair of vertical rails operative to support a pair of horizontally extending stacker forks. At their upper ends the rails are fixed to a horizontally aligned steel frame. An electric hoist mechanism fixed to the underside of the frame moves the stacker attachment vertically along the rails by means of its cable. The stacker platform is supported for rotation with respect to the crane carriage about a vertically aligned king-pin. The hook of the overhead crane is adapted to engage an eye of the king-pin to lift the stacker frame into engagement with the crane frame. Pins in the stacker are locked in holes in the crane frame to securely engage the two.

11 Claims, 3 Drawing Figures
STACKER CRANE ATTACHMENT

FIELD OF THE INVENTION

This invention relates to overhead traveling cranes of the type having winch supported hooks and to a vertically aligned stacker device adapted to be attached to such a crane to convert it to a stacker crane.

SUMMARY OF THE PRIOR ART

Two forms of overhead traveling cranes are in common industrial use. The cable crane supports a winch on a horizontally movable carriage and a hook or magnet attached to the lower end of a cable fixed to the winch is employed to engage loads to be moved by the crane. Stacker cranes employ a pair of vertical rails projecting downwardly from a crane carriage to support a pair of horizontally projecting forks. The forks may be moved vertically along the frame by a drive mechanism. Stacker cranes are frequently employed in warehouses where goods are retained on pallets that are stacked vertically in framing systems.

In some factory situations it is desirable to have both cable crane and stacker crane facilities available and at least one unit has been devised consisting of an attachment that can convert a standard cable crane into a stacker crane. The attachment includes a pair of vertical rails extending downward from a counterbalance arrangement which in turn is supported by the hook of the overhead crane. The forks are supported for vertical movement along the rails.

This type of attachment is relatively inexpensive and may easily be connected and disconnected to the cable crane but its utility is substantially less than that of a conventional overhead stacker crane for several reasons. First, since it is suspended solely from the crane cable it tends to tilt about that suspension point unless the center of gravity of its load is directly below the cable. To minimize this effect a counterweight system has been devised which projects horizontally outward from the suspension point. Since the counterweight arrangement is static and can only prevent tilting for an average load, a further arrangement has been devised which allows adjustment of the suspension point horizontally relative to the rails. Additionally, the hook support only provides vertical lift and no restraining force is imposed against rotation of the stacker attachment about the vertical axis. The operator must manually manipulate the attachment to prevent its rotation and tilting under the forces imposed by its interaction with the load.

SUMMARY OF THE PRESENT INVENTION

The present invention contemplates a stacker attachment for use with overhead hook cranes which retains the simplicity and ease of coupling of previous units and additionally corrects their shortcomings in a simple and economic manner.

In its broadest form the present invention contemplates a stacker attachment for a cable crane which may be lifted by the crane hook into locked engagement with a suitable undercarriage formed below the crane carriage. The attachment includes a pair of vertical guide rails projecting from the lower end of a frame which is adapted to abut and lock against the crane undercarriage. The stacker frame includes a fixed horizontal plate which abuts the cable undercarriage, and a rotatable plate drivingly connected to the fixed plate so the two may be rotatably adjustable about a vertical axis.

The positive engagement provided by the abutment between the stacker plate and the overhead crane undercarriage acts to impose any forces which would tilt the stacker onto the carriage. The carriage is supported on its rails in such a manner as to impose these forces on the rails. The rotatably supported underplate allows the forks to be aligned in any desired angle relative to the cable.

In a preferred embodiment of the invention which will subsequently be described in detail a conventional overhead hook crane carriage is adapted to retain the stacker attachment by means of an undercarriage taking the form of a horizontal plate supported below the carriage and retaining rollers which abut the undersides of the crane rails at points immediately below the carriage wheels. The stacker attachment is fixed to a frame hung from the kingpin having an eye at its upper end. The plate and the kingpin are rotatably supported with respect to a frame member adapted to lockingly engage with the frame undercarriage by means of notched pins which fit in holes in the undercarriage. The stacker frame is brought into locking abutment with the undercarriage by engaging and lifting the eye of the kingpin with the crane hook. The stacker assembly is rotatable about a vertical axis with respect to the stacker frame by a motor which drives the gearing disposed between the kingpin and the stacker frame.

