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[21]	Appl. No.	854,590
[22]	Filed	Sept. 2, 1969
[45]	Patented	Dec. 28, 1971
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[54] SIDE SHIFTING STORAGE AND TRANSFER APPARATUS
11 Claims, 12 Drawing Figs.

[52] **U.S. Cl.**..... **214/146.5,**
214/38 C, 214/DIG. 10

[51] **Int. Cl.**..... **B65g 67/12**

[50] **Field of Search**..... 214/38.22,
41, 512, 514, 38.40, 38.46, 515, 516, 517, 730,
130 R, 146.5, DIG. 10

ABSTRACT: A load storage and transfer apparatus for storing a load on transfer bunks near ground level, and transferring the load to a vehicle by first elevating the bunks and then side-shifting them to transfer the load to a vehicle load support. The transfer bunks are mounted for limited vertical tilting movement and for horizontal pivoting movement to facilitate transfer of the load to the vehicle and removal of the loaded vehicle from alongside the transfer bunks without clearance between the vehicle and transfer bunks.

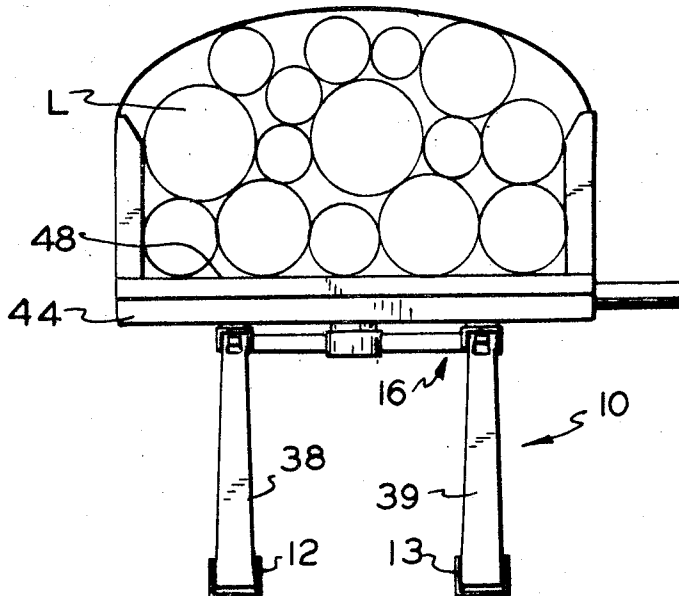


FIG. 1

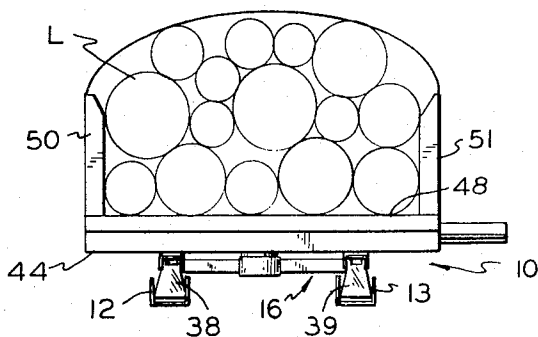


FIG. 2

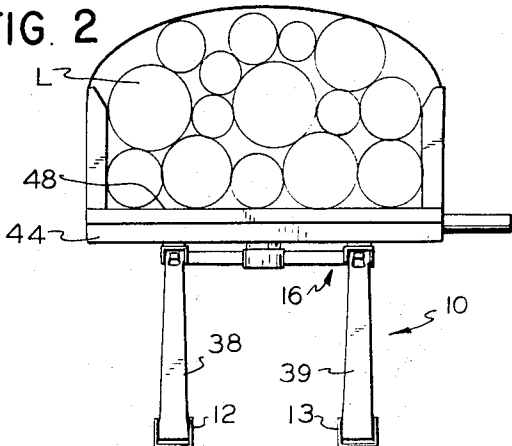


FIG. 3

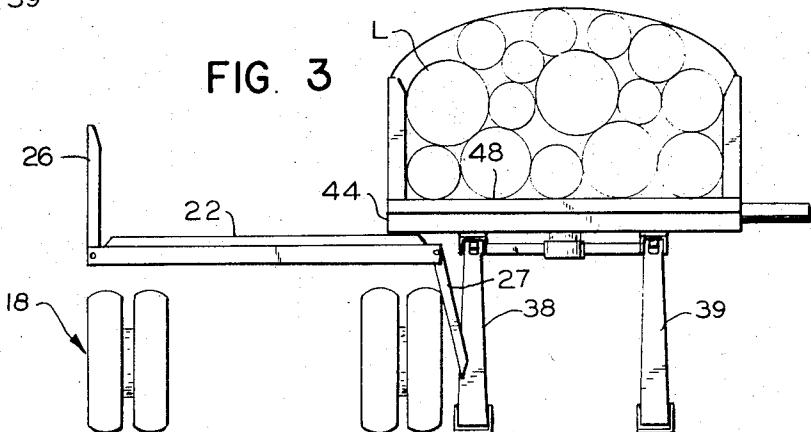


FIG. 5

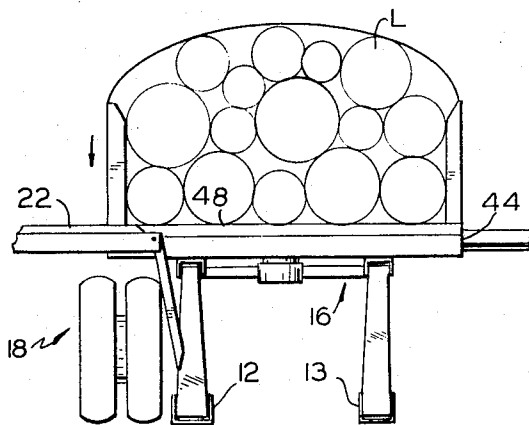
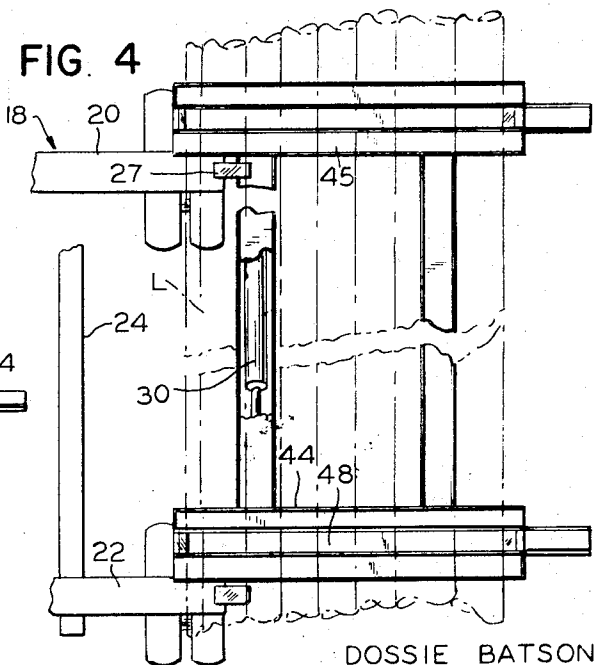
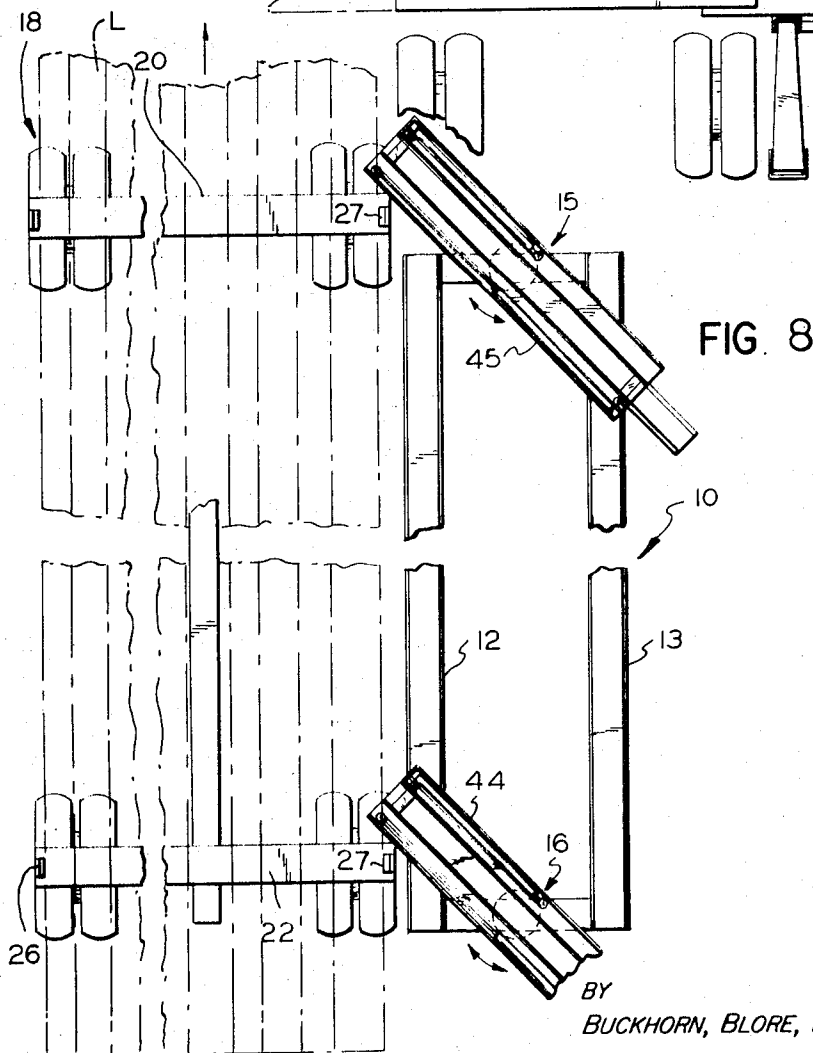
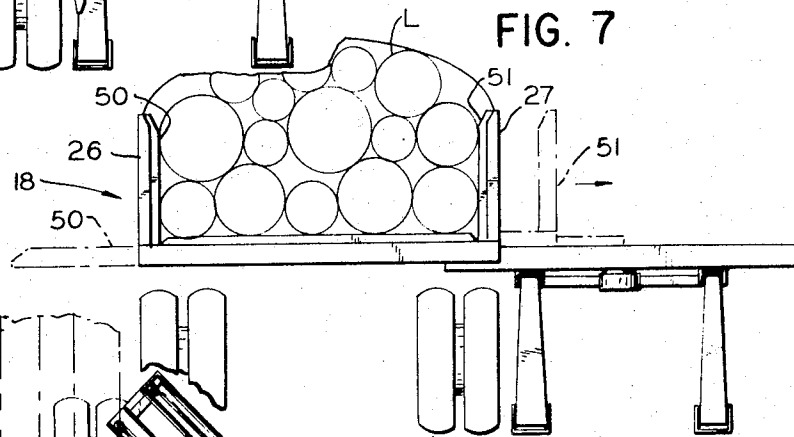
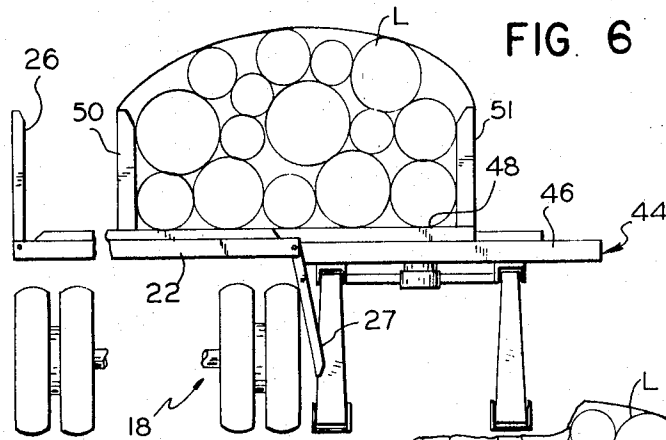


