

Mixed Cargoes Barge or Carrier

Field of Invention

5 **[001]** The present invention relates to mixed cargoes barges or carriers and methods of transporting mixed cargoes or a different cargo during each separate trip.

Background

10 **[002]** Cargo barges or supply vessels are used to move goods, fuel, food, fresh water and other produce by water transport. Barges plying rivers also transport mineral ores and agricultural products from inland areas to towns or plants located down the rivers. As costs of berthing at the ports are increasing, plus long turn-around time for discharging these goods and commodities, more and more fleet owners are resorting to ship-to-ship transfer at the port anchoring area to save money and time.

15 **[003]** Services provided by conventional cargo barges are limited by their single- or dedicated-purpose usage. For example, bunkering barges are designed and built to carry fuel oil to mother vessels and most of the piping facilities are installed on the deck surface, making the entire deck surface unsuitable for carrying other types of cargoes. Similarly, conventional flat-top barges use the entire deck surfaces to carry bulk cargoes and the spaces below the deck become under-utilised. In another example, hopper barges used for ship-to-ship transfer normally go to the mother vessels empty and return with containers or goods; similarly, barges on the supply trips may be loaded but return emptied of goods. Such one-way empty trips also happen in river, coastal and sea transportation; for example, empty barges go upstream to carry mineral ores or agricultural produce to towns downstream, or tanker barges carry fuel upstream to mines and plantations but return to the towns empty.

25 **[004]** It can thus be seen that there exists a need for another type of cargoes barge or carrier to carry mixed cargoes or a different cargo during each separate trip, thereby maximising the efficient use of cargoes barges or carriers.

Summary

30 **[005]** The following presents a simplified summary to provide a basic understanding of the present invention. This summary is not an extensive overview of the invention, and is not

intended to identify key features of the present invention. Rather, it is to present some of the inventive concepts of this invention in a generalised form as a prelude to the detailed description that is to follow.

- 5 **[006]** The present invention seeks to provide a cargo barge or carrier which can carry mixed cargoes or a different cargo during each separate trip, so that capacity of the cargoes barge or carrier is substantially utilized during both supply and return trips. For example, a deck on the barge can be used to carry bulk cargoes and after delivery the part of the deck surface emptied of bulk cargoes can be used to transport shipping containers, IMO tanks,
10 bulk cargoes or general cargoes. At the same time, some fluid storage tanks located below the deck can be used to deliver fluid products, such as, portable water, fuel oils, liquids, flowable granules, and so on. The hull of the barge or carrier can also be used to transport bulk cargoes. With this mixed cargoes barge or carrier, one-way empty trips are substantially avoided and the carrying capacity of the mixed cargoes barge or carrier is
15 substantially optimised. Preferably, the load plates or trays or segmented load plates or trays are tilted inwardly in relation to a conveyor to allow the bulk cargoes to fall onto the conveyor for discharging; such load plate or tray tilting process is performed by means of hydraulic actuators, or hoists on pillars or overhead gantry and hoists, without the hydraulic actuators or hoists being subjected to full load of decanting the load plates or trays or
20 segmented load plates or trays. The load plates and the segmented load plates can be pivoted to end plates, and these allow various ways of folding up the load plates, segmented load plates and the end plates to create loading spaces on the deck or in the hull for bulk cargoes, general cargoes, shipping containers or IMO tanks.
- 25 **[007]** In one embodiment, the present invention provides a mixed cargoes barge or carrier comprising: a hull; a conveyor located along a longitudinal or a transverse axis of the hull; a load plate with an inner edge being located adjacent the conveyor, so that the load tray is controllably tiltable, and when tilted, bulk cargo loaded on the load plate is allowed to fall onto the conveyor for discharging.
- 30 **[008]** Preferably, the load plate is located on each of two sides of the conveyor. Preferably, the load plate is segmented in a direction along the conveyor or transverse to the conveyor, with adjacent segments being pivotable, so as to provide various ways of folding and stowing the segmented load trays, thus providing various loading spaces in the hull or on

the deck to transport mixed cargoes. The conveyor can be a V-belt conveyor or a screw conveyor.