Other objectives, advantages, and applications of the invention will be made apparent by the following detailed description of the preferred embodiment to the invention. The description makes reference to the accompanying drawings in which:

FIG. 1 is a front elevation view of an overhead hook crane equipped with a stacker attachment formed in accordance with the present invention, with parts broken away for purposes of illustration;
FIG. 2 is a side view of the crane arrangement of FIG. 1 taken along line 2—2 of FIG. 1 with parts broken away for purposes of illustration; and
FIG. 3 is a perspective view from the upper side of the stacker attachment of the preferred embodiment and those parts which are permanently added to a standard overhead hook crane to enable it to receive the stacker attachment.

Referring to the drawings, the present invention relates to a standard overhead hook crane of the type that moves along a pair of parallel horizontal rails which may typically consist of I-beams. The rails may themselves be supported on additional rails (not shown) which provide the unit with a degree of freedom in the direction normal to the extension of the rails.

A crane carriage 12 is adapted to move along the rails 10 on two pairs of rotatably supported flanged wheels 14 which rest on the top flanges of the rails 10. The carriage 12 supports a winch 16 driven and powered by a motor 18. A hook 20 is suspended from the winch 16 by a cable (not shown) so that objects engaged by the hook may be raised and lowered in a conventional manner. The hook 20 is illustrated in FIGS. 1 and 2 as being in its elevated position wherein the cable is fully wound around the winch 16.

As thus far described, the crane is conventional. Loads may be lifted through use of the hook 20 and moved in any horizontal direction by combinations of...
3,810,551

3

motions of the carriage 12 along the rails 10 and motions of the rails 10 along their conventional supporting mechanism in directions normal to their extension.

To modify such an overhead crane for the receipt of a stacker attachment, as is generally indicated at 22, a permanent assembly, generally indicated at 24 in FIG. 3, is joined to the crane carriage 12. The attachment 24 consists of a rectangular undercarriage plate 26 suspended below the carriage 12 by four vertically aligned I-beam sections 28. These sections have their upper sides welded to the bottom of the carriage 12 and their lower ends welded to the top of the undercarriage plate 26 so that they extend between the rails 10. The I-beam sections 28 are of such length that the plate 26 is positioned horizontally below the bottom flange of the rails 10.

The undercarriage plate 26 has a central hole 30 through which the hook 20 of the crane may pass. The plate 26 is framed by four I-beam sections 32 having the upper surfaces of their upper flanges welded to the bottoms of the four edges of the plate 26.

The undercarriage plate 26 rotatably supports four steel rollers 34 which are spaced from the wheels 14 by distance equal to the height of the I-beams 10 and about the lower flanges of the I-beam. This arrangement allows the carriage 12 to remain steady despite the imposition of twisting forces on it through the attachment 22. Where the carriage is supported simply on the wheels 14 unbalanced forces imposed on the undercarriage 26 would tend to tilt the unit.

The lower flanges of the I-beams 32 on opposite sides of the frame have holes 36 formed therein through which notched pins 38 carried by a stacker plate 40 may pass. Electrically operated solenoids 42 are supported on these flanges and when actuated their rods engage notches in the pins 38 so as to lock the plate 42 to the undercarriage.

The undercarriage as thus described is a permanent part of the crane and allows it to be used as a hook crane in the normal manner. When it is to be used as a stacker crane the assembly 22 is coupled to it. As indicated, the assembly employs a frame including a square, steel plate 40 having notched pins 38 extending upwardly from its four corners. The stacker plate 40 has a central hole 42 formed in it and a kingpin 44 having an eye 46 at its upper end projects through the hole. The kingpin carries an outer cylindrical sleeve 48 with a ring gear 50 fixed thereon.

As is best seen in FIG. 2, the sleeve 48 is rotatable within the hole 42 and is fixed in a hole 52, formed in a disk shaped bearing plate 54 supported below the plate 40 by means of a key 55. A nut 56 is attached to a threaded section formed at the lower end of the kingpin 44 below the bearing plate 54. Accordingly, the pin 44 is rotationally fixed to the bearing plate and is rotatable with respect to the stacker plate 40.

The ring gear 50 is engaged by a spur gear 58. A motor 60 fixed to the stacker plate 40 powers the spur gear and thus rotates the kingpin sleeve and the bearing plate 54 relative to the plate 40.

A rectangular frame formed of four I-beams 62 is affixed to the underside of the bearing plate 54. The bearing plate 54 is relieved along a portion of its upper side to decrease the bearing area between it and the stacker plate 40 and to allow the introduction of lubricant between the two.

4

A pair of stacker rails 64, constituting I-beams, have their upper ends fixed to the underside of adjacent edges of the frame 62. Angle plates 66 reinforce the joiner and act to distribute the load imposed by the stacker rails on the frame. The I-beams which constitute the rails 64 have their flanges facing one another and these spaces act as a guide for four slide blocks 68 which carry a stacker plate 70.