FIG. 4



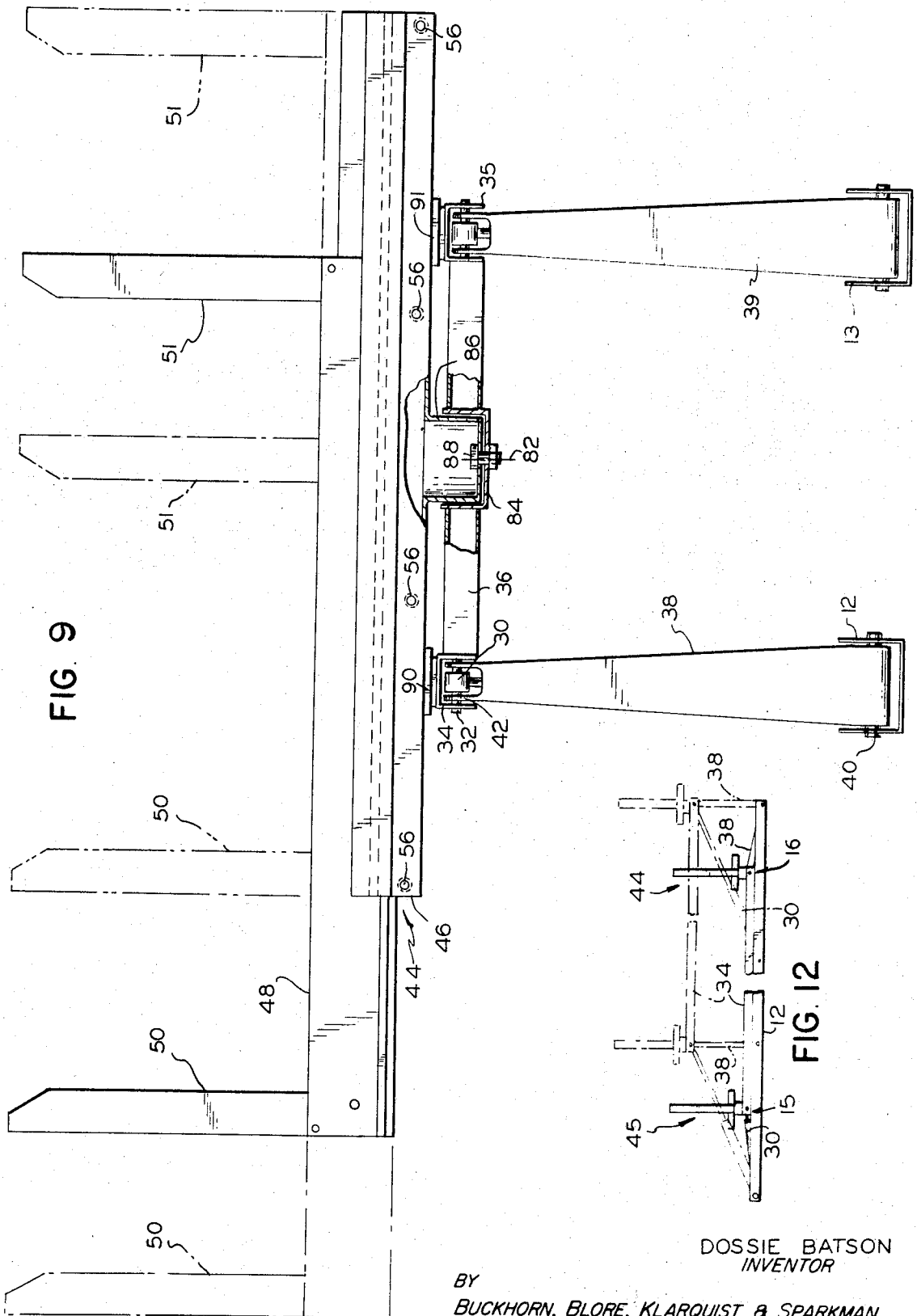
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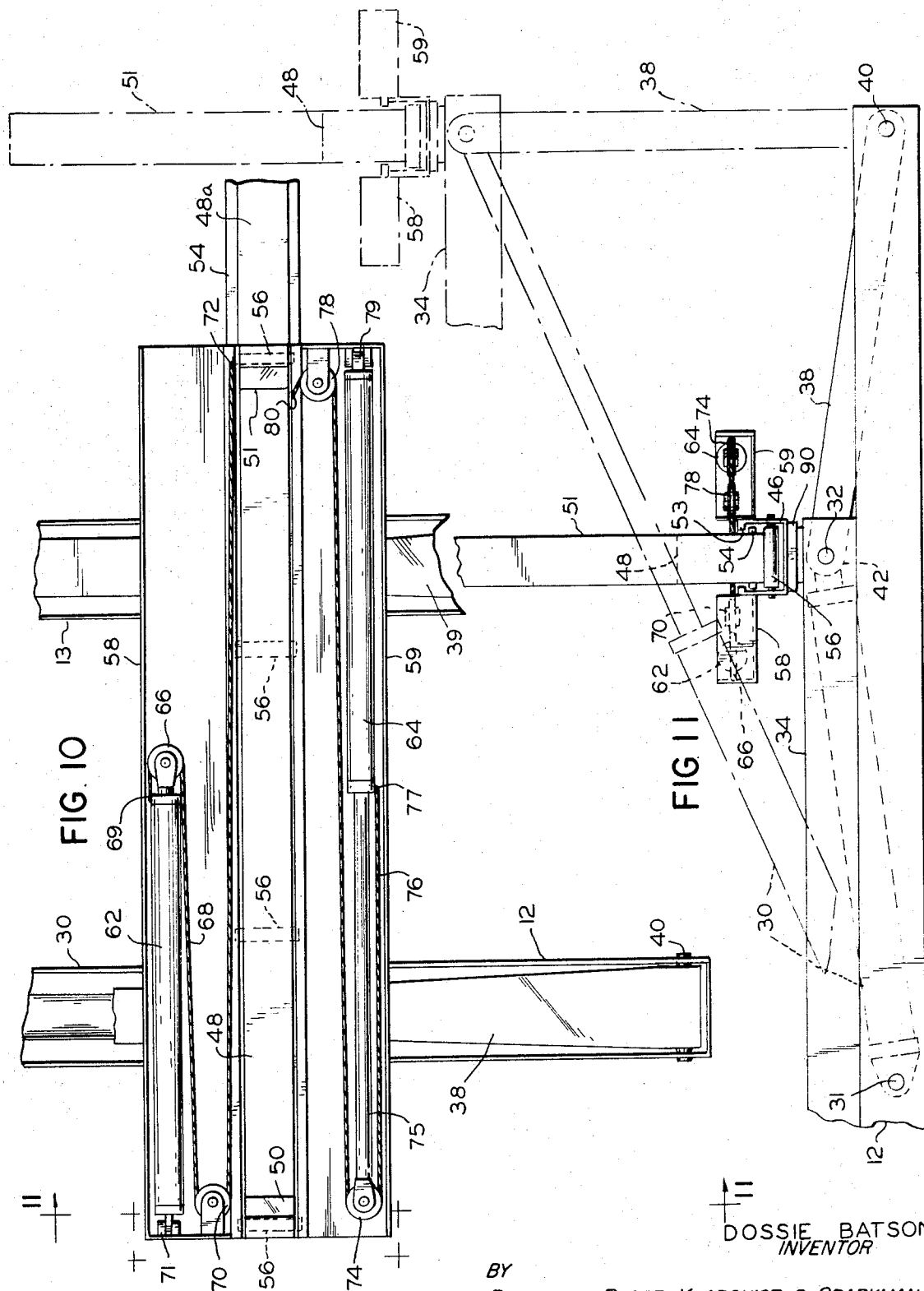
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SIDE SHIFTING STORAGE AND TRANSFER APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to apparatus for storing a load and transferring the load between a low level position and a higher level position such as on a load-supporting vehicle.

2. Description of the Prior Art

Traditional systems for loading and unloading vehicles of containerized loads or loose loads includes the use of heavy lifting equipment such as cranes or, in the case of logs, large grapples. There is usually only one such grapple or crane at a loading or unloading site because of the expense of such equipment. Accordingly, expensive vehicles and drivers are often delayed at the site while waiting to be loaded or unloaded. On the other hand, there are often long periods of inactivity for the expensive lifting equipment when the vehicles are finally loaded or unloaded. Thus the foregoing system is grossly inefficient in the use of both men and equipment.

