

Apparatus for Storing Chassis such as Trailers

The present invention relates to apparatus for storing a plurality of chassis, such as trailers, generally horizontally in a vertically spaced relationship.

In a harbour, with facilities for container ships, large numbers of containers are required to be handled. These large containers are moved about by being loaded onto trailer chassis which are towed by a tractor. After the containers are conveyed by the tractor to a predetermined place, a forklift truck is used to lift and stack the chassis and its containers on a temporary basis.

In this way, however, only a few trailer chassis can be stacked. Especially in a city harbour, it is desirable to utilize its limited space effectively, preferably by stacking up a large number of chassis, with or without containers.

An object of the present invention is to provide apparatus for storing a number of chassis, such as trailers, in a vertically spaced relationship, to effect a substantial saving in space.

Another object of the invention is to provide apparatus for storing a number of chassis in a vertically spaced relationship, which enables support pallets for the chassis to be easily and rapidly stored.

A further object of the invention is to provide apparatus for storing a number of chassis in a vertically spaced relationship, which enables easy maintenance and inspection.

According to one aspect of the invention, there is provided apparatus for storing chassis, such as trailers, generally horizontally in a

vertically spaced relationship, which comprises a structure and a pallet support mechanism including a plurality of long guide members suspended vertically from the structure via lifting and rotating mechanisms, a plurality of sets of hooks, which sets are attached to said guide members at vertically spaced positions, said guide members being adapted to be rotated by the rotating mechanism to rotate the hooks into or out of engagement with the pallets, and a plurality of sets of pallet support elements arranged at vertically spaced positions corresponding to the sets of hooks and so that each set of support elements is in confronting relation with a set of hooks, the elements of each set being movable to and from support positions for a pallet located on the corresponding set of hooks.

A cycle of operations is effected to lift a number of pallets and thus store them in a vertically spaced relationship. This results in a substantial saving in space as well as easy and rapid storing of the pallets. Such a cycle of operations generally includes inward movement of the support elements, downward movement and rotation of the long guide members and the hooks, outward movement of the support elements, and upward movement of the long guide members and the hooks. A reverse cycle of operations permits the pallets to be moved out of the structure.

According to a feature of the invention, said long

guide members of said pallet support mechanism comprise columns, and a plurality of operating bars extend adjacent to and along respective columns, each operating bar having a plurality of inclined slots, a plurality of pallet support pegs arranged in vertically spaced relation in each column and guided either to project from or retreat into each column via said inclined slots by appropriate movement of the operating bars, and a lifting/driving mechanism operatively associated with said operating bars.

Lateral movement of the pallet support pegs is smoothly and securely effected in association with the operating bars and the inclined slots formed therein. This arrangement also provides a substantial support for the pallets, and thus, improves operability of the apparatus.

The above and further objects, aspects and advantages of the invention become apparant from the following description when taken in conjunction with the accompanying drawings, in which:

Figure 1 is a front elevational view of apparatus for storing a number of trailer chassis in a vertically spaced relationship, according to a first embodiment of the present invention;

Figure 2 is a side elevational view of the apparatus shown in Figure 1;

Figure 3 is a sectional plan view of the apparatus shown in Figure 1;

Figure 4 is a diagrammatic view showing a lifting mechanism; for use in the first embodiment

Figures 5(A) through 5(G) are diagrammatic views showing the manner in which trailer chassis are stored;

Figure 6 is a perspective view of a second embodiment of the present invention;

Figure 7 is an enlarged side view of that part of referenced VII in Figure 6; and

Figure 8 is a view similar to Figure 7, but showing the manner in which an operating bar is moved downwards to retreat a peg into a column;

Figures 1 to 5 illustrate a first embodiment of this invention. Reference numeral 1 designates a storage structure on which a number of pallets 2 can be supported one above the other, and a pallet support mechanism. The pallet support mechanism includes a plurality of long vertical guide members 5 suspended from the structure 1 via lifting and rotating mechanisms discussed in detail below, hooks 6 which are attached in sets in spaced relation on the guide members 5, each set being adapted to support a pallet 2 thereon, and sets of support elements 3 are correspondingly vertically spaced so that each set is in confronting relationship with a set of hooks 6 and movable to and from a support position for a respective pallet 2.