The plate 70 is disposed in a vertical attitude and a pair of stacker forks 72 are retained on the plate by means of hooks which pass over the top of the plate and lie vertically against the front of the plate. The stacker forks 72 thus project parallel to one another and horizontally.

The stacker plate 70 and the forks 72 may be moved vertically by a cable 74 powered by a chain hoist 76 hung below the frame 62 by a hook and eye arrangement 78. A hook 80 carried at the lower end of the cable 74 engages an eye 82 fixed to the upper edge of the plate 70.

The stacker attachment 22 may be conveniently stored in a vertical attitude when not in use and the cable crane may then be used in the normal manner. When it is desired to convert to stacker crane operation, the carriage 12 is moved over the storage position of the attachment 22 and the hook 20 is engaged with the eye 46 of the kingpin. The hook is then lifted by the winch 16 to bring the stacker plate 40 into abutment with the underside of the I-beams 32 and the stacker 22 is manually guided so that the locking pins 38 enter the holes 36 in the beams 32. The solenoids 42 are then electrically energized to lock the pins 38 in position.

The stacker crane thus formed may be moved in the horizontal plate by appropriate movements of the carriage 12 along the rails 10 and along the rail supports. Vertical movement of the stacker fork 72 is achieved by use of the hoist 76. Appropriate electrical interconnections (not shown) may be employed to provide power to the chain hoist 76 through the cable crane. Similarly, control connections (not shown) may be provided for the motor of the chain hoist 76 and the motors 18 and 60.

The stacker attachment may be rotated about a vertical axis relative to the carriage 12 by means of the motor 60 which acts through the gears 58 to rotate the kingpin sleeve and hook 20 relative to the plate 26.

The stacker attachment is therefore seen to be relatively simple in construction so as to be low in cost and flexible in use.

Having thus described my invention, I claim:

1. A crane including a carriage; means supporting the carriage for movement in the horizontal plate; a winch supported on the carriage; a cable having one end fixed to said winch; engaging means attached to the other end of the cable and adapted to be moved vertically; support means attached to said carriage; a stacker frame removably attachable to said support means; a vertical guide projecting downward from said stacker frame; fork means slidably supported on the guide for vertical movement and extending normally from said guides; and means on the stacker frame for receiving said engagement means, whereby said stacker frame may be lifted by said winch into attachment with the support means.

2. The crane of claim 1 wherein the guides are rotatably supported with respect to said stacker frame, for movement about a vertical axis.
3,810,551

3. The crane of claim 1 wherein said frame consists of a downward extension supported below said carriage.

4. The crane of claim 1 wherein said support means is retained below said carriage and includes a pair of points displaced horizontally with respect to one another which are fixed relative to one another and relative to said carriage, and said stacker frame includes a pair of points fixed relative to one another and engageable with said points of the support means.

5. The crane of claim 1 wherein said means supporting the carriage for movement in the horizontal plane includes a pair of rails, and said carriage is supported on said rails by means of members rotatably supported about a horizontal axis and engaged to said rails at complementary points on their tops and bottoms.

6. An overhead lift crane convertible into a stacker crane comprising: a pair of parallel, horizontally aligned rails; a carriage; means supported on said carriage for rotation in the horizontal plane and adapted to engage complementary points on the tops and bottoms of said rails so as to support the carriage for movement along said rails; a cable; means supported on the carriage connected to one end of the cable and adapted to extend and retract said cable; a hook attached to the free end of said cable; a stacker frame engageable by said hook; means on said stacker frame adapted to engage said carriage so as to rigidly support said stacker frame relative to said carriage; vertically aligned guide means having their upper ends fixed to said stacker frames; and support means slidably retained on said guide means and extending in the horizontal plane.

7. The crane of claim 6 wherein said guide means are supported for rotation about a vertical axis relative to said carriage.

8. The crane of claim 6 wherein said stacker frame includes a plate engageable with said carriage and a frame rotatably supported with respect to said plate for rotation about a vertical axis, and said guide means are fixed to said frame.

9. The crane of claim 6 wherein the carriage includes a first horizontal plate supported below said rails and said stacker frame includes a second horizontal plate adapted to abut the first horizontal plate when the two are engaged.

10. The crane of claim 9 wherein male and female locking members are supported relative to one another on said first and second plates.

11. The crane of claim 10 wherein one of said horizontal plates supports solenoid actuated means for locking said male members relative to the female members.

* * * * *