Moreover, loads waiting to be transferred to or from a vehicle with the above system often must be stored for long periods at the loading or unloading site, requiring separate storage facilities, since the foregoing lifting equipment is not capable of storing loads. Such facilities further increase the expense and inefficiency of the loading or unloading operation.

Although the use of loading platforms which can be raised and lowered to and from the level of the vehicle have been suggested for loading and unloading vehicles and transferring loads between two vehicles, such apparatus has been unduly complex and therefore expensive and not adaptable for low-cost transfer and storage of loads. Also, such prior apparatus has not been capable of handling large, heavy loads such as an entire truckload of logs or a containerized load consisting of an entire truckload of goods, without the use of auxiliary equipment.

SUMMARY OF THE INVENTION

The present invention overcomes the foregoing deficiencies in the prior art by providing a simple and inexpensive apparatus capable of both storage and transfer of large, heavy, loose or containerized loads of truckload size between a low-level storage position and a higher level vehicle load support alongside the transfer apparatus.

The apparatus includes a load support bunk alongside a vehicle to be loaded or unloaded at a position offset longitudinally from the vehicle load support. Mechanism is provided for elevating the bunk first to a level above the vehicle load support to permit the vehicle to be driven up alongside the bunk and then to the same level as the vehicle load support. Additional mechanism is provided for shifting the bunk laterally thereby transferring the weight of the load progressively from the bunk to the vehicle load support as the lateral shifting movement of the bunk continues.

When the transfer is completed, the loaded vehicle can be driven from alongside the bunk without clearance between the bunk and the vehicle because of a pivotal mounting of the bunk, which swings clear as the vehicle is driven away. Limited lateral tilting movement of the bunk facilitates transfer of the load from the bunk to the vehicle as the load is shuttled toward the vehicle.

Another feature of the invention is a horizontal cylinder arrangement on the transfer bunk for shuttling the load-supporting portion of the bunk sideways toward the vehicle.

Still another feature of the invention is a cylinder-and-linkage arrangement for elevating the transfer bunk from a storage position near ground level to a high-level transfer position.

Because of the relatively low cost, simplicity and rugged construction of the storage and transfer apparatus, it may be used to store loose or containerized loads for long periods of time at a loading or unloading site. The apparatus can also be used in multiples so that numerous vehicles can be loaded or

unloaded at the same time to avoid the tieup of expensive, heavy-duty lifting equipment and vehicles.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing objects and advantages of the present invention will become more apparent from the following detailed description which proceeds with reference to the accompanying drawings wherein:

FIG. 1 is a schematic end elevational view of a storage and transfer apparatus in accordance with the present invention in its storage position;

FIG. 2 is a view similar to FIG. 1 showing the transfer bunks in a fully elevated condition;

FIG. 3 is a view similar to FIG. 2 with a vehicle to be loaded alongside the apparatus;

FIG. 4 is a schematic plan view of the apparatus and a portion of the vehicle of FIG. 3;

FIG. 5 is a view similar to FIG. 3 showing the bunks in a slightly lowered position just prior to transferring the load to the vehicle;

FIGS. 6 and 7 are views similar to FIG. 5 illustrating further steps in the transfer of the load from the bunks to the vehicle;

FIG. 8 is a schematic plan view showing a loaded truck moving away from the unloaded bunks;

FIG. 9 is a view similar to FIG. 2 but on an enlarged scale showing details of a transfer bunk with portions broken away for clarity and showing schematically the bunk in various lateral positions of adjustment;

FIG. 10 is a top plan view of the bunk of FIG. 9 on approximately the same scale as FIG. 9;

FIG. 11 is a side elevational view of the bunk of FIGS. 9 and 10 in its lowered position and also showing the bunk schematically in its fully raised position; and

FIG. 12 is a foreshortened schematic side elevational view on a reduced scale of the apparatus in its raised and lowered positions.

DETAILED DESCRIPTION

General Arrangement

With reference to the drawings, FIGS. 1 through 8 and 12 disclose a load storage and transfer apparatus 10 in accordance with the invention including a pair of generally elongate base members 12, 13 joined together at their opposite ends by a pair of generally laterally extending, longitudinally spaced load support means 15, 16.

A typical log truck 18 to be loaded is shown positioned alongside the storage and transfer apparatus, the truck including a tractor bunk 20 and trailer bunk 22 interconnected by a longitudinally extending reach member 24. In transporting logs and other loose loads L the truck is provided with upright stakes 26, 27 at the opposite ends of each bunk for laterally containing the load on the bunks.

As will be evident from FIGS. 1, 2 and 12, means are provided for raising and lowering load-support means 15, 16 with respect to their base members 12, 13. As will be apparent from FIGS. 6 and 7, additional means are provided for shuttling or side-shifting an upper load-contacting portion of the load support means toward truck 18 to transfer the load L to the vehicle load supports 20, 22.