5 [0009] The mixed cargoes barge further comprises container mounting rails for fixing inside the hull, on a deck of the hull or on the load tray, so that the mounting rails are operable to secure shipping containers or IMO tanks onto the load trays, segmented load trays, inside the hull or on the deck during transportation. Preferably, a space below the deck is configured to house storage tanks for storing fluid, liquid, flowable cargoes or ballasting water.

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[0010] In another embodiment, the present invention provides a method for transporting mixed cargoes on the above mixed cargoes barge or carrier, the method comprising: loading load trays or segmented load trays separately with bulk cargoes, shipping containers, IMO tanks or general cargoes; and at the same time, carrying fluid or flowable
15 cargoes in storage tanks located in a hull of the mixed cargoes barge or carrier, or on a deck of the hull; so that different types of cargoes and goods can be transported together, thereby substantially maximizing utility of the mixed cargoes barge or carrier.

[0011] Preferably, the load plate or the segmented load plate located on each side of the
20 conveyor are tiltable inwardly before bulk cargoes is loaded thereon. When the load plate or segmented load plate in horizontal orientation are loaded with bulk cargoes, tilting of the load plate or the segmented load plate is controllably operable by retracting hydraulic actuators located along an inner edge of the load plate or the segmented load plate. In another method, tilting of the load plate or the segmented load plate are mechanically
25 guided by pillars, with hoists on pillars or overhead gantry being operated to tilt the load plate or the segmented load plate, and locking pins are used to locate and secure the tilted load plate or tilted segmented load plate at the desired angle of inclination, prior to loading of the bulk cargoes. Where the load plate or a segmented load plate had been used for transporting shipping containers, IMO tanks, bulk cargoes or general cargoes, and when the
30 load space is emptied, the load space can then be used to transport other shipping containers, IMO tanks, bulk cargoes or general cargo.

[0012] In another embodiment, the present invention provides a method for transporting bulk cargoes comprising: a bulk cargo in a hull or in a compartment in the hull of the barge or carrier during a trip; and transporting another bulk cargo in the hull or in the
35 compartment in the hull after deploying segmented load plates to contain the another bulk

cargo in the hull or in the compartment during a subsequent trip, so as to minimize cross-contamination.

Brief Description of the Drawings

5 **[0013]** This invention will be described by way of non-limiting embodiments of the present invention, with reference to the accompanying drawings, in which:

[0014] FIG. 1 illustrates a plan view of a mixed cargoes barge according to an embodiment of the present invention;

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[0015] FIG. 2A illustrates a representative sectional view of the above mixed cargoes barge;

[0016] FIGs. 2B and 2C illustrate a method of operating the mixed cargoes barge to discharge bulk cargoes according to another embodiment; FIG. 2D illustrates a method of
15 discharging bulk cargoes; and FIG. 2E illustrates yet another method of discharging bulk cargoes;

[0017] FIG. 3 illustrates use of a conveyor to discharge bulk cargoes;

20 **[0018]** FIG. 4A illustrates a plan view of a mixed cargoes barge with compartmented load plates or trays according to another embodiment; and FIG. 4B illustrates a method of tilting the compartmented load plates or trays using hoists before loading bulk cargoes thereon;

[0019] FIG. 5 illustrates a plan view of a mixed cargoes barge with a swivel hopper and a
25 discharge conveyor;

[0020] FIGs. 6A-6D illustrate a mixed cargoes barge with pivoted load plates and end plates according to another embodiment;

30 **[0021]** FIGs. 7A-7D illustrate the mixed cargoes barge shown in FIGs. 6A-6D fitted with fenders;

[0022] FIG. 7E illustrates the mixed cargoes barge shown in FIGs. 7A-7D with the load plates and the end plates being pivoted to form a quadrangle loading space, whilst FIGs. 7F
35 and 7G illustrate the load plates and the end plates being pivoted to form a flat loading space;

[0023] FIGs. 8A-8B illustrate the mixed cargoes barge shown in FIG. 7A-7D with the load plates and the end plates being formed in three compartments; FIGs. 8C-8D illustrate the mixed cargoes barge shown in FIGs. 8A-8B with the load plates and the end plates being pivoted to form a quadrangle loading space;

[0024] FIGs. 9A-9E illustrate a mixed cargoes barge with the load plates being pivoted in two segments, thereby providing various ways of folding the segmented load plates to form loading spaces on the deck;