Reference is now made respectively to the lifting and rotating mechanisms in more detail. As shown in Figures 1 and 4, the lifting mechanism includes lifters 8 in the form of hydraulic piston/cylinders arranged near both lower sides of the structure 1, sheaves 9a, 9a vertically movable by the lifters 8, a wire 10 adapted to pass around the sheaves 9a as well as a plurality of further guide sheaves 9 mounted on the structure 1, and a lifting beam 11 to which opposite ends of the wire 10 are secured. The lifting beam 11 is suspended near the upper portion of the structure 1. The rotating mechanism includes a set of four sprockets 15 located at the four corners of the lifting beam 11 respectively, a chain 16 trained around the sprockets 15, and a drive unit 14 to rotate the sprockets 15 via the chain 16. The guide members 5 are fixed to the sprockets 15 so as to be rotatably supported by the lifting beam 11.

As shown in Figures 2 and 3, each pallet 2 has at its corners four receiving elements 13 through which the guide members 5 and the hooks 6 in an inoperative position can pass. However, when the guide members 5 are rotated 90° by their rotating mechanisms, the hooks 6 are brought into engagement with the underside of the receiving elements 13 to support the pallet 2.

Reference is now made to the pallet support mechanism in more detail. As best seen in Figure 1, the support elements 3 are arranged in sets of four and the sets are fixedly attached in vertically spaced relation to four long vertical support members 20. The support elements 3 are also arranged in confronting relation to the hooks 6 so that, when the support

members 20 are rotated 90° by rotating means 21, they are moved under the four corners of a cooperating pallet 2.

As shown in Figures 2 and 3, lifting units, designated at 12, are arranged at the lower sides of the structure 1 and are adapted to move a pallet 2 up to the lowermost support element 3.

In operation, a pallet 2, placed in the lower portion of the structure 1, is lifted by the lifting units 12. The support members 20 are then rotated to move the support elements 3 under the pallet 2 for supporting purposes. The lifters 8 are operated to lift the sheaves 9a by a required distance whereby the lifting beam 11 is lowered to permit the guide members 5 and the lowermost hook 6 to be inserted into the receiving elements 13. Thereafter, one of the sprockets 15 is rotably driven by the drive unit 14 to thereby rotate the other sprockets 15 and the chain 16. This causes the guide members 5 and the hooks 6 to rotate and thus bring the hooks 6 into engagement with the receiving elements 13. Under these circumstances, a trailer chassis is placed on the pallet 2 as shown in Figure 5(A).

Next, the support members 20 are rotated to retreat the support elements 3 from the pallets 2 as shown in Figure 5(B). The lifters 8 are again operated to lower the sheaves 9a by the required distance to raise the guide members 5 and thus, the pallet 2 and the trailer chassis a as shown in Figure 5(C). The lifting units 12 are operated to further raise a next pallet 2. Thereafter,

the support members 20 are rotated to move the support elements 3 under this lower pallet 2 as shown in Figures 5 (D) and 5 (E). The guide members 5 are then lowered and rotated as shown in Figure 5 (F). Following placement of another chassis a on the lower pallet 2 (see Figure 5 (G)), the lower pallet 2 and the chassis a are supported by the lowermost hook 6 and are raised. By this cycle of operation, a number of trailer chassis can be loaded one by one in the structure 1 and stored in a vertically spaced relationship. It will be appreciated that, if necessary, an empty container b may be loaded on the chassis as shown in Figures 1 and 2.

A reverse cycle of operation permits the trailer chassis a to be removed one by one from the structure 1.

Figures 6 through 8 illustrate a second embodiment of the invention directed particularly to a pallet support mechanism to be used in the above described apparatus for storing a number of chassis.