CONSTRUCTIONAL DETAILS

Now with reference to FIGS. 9 and 11 showing the details of rear load-support means 16, the means for raising and lowering each load-support means 15, 16 includes a cylinder and link arrangement at each side of each support means. Each such arrangement includes an extensible fluid-powered cylinder 30 hinged by pin 31 to its associated base member 12. The cylinder is connected at its opposite, piston rod end to a pin 32 extending transversely through one of a pair of longitudinal stabilizing members 34, 35 extending between the two support means 15, 16. The stabilizing members are connected

at their opposite ends to a pair of cross members 36, one forming part of each load support means. A rigid link or leg 38 is also pivoted to base 12 by a pin 40 at a position spaced along the base from cylinder pin 31. An opposite yoke-shaped end portion 42 of leg 38 is connected by pin 32 to stabilizing member 34 and thus to one end of cross support member 36. The opposite end of cross support member 36 is connected in the same manner by a second pivoted leg 39 to the opposite base member 13.

Base members 12, 13 and stabilizing members 34, 35 are channel-shaped in cross section so that when lift cylinders 30 are retracted, the cylinders and connected legs nest within the channels. Stabilizing members 34, 35 are prevented from nesting within their respective base members to maintain the pivot pins 32 of cylinders 30 in an overcenter position when the cylinders are retracted, by limiting the spacing between pivot pins 31 and 40 to less than the total combined length of retracted cylinder 30 and its connected leg 38. This arrangement enables the extension of cylinder 30 to pivot leg 38 to an upright position as shown in phantom lines in FIG. 11, thereby also elevating stabilizing member 34 and cross member 36. Of course, all four lift cylinders 30, at the opposite sides of each load support, are operated in unison to elevate or lower both load supports together to maintain load L horizontal at all levels of adjustment of the supports. From FIG. 12 it will be evident that base members 12, 13 stabilizing members 34, 35 and the two pairs of legs 38, 39 at the opposite ends of the base members and cross connected by members 36 define a stable parallel linkage system which is extended or collapsed by simultaneous operation of the cylinders.

In addition to legs 38, 39 cross member 36 and stabilizing members 34, 35, each load-support means 16, 15 includes load storage and transfer bunk assemblies 44, 45, respectively. Each bunk assembly includes a stationary lower bunk portion 46 which serves as a track for a laterally shiftable upper bunk portion 48. Upper bunk portion, or shuttle 48 has a pair of normally upright load-containing stakes 50, 51 at its opposite ends. These stakes can be collapsed or removed when required, as when withdrawing the shuttle from beneath a load on the vehicle or when handling containerized loads.

As shown best in FIG. 11, lower bunk portion 46 is generally channel-shaped in cross section and includes laterally inwardly extending flange portions 53 overlying side ridges 54 on upper bunk portion 48. This enables the lower-bunk portion to support the upper-bunk portion when the upper-bunk portion is extended laterally toward the truck as shown in FIG. 6. Upper-bunk member 48 also has an end extension 48a beyond stake 51. The upper-bunk extension insures support of the upper bunk by the lower bunk when the former is in its fully extended position as shown in FIG. 7. Upper bunk 48 is supported on a series of spaced rollers 56 rotatably mounted within lower bunk 46 to prevent binding of the bunk portions during their relative movement.

Referring to FIG. 10, lower-bunk portion 46 carries on its opposite sides a pair of upwardly opening channel-shaped cylinder housings 58, 59. These housings mount the means for shifting upper bunk portion 48. Such means includes a pair of horizontal fluid-actuated cylinders, including a first extension cylinder 62 connected at 71 to one end of housing 58 for extending upper bunk 48 toward the left in FIG. 10 and a second, retraction cylinder 64 pivoted at 79 to the opposite end of housing 59 for returning the upper bunk to its centered position over base members 12, 13. A sheave 66 at the outer end of the piston rod of cylinder 62 receives a cable 68 dead ended at 69 to the cylinder casing. The cable is also trained about an idler sheave 70 near pivot connection 71 of cylinder 62 and is fixed at its opposite end 72 to the end of upper bunk 48 opposite sheave 70. With the describe cylinder and reeving arrangement, extension of cylinder 62 a given distance toward the right in FIG. 10 extends upper-bunk portion 48 to the left twice such distance. Full extension of cylinder 62 positions stake 51 at the left end of lower-bunk portion 46.

A sheave 74 is mounted at the outer end of the piston rod 75 of retraction cylinder 64. A cable 76 dead ended at 77 to the casing of cylinder 64 is trained about sheave 74 and about a second sheave 78 connected to housing 59 adjacent pivot connection 79 of cylinder 64. The opposite end of cable 76 is dead ended at 80 to the same end of the upper bunk 48 as cable 68. With this reeving arrangement and with the upper bunk 48 in its fully extended position as shown in FIG. 7, cylinder 64 is fully retracted. Thus extension of cylinder 64 under these conditions pulls upper-bunk portion 48 back to its storage position centered above base members 12 and 13 at a 2:1 ratio of bunk to cylinder movement.