[0025] FIG. 10 illustrates a mixed cargoes barge with the load plates being pivoted, folded and stowed away along edges of the barge;

[0026] FIG. 11A illustrates a box with a pivoted cover being disposed over the conveyor; FIG. 11B illustrates a mixed cargoes barge with the conveyor and pivoted cover providing another way of arranging the above load plates according to another embodiment;

[0027] FIGs. 12A-12B illustrate a mixed cargoes barge with the load plates being pivoted in three segments, thereby providing other ways of forming loading spaces in the hull;

[0028] FIGs. 13A-13C illustrate a mixed cargoes barge or carrier equipped with overhead gantry rails and hoists for moving the segmented load plates to their stowing locations; and

[0029] FIG. 14A illustrates a Very Large Product Carrier (VLPC) configured for transporting mixed cargoes in different compartments, with each compartment employing the above load plates or segmented load plates; whilst FIGs. 14B-14C illustrate the segmented load plates are pivotable longitudinally or transversely.

Detailed Description

[0030] One or more specific and alternative embodiments of the present invention will now be described with reference to the attached drawings. It shall be apparent to one skilled in the art, however, that this invention may be practised without such specific details. Some of the details may not be described at length so as not to obscure the present invention. For ease of reference, common reference numerals or series of numerals will be used throughout the figures when referring to the same or similar features common to the figures.

[0031] FIG. 1 shows a simplified plan view of a mixed cargoes barge 100 according to an embodiment of the present invention. As schematically shown in FIG. 1, the mixed cargoes barge 100 has a hull 103, a deck 108, load trays 110, 110L, 110R, a hatch 104 and a piping skid 106, besides other barge equipment like mooring points (which are not shown in the figures). The deck 108 is more clearly seen in FIGs. 2B and 2C. The mixed cargoes barge 100 has a forward end or bow 101 and a stern 102 at the rear. Located along a longitudinal centre of the mixed cargoes barge is a conveyor 150 that is operable to transfer bulk cargoes BC (such as, ores, coals, sand and aggregates, granules, etc.) in a forward direction to the bow 101 and over the hull 103. Located on both sides of the conveyor 150 are the load trays or plates 110, 110L, 110R that are operable to be controllably tilted to decant bulk cargoes BC onto the conveyor 150. Discharging of the bulk cargoes BC onto the conveyor 150 is also regulated by intake valves 151 (which are more clearly seen in FIGs. 2A-2D) located above and along the conveyor 150. On the outside edges of the load trays or plates, there are fenders 111R, 111L. Preferably, the fenders 111R, 111L are rotationally indexable; as can be seen from FIG. 2D, by rotationally indexing the fenders 111R, 111L, the amount of bulk cargoes BC that can be carried on the mixed cargoes barge 100 can thus be increased.

[0032] Located on the load trays or plates 110, 110L, 110R are container mounting rails 114. The container mounting rails 114 are arranged in parallel pairs so that 20-foot shipping containers 132 and 40-foot shipping containers 134 can be located and secured onto the load trays or plates 110, 110L, 110R. Some mounting rails 114 have container mounting points for securing shipping containers 132, 134 on both sides of such mounting rails, which become shared mounting rails. In one embodiment, the shipping containers 132, 134 are oriented parallel to the length axis of the mixed cargoes barge 100. Preferably, the conveyor 150 is less than the width of the shipping containers 132, 134 so that these shipping containers can be located astride above the conveyor 150. In another embodiment (as seen in FIG. 4A), the shipping containers 132, 134 are oriented transverse to the length axis of the mixed cargoes barge 100. 20-foot or 40-foot IMO tanks configured with the 20-foot or 40-foot mountings and used to transport fluid cargoes can also be secured on the container rails 114. With the present invention, the load trays or plates 110, 110L, 110R can be used to transport both bulk cargoes BC, shipping containers 132, 134 and IMO tanks above the deck 108 whilst liquid or flowable bulk cargoes can be stored in containers 130 located below the deck 108.