In these Figures reference numeral 120 designates a plurality of, but at least four vertical columns (corresponding to the long support members 20 in the first embodiment shown in Figures 1 through 5) having a plurality of vertically spaced bosses 106 through which a plurality of pallet support pegs 103

are guided. Operating bars 102 extend adjacent to and along the respective columns 120 and are movable therealong. Each operating bar 102 has a plurality of vertically spaced brackets 104 which provide inclined slots 105 into which pins 107, fixed to the base ends of the pallet support pegs 103, are loosely fitted. In this arrangement, vertical movement of the operating bars 102 causes the pins 107 to move along the inclined slots 105 so that, depending on the direction of movement, the pallet support pegs 103 are either projected from or retreated into the columns 120 as best seen in Figures 7 and 8. The operating bars 102 are operatively associated with a lifting/driving mechanism 110 which will be explained in more detail below.

The lifting/driving mechanism 110 includes spur gears 111 formed on the upper portions of the operating bars 102, gears 112 adapted to mesh with the spur gears 111, sprockets 113 arranged in coaxial relation with the respective gears 112, endless chains 114 each passing between the sprockets 113, and drive units 115 each provided for a chain 114. The gears 112 and sprockets 113 are attached to the columns by any suitable means. With this arrangement, the chains 114 are moved in directions shown by a double-headed arrow by means of the drive units 115, so that the operating bars 102 are vertically moved through the sprockets 113, the gears 112 and the spur gears 111.

In operation, the drive units 115 are first operated to rotate the chains 114 in the directions of the double-headed arrow. This causes the sprockets 113 and the gears 112 to

rotate in a clockwise or counterclockwise direction. At this time, meshing engagement of the gears 112 with the spur gears 111 will raise or lower the operating bars 102. Upon upward and downward movement of the operating bars 102, the pallet support pegs 103 are moved laterally inwards or outwards through the inclined pins 107 while being guided by the bosses 106 of the columns 120. More specifically, when the operating bars are raised, the pallet support pegs 103 project from the columns to support the pallets thereon as shown in Figure 7. When the operating bars 102 are lowered, the pallet support pegs 103 retreat into the columns 120 as shown in Figure 8. In this state, the pallets are free to move vertically in the storage structure.

As stated above, the pallet support pegs 103 are not only guided by the bosses 106 of the columns 120, but also moved synchronously with the operating bars 102 through the inclined slots 105. This provides smooth operation of the pallets.

While specific constructions and modifications have been described and illustrated herein, it is obvious that other alternate constructions and modifications can be made by one skilled in the art without departing from the scope of the invention set out in the appended Claims.



CLAIMS

1. Apparatus for storing a plurality of chassis generally horizontally in a vertically spaced relationship, comprising a structure and a pallet support mechanism including a plurality of long guide members suspended vertically from said structure via lifting and rotating mechanisms, a plurality of sets of hooks, which sets are attached to said guide members at vertically spaced positions, said guide members being adapted to be rotated by the rotating mechanism to rotate the hooks into or out of engagement with the pallets, and a plurality of sets of pallet support elements arranged at vertically spaced positions corresponding to the sets of hooks and so that each set of support elements is in confronting relation with a set of hooks, the elements of each set being movable to and from support positions for a pallet located on the corresponding set of hooks.

2. Storage apparatus as claimed in Claim 1, wherein said long guide members of said pallet support mechanism comprise columns, and wherein a plurality of operating bars extend adjacent to and along respective columns, each operating bar having a plurality of inclined slots, a plurality of pallet support pegs arranged in vertically spaced relation in each column and guided either to project from or retreat into each column via said inclined slot by appropriate movement of the operating bars, and a lifting/driving mechanism operatively associated with said operating bars.



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3. Storage apparatus for storing chassis generally horizontally in vertically spaced relationship constructed, arranged and adapted for use substantially as hereinbefore described with reference to, and as shown in, Figures 1 to 5 or 6 to 8 of the accompanying drawings.