Each bunk assembly 44, 45 includes means mounting the assembly on cross member 36 for horizontal pivoting movement about a pivot axis 82 as shown in FIG. 9 centered between opposed legs 38, 39. The pivotal-mounting means includes an upwardly open cylindrical socket member 84 formed as a central part of crossmember 36. Socket 84 receives a cylindrical downwardly projecting plug or fifth wheel portion 86 of lower-bunk portion 46 with just enough clearance to permit a limited lateral tilting movement of the bunk assembly when the load on the upper-bunk portion is off center with respect to axis 82. This feature facilitates transfer of loads from bunk to truck in a manner to be described. A kingpin-type fastener 88 connects pivot portion 86 of the lower-bunk assembly to socket portion 84 of crossmember 36 to permit pivoting movement of the entire bunk assembly about vertical axis 82 of the connection.

Support pads 90, 91 at the opposite ends of each longitudinal stabilizing member 34, 35 are adapted to contact and thereby lend support to lower-bunk portion 46 near its opposite ends. However, the upper surfaces of these pads may be spaced slightly below the undersurface of lower-bunk portion 46 when the latter is truly horizontal to permit the previously mentioned slight lateral tilting movement of the bunk assembly. If desired, pads 90, 91 may be made of a resilient material to help absorb the shock which would otherwise be transmitted to the posts and base members during the loading, unloading and transfer operations.

OPERATION

In operation, the storage and transfer apparatus is loaded, for example, with a load of logs L with the bunks in their lowered storage positions near ground level as shown in FIGS. 1 and 12. While loading the bunks, one set of the stakes, such as the stakes 51 at the right side of FIG. 1, can be removed or lowered to facilitate loading of the bunks from that side. For example, a bulldozer can be used for this purpose to push logs up an earth or other ramp onto the bunks from one side of the bunks. Then with the bunks full, stakes 51 are erected to help contain the load.

In the next step, the transfer bunks are elevated by the simultaneous extension of all four cylinders 30 to raise load L to its maximum height as determined by the length of support legs 38, 39, as shown in FIG. 2. This maximum height is above the level of the load supports 20, 22 of the log truck 18 to be loaded.

Then, as shown in FIG. 3, truck 18 is driven into position alongside the storage and transfer apparatus with its right-hand stakes 27 lowered and with the storage and transfer bunks actually extending over the right-hand side of the truck bunks 20, 22 as viewed in FIG. 3. However, as viewed in FIG. 4, it will be apparent that the truck is driven next to the transfer bunks so that the truck bunks 20 and 22 are offset longitudinally of the transfer bunks 44, 45.

With the truck and transfer bunks positioned as in FIGS. 3 and 4, the transfer bunks are lowered slightly by retracting cylinders 30 until the load-supporting surfaces of upper-bunk portions 48 of the transfer bunks are at the same level as or slightly below the load-supporting surfaces of truck bunks 20, 22, as shown in FIG. 5.

In the next step, as shown in FIG. 6, movable upper-bunk portions 48 of the transfer apparatus are shifted laterally toward the truck by extension of shuttle cylinders 62. As this shifting occurs, the load is progressively transferred from transfer bunks 48 onto truck bunks 20 and 22. This transfer is facilitated by the tendency of bunks 48 to tilt progressively downwardly as they extend laterally, as permitted by the pivotal mounting of the transfer bunk assembly.

In the fully extended positions of the upper transfer bunk portions 48, as shown in solid lines in FIG. 7, stakes 50, 51 of such bunks are positioned slightly inwardly of stakes 26 and 27 of the truck bunks. When the transfer bunks reach this position, the right-hand truck stakes 27 are raised and positioned for containing the load on the truck bunks. Then left-hand stakes 51 of the transfer bunks are lowered to their dashed-line positions as shown to permit withdrawal of transfer bunks 48 from beneath load L, which is now fully supported on the truck bunks and which is retained on such bunks during withdrawal of the transfer bunks by truck stakes 27.

When transfer bunks 48 are returned to their fully retracted positions by full extension of return cylinders 64, the loaded truck 18 is driven forward from alongside the transfer bunks as shown in FIG. 8. This can be done even though upright truck stakes 27 prevent full clearance between the truck and transfer bunks because of the pivotal mounting of the transfer bunks to their cross members 36. Thus as truck 18 moves forwardly in FIG. 8, transfer bunks 44 and 45 are contacted by truck stakes 27 and forced to swing in the clockwise direction shown, about their respective vertical pivot axes.

With the truck removed from alongside the transfer bunks, such bunks are lowered to their storage positions and returned to their normal transfer positions perpendicular to the longitudinal base members in readiness to receive another load.

A load can be transferred from a vehicle to the transfer bunk by reversing the procedure just described. To do this, first a truck is driven alongside the fully retracted but fully raised transfer bunk, with the left-hand stakes 50 of the transfer bunks in their lowered positions as shown in FIG. 7. Then the empty transfer bunks are shuttled sideways at a level slightly beneath the level of the truck bunks until the right-hand stakes 51 of the transfer bunks are in approximate longitudinal alignment with the upright truck stakes 27 as shown in FIG. 7. Then right-hand truck stakes 27 are lowered and left-hand transfer stakes 50 are raised. Also, if necessary, the level of transfer bunks 48 is raised slightly until they contact the underside of the load. Then the transfer bunks 48 are retracted laterally toward their supporting base structure and toward the right as shown in FIG. 6, thereby progressively transferring the load from the truck bunks to the transfer bunks.