[0033] As seen in FIGs. 2A and 2B, the load trays or plates 110,110L,110R are strengthened by structures 113 at the underside. For illustration, structural members 112 are located on the deck 108 for structural strength, but these structural members 112 are not shown in the other figures. These figures also show a gap between the load trays or plates 110L,110R which gap is operable to be closed by a pair of chutes 117L,117R with each chute being associated with the load tray or plate on each side of the conveyor 150. These chutes 117L,117R are extendable or rotatable and when they are in the closed position, the chutes 117L,117R help to protect the intake valves 151 from mechanical damage, for eg., during loading of the bulk cargo BC onto the mixed cargoes barge 100. Preferably, the chutes 117L,117R are formed in segments for easier installation, maintenance and repair. In use, the chutes 117L,117R are also operable to direct the bulk cargoes BC to fall onto the conveyor 150; the chutes 117L,117R are thus operable to minimise any bulk cargoes from spilling onto the deck 108.

[0034] Located below the deck 108 are fluid storage tanks 130. These fluid storage tanks 130 may be used to store liquid goods, such as, fresh water, fuel, bunkering oil, liquids, granular cargo, etc. To prevent cross-contamination, these fluid storage tanks 130 are dedicated for storing specific contents. The piping skid 106 is provided, for eg., below the deck 108, at the stern 102, and inside a hatch 104. From the piping skid 106, there are ports, flow valves and pipes to the associated storage tanks 130 so that contents of the fluid storage tanks 130 can be transferred in or out of the mixed cargoes barge 100.

[0035] FIGs. 2A-2C show a transverse sectional view of the mixed cargoes barge 100. As seen from FIGs. 1 and 2A-2C, each of the load trays or plates 110L,110R is pivoted at an inside edge along an axis parallel to the conveyor 150 and are actuated by hydraulic actuators 118 to tilt the load trays or plates 110L,110R inwardly, thereby to decant the bulk cargoes BC to fall into the conveyor 150. In one embodiment, the inside edge pivots are supported by members 116. Above the conveyor 150, the intake valves 151 control starting and stopping of the bulk cargoes flowing onto the conveyor 150. For eg., after starting the conveyor 150, the intake valves 151 are selectively opened to gradually control amounts of the bulk cargoes BC being moved onto the conveyor 150. Preferably, the intake valves 151 are selectively opened in series starting from the discharge end to prevent choking on the conveyor 150. As seen in the figures, the discharge end of the conveyor 150 has a portion that is inclined and discharges the bulk cargoes BC over the bow 101 or over the hull 103.

[0036] FIGs. 2B-2C show a method of discharging the bulk cargoes BC. In this embodiment, the inside edge support members 116 are configured as hydraulic actuators. Before loading of the bulk cargoes BC, both types of the hydraulic actuators 116 and 118 are extended, so that the load trays or plates 110L,110R are substantially horizontal; the bulk cargoes BC is then loaded onto the load trays or plates; after being loaded and the mixed cargoes barge 100 has reached a destination, the inside edge hydraulic actuators 116 are retracted and the load trays or plates 110L,110R become controllably tilted inwardly with respect to the conveyor 150 so that the bulk cargoes BC is allowed to fall onto the conveyor 150 and be moved to the bow 101 or over the hull 103 for discharge. It is possible that vibrators are attached onto the load trays or plates 110L,110R to help to loosen the bulk cargoes BC during discharging. It is also possible that the outer edge hydraulic actuators 118 be further extended in stroke to increase the angle of decant, as part of the bulk cargoes BC has already been discharged and lower forces are then required from the hydraulic actuators 118.

[0037] FIG. 2D shows another method of discharging the bulk cargoes BC. In this embodiment, the outer hydraulic actuators 118 are configured as telescopic actuators. In one embodiment, the inner edge support members 116 serve as pivots for the load trays or plates 110L,110R and extension of the telescopic actuators 118 tilt the load trays or plates 110L,110R inwardly with respect to the conveyor 150. The telescopic actuators 118 are extended (at least partially) and the load trays or plates are tilted inwardly to the conveyor 150 before the mixed cargoes barge 100 is loaded with bulk cargoes BC. After part of the bulk cargoes BC has been moved away by the conveyor 150, the telescopic actuators 118 may be further extended to decant the remaining bulk cargoes BC on the load trays or plates 110L,110R, as the force required from the telescopic actuators 118 are now reduced.

[0038] FIG. 2E shows a simplified plan view of a mixed cargoes barge 100a according to another embodiment and another method of discharging bulk cargoes. As seen from FIG. 2E, the mixed cargoes barge 100a also has load tray or plates 110L,110R located on each side of the conveyor 150; as like the above mixed cargoes barge 100, these load trays or plates 110L,110R are pivoted at the inner edge along an axis parallel to the conveyor 150. Pillars 120 are provided at lateral sides of the load trays or plates 110L,110R to mechanically guide their pivoting motion. Pillars 121 are also provided along the outer edges of the load trays or plates 110L,110R. Hoists are located on these pillars 120,121

(but are not shown in the figures) and are used to tilt the load trays or plates 110L,110R; the load trays or plates 110L,110R are tilted inwardly and are secured, for eg., with locking pins, to the pillars 120, 121 before bulk cargoes BC are loaded thereon.

5 [0039] FIG. 3 shows a longitudinal sectional view of the above mixed cargoes barge 100,100a. As described above, the conveyor 150 is located along a central length axis of the mixed cargoes barge 100,100a and is operable to convey the bulk cargoes BC to the bow 101 or over the hull 103. The discharge portion of the conveyor 150 is more clearly shown to be inclined so as to discharge the bulk cargoes BC over the bow 101 or the hull
10 103. A cockpit 107 for operating the conveyor 150, vibrators and any other barge equipment, may be located near the hatch 104 and the piping skid 106.

[0040] Depending on the length of the mixed cargoes barge 100,100a, each load tray or plate 110,110L,110R can be an integral member or each of the load trays or plates can be
15 formed in sections or compartments (as seen in FIG. 4A). With the sectional or compartmented load trays or plates embodiment, different types of bulk cargoes can be transported in different sections or compartments, and other sections or compartments can be used to transport shipping containers, IMO tanks, bulk cargoes or general cargoes, etc. When loading space in a section or compartment is emptied, for eg., after delivery of bulk
20 cargoes, the emptied space can be used to transport other shipping containers, IMO tanks, bulk cargoes or general cargoes.

[0041] FIGs. 4A-4B show a mixed cargoes barge 200 according to another embodiment. The mixed cargoes barge 200 is similar (using similar number series to refer to functionally
25 similar members) to the above mixed cargoes barge 100,100a except that the load trays or plates are now in sections 210a-210f and pillars 220 are erected from a deck 208 as structural guides. Some of the pillars are located between two sectional load trays or plates and these are identified in FIG. 4A as pillars 223. These pillars 220,223 are provided with hoists (manual or powered but are not shown in the figures) to tilt the associated load trays
30 or plates 210a-210f before bulk cargoes BC are loaded onto the mixed cargoes barge 200. Preferably, mechanical guides (such as, rollers or slide plates but are not shown in the figures) are provided on the pillars 220,223 to assist smooth motion of the load trays or plates 210a-210f on the associated pillars 220,223. Locking pins (also not shown in the figures) are provided to lock and secure the load trays or plates once the load trays/plates
35 210 are tilted to the desired angle of inclination prior to loading of bulk cargoes BC; after

the bulk cargoes BC has been discharged and the load trays/plates 210 are returned to their home positions (ie. substantially horizontal on the deck 208), these load trays/plates are again locked in position with the locking pins. By tilting the load trays/plates 210 and locking them prior to loading of the bulk cargoes BC, the hoists are only subjected to part
5 of the deadweight of the load trays/plates 210. When the load trays/plates 210 are in the home positions and are loaded with shipping containers 132,134, the loads are taken up by the load tray/plate structural members 113 and the deck structure 112.

[0042] The other differences of mixed cargoes barge 200 from the above are: a cockpit 207
10 in FIG. 4A is shown located near a bow 201 (instead of near a stern 202). Also in FIGs. 4A-4B, the container mounting rails 214 for securing shipping containers 132,134 are arranged parallel to the length axis of the mixed cargoes barge 200 so that the shipping containers 132,134 or IMO tanks are now transversely mounted on the mixed cargoes barge 200. As in the above embodiments, edge fenders 211L,211R are pivotable indexable
15 and pivotable or retractable chutes 217L,217R provide mechanical protection to intake valves 251.