Eventually the load and transfer bunks reach the position as shown in FIG. 5 with respect to the truck bunks. Thereafter the transfer bunks are elevated to the position shown in FIG. 3 to permit removal of the truck from alongside the transfer apparatus. Finally, the transfer bunks are lowered to their storage positions as shown in FIG. 1 for storage or removal of the load.

It is to be understood that the transfer bunks could be modified to enable the handling of containerized truckloads in addition to the loose loads shown. In handling containerized loads, the upright stakes of the transfer bunks could be omitted, as would be the corresponding truck stakes. However, it would be desirable to provide some sort of lateral limit-determining means or centering means, such as modified load-centering stakes of shortened length or a pin and socket arrangement on the container and various bunks for enabling centering of the load on a vehicle and on the transfer bunks.

The same principle of transfer as illustrated could be used in a modified bunk arrangement where a single transfer bunk platform would be substituted for the two separate transfer bunks 44, 45. In such case the transfer platform would be positioned between the spaced truck bunks. Conversely, if the truck had a single load-supporting platform instead of the

truck bunks shown, the pair of transfer bunks would be positioned longitudinally beyond the opposite ends of the truck platform.

Having shown and described an embodiment illustrative of the general principles of the invention, numerous modifications and equivalents in arrangement and detail will no doubt occur to persons skilled in the art. The illustrated embodiment is not intended as a limitation on the scope of the invention. It is intended to cover all modifications and equivalents embodying principles within the scope of the invention.

I claim:

1. Load storage and transfer apparatus comprising:

stationary ground-engaging base means having a longitudinal dimension,

beam or platform-type load support means for undergirding and supporting the full base width of a load on said base means,

first moving means including leg means pivotable from a generally horizontal longitudinal disposition to a generally vertical disposition connecting said load support means to said base means for raising and lowering said load support means between a low-level limit position and a high-level limit position,

second moving means on said load support means for shifting a movable upper load-contacting portion of said load support means laterally toward a load-receiving station alongside said base means,

said load-support means including means wholly supporting said movable load-contacting portion in all lateral positions of adjustment thereof.

2. Apparatus according to claim 1 including means mounting said upper load-contacting portion for limited lateral tilting movement in a vertical plane under the influence of a load thereon.

3. Apparatus according to claim 1 including means mounting said load support means for pivoting movement about an upright axis intermediate the laterally opposite ends of said load support means.

4. Apparatus according to claim 1 including means mounting said load support means in a manner permitting limited lateral tilting movement of said upper load-contacting portion and permitting horizontal pivoting movement of said load support means about an upright axis positioned within the lateral limits of said base means.

5. Apparatus according to claim 1 wherein said second moving means for shifting said upper load-contacting portion includes fluid-powered extensible cylinder means on said load support means.

6. Apparatus according to claim 5 wherein said cylinder means includes a pair of laterally extending fluid cylinders mounted on a lower portion of said support means and cable means interconnecting said cylinders and said upper load-contacting portion in a manner so that one said cylinder shifts said upper portion laterally away from said lower portion and the other said cylinder returns said upper portion laterally toward said lower portion.

7. Apparatus according to claim 1 wherein said first moving means includes generally horizontally disposed and longitudinally extending fluid-powered extensible cylinder means pivoted at one set of ends to said base means and pivoted at the other set of ends to said leg means in a manner so that extension of said cylinder means elevates said leg means and thus said load support means.

8. Apparatus according to claim 1 wherein said leg means are pivoted at one end to said base means for vertical pivoting movement longitudinally of said base means, extensible fluid cylinder means pivoted at one end to said base means at a position spaced longitudinally from the pivot connection of said leg means to said base means, means pivotally interconnecting the opposite free ends of said cylinder means and said leg means in a manner so that extension and retraction of said cylinder means pivots said leg means between a generally horizontal disposition and a generally upright position for raising and lowering said load support means.

9. Load storage and transfer apparatus for storing a vehicle-sized loose or containerized load at a low level and transferring said load to a vehicle bed at a higher level alongside said apparatus, said apparatus comprising:

- a retractable and extensible frame including a longitudinally extending base, at least four leg members pivoted at their lower ends to said base for movement between generally horizontal longitudinal retracted positions and generally vertical extended positions,
- first fluid power cylinder means pivoted at one end to said base and at an opposite end to the upper ends of said leg members for extending and retracting said leg members,
- a cross frame member interconnecting the upper ends of each laterally opposed pair of said leg members,
- a longitudinal frame member pivotally interconnecting the upper ends of each longitudinally opposed pair of said leg

members,
a load-supporting bunk member swivably connected to each said cross frame member,
each bunk member including a lower-bunk portion and an upper, load-engaging bunk portion mounted for generally horizontal extending and retracting movement longitudinally of said lower bunk portion,
power means carried by said lower-bunk portion for extending and retracting said upper-bunk portion.

10. Apparatus according to claim 9 wherein said upper-bunk portion is tiltable within limits under load when extended to facilitate transfer of a load therefrom.

11. Apparatus according to claim 9 wherein said upper-bunk portion includes end stakes for containing the sides of a loose load.

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