[0043] FIG. 5 shows an arrangement of the mixed cargoes barge 200 where a conveyor 250 discharges bulk cargoes BC into a receiving hopper 259 and from the receiving hopper 259
20 the bulk cargoes are discharged via a discharge conveyor 258. As seen from FIG. 5, the discharge conveyor 258 is rotatable about the receiving hopper 259 so that discharging can be carried out laterally to left- or right-side or at any intermediate angle from the mixed cargoes barge 200.

[0044] FIGs. 6A-6D show a mixed cargoes barge 300 with the load plates 110L,110R being pivoted about pivots 360L,360R; these pivots 360L,360R are located along the intake valves 151 and the conveyor 150. These load plates 110L,110R form a V-shaped load space and are held in position by end plates 362L,362R,372L,372R,366,377, for eg., by
25 latches, which are not shown in the figures; the mechanisms for tilting the load plates 110L,110R, for eg. with hydraulic actuators 116,118 or guide pillars 120,121,223 and hoists are also not shown in these figures. Preferably, the load plates 110L,110R are also connected to the associated end plates 362L,362R,372L,372R by pivots. Preferably, the end plates 366,376 are also pivoted so that they can be folded to lay horizontally above the intake valves 151. As seen in FIG. 6D, the end plate 362L is shown pivoted and lay on the
30 associated load plate 110L; FIG. 6D also shows that the right-hand load plate 362R can

also be pivoted outwardly. As in the above embodiments, the V-shape volume formed by the load plates and the end plates can be used to store bulk cargoes (BC), and when the load plates and the end plates are folded up, a flat loading space may then be fitted with mounting rails 114 for securing containers 132,134, IMO tanks or general cargoes.

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[0045] FIGs. 7A-7D shows a mixed cargoes barge 300a according to a variation of the above mixed cargoes barge 300. The mixed cargoes barge 300a is different in that the load plates 110L,110R and the end plates 362L,362R,372L,372R have additional fenders 311L,311R,311a connected thereto by pivots 382L,382R,392L,392R, etc. so that the V-shaped loading space is enlarged. These fenders 311,311L,311R,311a can be folded up or folded to lay on the load plates 110, as seen in FIG. 7D, for eg., when not in use.

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[0046] FIGs. 7E and 7F show the mixed cargoes barge 300a with the load plates 110L,110R, the end plates 362L,362R,372L,372R and the fenders 311L,311R,311a, 383L,383R being folded to form a quadrangle loading space. In FIG. 7G, the load plates and the end plates are folded to form a flat loading space, which may then be fitted with the mounting rails 114 (not shown) to secure containers 132,134 or IMO tanks.

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[0047] FIG. 8B shows a mixed cargoes barge 300b according to another embodiment, whilst FIG. 8A shows a view from section AA. The mixed cargoes barge 300b is similar to the above barge 300,300a but the load plates 110L,110R and the end plates 362L,362R,372L,372R,366,376 are provided in sections or compartments, which are similarly shown in FIG. 4A. As seen in FIGs. 8A and 8B, the load plates 110L,110R are shown folded up above the intake valves 151 and the conveyor 150; the open space in the middle section or compartment can then be fitted with mounting rails 114 to secure containers 132,134 or IMO tanks or may be installed with addition fenders to store bulk cargoes or general cargoes.

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[0048] FIG. 8C shows the mixed cargoes barge 300b where the load plates 110L,110R, the end plates 362,272,366,376 and the fenders 311L,311R,311a are arranged to form a quadrangle load space, for eg. for bulk cargoes or general cargoes. As in the above embodiments, 100,200,300, the flat loading space can then be fitted with mounting rails 114 for securing containers 132,134 or IMO tanks; the fenders 311L,311R can also be folded up or temporarily removed to provide a flat loading space.

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[0049] FIGs. 9A-9E show a mixed cargoes barge 300c according to another embodiment. FIGs. 9A-9B show the intake valves 151 and the conveyor 150 are mounted on the deck surface 108, whilst FIGs. 9C-9D show the conveyor 150 is mounted below the deck surface 108. As seen in the figures, the load plates 110L,110R are formed with two pivoted segments 110a,110b; these allow the segmented load plates 110a,110b to be arranged to provide a V-shaped or flat loading space. These segmented load plates 110a,110b and the fenders 311L,311R can be folded above the conveyor 150 (for eg., in two ways as seen in FIGs. 9C-9E) to provide flat loading spaces on the deck surface 108, as shown in FIGs. 9C-9D. Likewise, the mounting rails can be mounted on the deck surface 108 to secure shipping containers or IMO tanks.

[0050] FIG. 10 shows a mixed cargoes barge 300d according to another embodiment. Barge 300d is similar to the barge 300c but the segmented load plates 110a,110b and the fenders 311L,311R are folded and stored in stowing areas 395L,395R located along outer edges of the deck surface 108. FIG. 10 also shows the segmented load plates and the fenders are foldable in two different ways.

[0051] FIG. 11A shows a box with a pivot cover 156 being provided to cover the conveyor 150. The box is made with two side plates 155, and the pivot cover 156 is joined to one of the side plates. A rotary actuator 157 is provided to rotate the pivot cover 156. This embodiment allows the conveyor 150 to be sealed off and the loading spacing can carry liquid bulk cargoes or granular cargoes; a pumping system may then be used to discharge such liquid or granular cargoes. Another way of using the above mixed cargoes barge 100,200,300 is shown in FIG. 11B. When the conveyor 150 or a section of the conveyor 150 is not in use, the pivot cover 156 closes off the conveyor 150; without using the conveyor 150, other method of discharging the bulk cargoes may be used, for eg. using clam-shell grabs. This embodiment provides more ways of using the above mixed cargoes barge 100,200,300. As seen from FIG. 11B, the above load plates 110L,110R, segmented load plates 110a,110b and the fenders 311a-311c, etc. are configured on the mixed cargoes barge 100,200,300 for transporting cargoes in separate compartments or loading spaces. Also seen from FIG. 11B, structural members 160 are provided below the load plates or segmented load plates to give support; rotary actuators 390 are operable for folding and unfolding of the segmented load plates 110a,110b, etc. about the pivot lines; and flexible seals 391 are provided to prevent leakage of flowable or granular bulk cargoes. The structural members 160 can be pivoted and can be folded to allow more compact stowing

away of the load plates; another advantage is that when the structural members 160 are moved away with the load plates, the structural members 160 would not interfere with use of clam-shell grabs or mobile movers to move the bulk cargo stored inside the hull 103; this is also true for structural members 161 shown in FIGs. 13A-13C. The structural members 160,161 are redundant if the load plates are segmented, as is shown in FIG. 9B. The above chutes 117L,117R can also be deployed when there is a need to guide discharging of bulk cargoes onto the conveyor 150. It is also possible that impermeable cover sheets or bags (not shown in the figures), such as those made of plastics, vinyl, etc., are disposed on surfaces of the load plates or the segmented load plates in one or more of the compartments of the mixed cargoes barge 100,200,300 to carry liquid cargoes.

[0052] FIGs.12A-12B show a mixed cargoes barge 400 according to another embodiment. As in the above embodiments, 100,200,300, the intake valves 151 and the conveyor 150 are located along the longitudinal centre of the barge 400. The load plates are formed in three pivoted segments 110a,110b,110c with the fenders 311L,311R. A cover 492 is provided over the fenders 311L,311R so that the load space inside the barge 400 is protected from external weather conditions and is thus suitable to carry some types of bulk cargoes or general cargoes. FIG. 11B shows that the load plates 110a,110b,110c can be folded up and the load space can be fitted with mounting rails to secure containers 132,134 or IMO tanks for transportation; in addition, some of the load space can be used to carry general cargoes, for eg. in load space 493 or 494.

[0053] FIGs. 13A-13C show a mixed cargoes barge or carrier 400a according to another embodiment. As seen in these figures, overhead gantry rails 496 and hoists 497 are configured across the loading space in the mixed cargoes barge or carrier 400a, preferably below the cover 492. With the overhead gantry rails 496, the hoists 497 can be moved above the loading spaces; by attaching cables 498 from the hoists 497, the segmented load plates 110a-110f can be folded into or unfolded from the stowing areas 395L,395R. The rotary actuators 390 are operable to cooperate with operation of the hoists 497 in manual, semi-manual or automated modes. FIGs. 13B-13C show the segmented load plates 110a,110b,etc. are in various stages of being folded or unfolded, or tilted to discharge the bulk cargoes. The load plates 110,110a,110b, etc. can be washed each time different cargoes are to be transported; this helps to avoid or minimize any cross-contamination of the cargoes. The stowing areas 395L,395R need not be fixed and they can be repositioned, for eg. according to shipping or operational safety needs.

[0054] With the overhead gantry hoists 497, when the conveyor 150 is not in use, at least temporarily, it is possible to move and store the conveyor 150, in another stowing location, to free up a loading space in the hull 103 for other cargoes. In another way of transporting bulk cargoes, it is possible that the conveyor 150 and segmented load plates 110a-110f are moved into the stowing areas, and the loading space in the hull is used to transport one type of bulk cargo during a trip and then the segmented load plates 110a-110f are deployed to transport another type of bulk cargo during a subsequent trip; with flexible seals 391 deployed to prevent leakages along the pivot lines of the segmented load plates 110a-110f, the bulk cargoes can be a liquid, a flowable, granules or ore. It is also possible to deploy an impermeable sheet or bag on the load plates before filling the loading space with a liquid or flowable cargo. In this way, cross-contamination due to different types of cargoes is minimized and this would comply with shipping regulations. Depending on the nature of the bulk cargoes, different bulk cargoes can also be transported in separate compartments in the barge or carrier.

[0055] FIG. 14A shows a VLPC (Very Large Product Carrier) 500 that is configured to carry mixed cargoes. As seen in FIG. 14A, a loading area of the VLPC is divided by partition members 515 into compartments 505, so that each compartment can transport different types of cargoes. In each compartment, the load plates 110,110L,110R can be an integral piece or segmented 110a,110b, etc. Pivot lines 590 of these segmented load plates 110a,110b, etc. may be aligned longitudinally or transversely, as shown in FIGs. 14B-14C. The above rotary actuators 390 to fold or unfold the segmented load plates are not shown in the figures. In FIG. 14A, two conveyors 150,150a are shown, with one aligned transversely. It is also possible that external clam-shell grabs are used to unload some of the bulk cargoes, besides using the conveyors 150,150a,250. Some compartments may be used to transport liquid or granular cargoes and a pump system is employ for discharging such liquid or granular cargoes.

[0056] With the mixed cargoes barges 100,100a,200,300,400,500 of the present invention, cargoes of different nature and forms can be transported during a trip or a different cargo can be transported during each subsequent trip. For example, after delivery of bulk cargoes BC or bulk cargoes BC on a segmented load tray 110,110L,110R,110a,110b-110f,210, the load trays 110,110L,110R,110a-110f,210 can be cleaned up and shipping containers 132,134 or IMO tanks can be mounted on the container mounting rails 114,214 and then be

transported in a following trip, together with general cargoes thus substantially maximizing utility of the mixed cargoes barge 100, 200, 300, 400, 500. At the same time, fluid cargoes or flowable cargoes (including grains or granular products) can also be transported in the fluid storage tanks 130, 230 located below the deck 108, 208 or in IMO tanks secured on the deck 5 108, 208, on the load plates 110, 110L, 110R, 110a-110f or in the hull 103.

[0057] While specific embodiments have been described and illustrated, it is understood that many changes, modifications, variations and combinations thereof could be made to the present invention without departing from the scope of the present invention. For 10 example, the container mounting rails 114, 214 can be orientated substantially parallel or transverse to the length axis of the mixed cargoes barge or carrier. The conveyor 150, 250 is described to carry the bulk cargoes BC to the bow 101, 201 for discharging; it is possible that the conveyor is arranged to discharge bulk cargoes at the stern or board side. Also, the conveyor can also be screw conveyor or V-belt type. Depending on design of the mixed 15 cargoes barge or carrier, it is possible that some of the fluid storage tanks are used for ballasting. When the above barge or carrier is configured to transport a liquid cargo, baffle plates are moved and lowered (at least partially into the liquid surface using the overhead gantry hoists) so as to prevent surging of the liquid to provide rolling stability control. The above barge or carrier can be newly built; it is possible that above the load plates, 20 segmented load plates, end plates are retrofitted into an existing barge or carrier, or a compartment of such existing barge or carrier.