

PATENT SPECIFICATION

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(54) IMPROVEMENTS IN OR RELATING TO A SLEWING ACCESS RAMP FOR VEHICLES

- (71) We, MACGREGOR INTERNATIONAL S.A., a Body Corporate organized under the laws of Switzerland, of St. Jakobsstrasse 9, 4002 Basel, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- 10 The present invention relates generally and is essentially directed to a movable device forming an access ramp or like gangway, or bridge means adapted to provide a communication between on the one
- 15 hand a vehicle in particular of marine character such as for instance a ship, boat or like floating vessel and on the other hand an outside loading or unloading area or platform such as a quay, pier, wharf, bank, shore or beach or even another
- 20 vehicle as well as the various systems, arrangements, assemblies, appliances, equipments, plant and installations provided with such devices or apparatus.
- 25 There are already known especially in naval or marine applications, transport or cargo ships of the roll on-roll off kind for conveying for instance wheeled vehicles and in particular automotive or motor
- 30 vehicles or various goods and products. In the case of automotive vehicles, the shipping and unshipping thereof is effected by their own self-contained or independent propulsion or drive means by their moving onto a movable access ramp interconnecting the ship (and more specifically the loading deck or flooring thereof) and the quay or the like. In the case of general cargo, such a ramp is also used directly
- 40 by automotive handling carriages, trucks or like carts or wheeled cargo-handling gears running on said ramp in a shuttle-like manner enabling them to have direct access to the ship and to come back to the quay for loading or shipping and un-
- loading or unshipping goods and like cargoes. For this purpose the ship is provided at least at one end thereof, i.e. generally aft or astern or possibly also at the bow with at least one large-sized ramp of the kind pivotally connected with its inboard end (or forward end when located aft) to the ship for swinging motion in parallel relation to a relatively vertical plane so that it may be swung upwards, i.e. lifted or raised to an upstanding position in a stowed or lashed condition on board ship during the sea trip of the latter and downwards i.e. lowered into an operative working position, to bear onto the quay with its opposite, i.e. outboard (or outside or rear) end. As the ship is generally moored or secured along the quay berth in parallel relation thereto, said ramp, when it is located astern, i.e. at the rear end of the ship, is generally positioned slantwise in its lowered working condition with respect to the longitudinal central vertical plane of the ship so that the longitudinal direction of the ramp is at an angle of about 45° with respect to the longitudinal direction of the ship. Such a ramp thus enables various kinds of wheeled vehicles to be taken aboard the ship for instance from quays which are not otherwise suited for such a use.
- This ramp known from the prior art exhibits the serious disadvantage of being placed in dissymmetrical relation to the longitudinal vertical central plane of the ship served by the ramp, so that the ship is required to come alongside always with the same ship side in view of the stationary attitude or orientation of the ramp in its working position or operative state.
- One main object of the invention is therefore to remove the aforementioned drawback inherent with the prior known state of the art by providing a selectively orientable, for instance swivelling or slew-

ing ramp enabling access of the ship to the quay whatever the relative angular position of the ship with respect to the quay, i.e. irrespective of the attitude of the ship.

5 According to the present invention there is provided an access ramp for a vehicle, which is arranged for attachment to a vehicle so as to be rotatable in relation to the vehicle both in the vertical sense
10 and in the horizontal sense, the rotation in the vertical sense enabling the ramp in use, to be moved between an upright, stowed position and a lowered, operative position in which it provides access to
15 the vehicle, the rotation in the horizontal sense enabling the orientation of the ramp in relation to the vehicle to be varied to suit different dispositions of the vehicle in relation to a loading/offloading area.

20 Preferably the ramp comprises means for variable connection with said vehicle so that it may be angularly positioned or oriented in parallel relation to a horizontal plane, for instance swivelled or slewed
25 about at least one relatively vertical axis of rotation, so that in the lowered state or downward swung condition, the relative angular position of its longitudinal direction be selectively adjustable with respect
30 to said vehicle.

According to a preferred feature of the invention said ramp is pivotally connected with its inboard or innermost end to at least one carriage, trolley or like slide-
35 rest moveable along a guiding track or runway provided on the vehicle along a substantially planar curved path of travel, preferably at least partially and approximately in the shape of an arc of circum-
40 ference.

Such an arrangement according to the invention exhibits the significant advantage of enabling an arbitrary orientation of the ramp into at least three different
45 relative angular positions in particular in the case of a ramp mounted on a ship at the rearward end or stern thereof with said guiding track or runway located symmetrically with respect to the longitudinal
50 vertical central plane of the vessel. In such a case the ramp may thus be arranged either to extend substantially along the longitudinal axis of the ship in outwards aligned extended registering relationship
55 therewith or in a slant position to starboard or in a slant position to port, the ramp making in each slant position for example an angle of about 40° with the longitudinal direction of the vessel. This
60 multiple-orientation capability of the ramp minimises the restrictions imposed by known ramp-means by making the use of the ramp substantially independent of the effective angular mooring position of the
65 ship or more generally of the attitude of

the ship to be served, in relation to the quay.

In the aforesaid embodiment the ramp is pivotally connected with its inboard or innermost end for swinging motion about
70 a substantially horizontal axis of rotation, to a carriage, truck or like trolley which is guided on both sides thereof and movable on and in a substantially horizontal
75 runway or like trackway in the shape of an arc of circumference concentric with the theoretical vertical geometrical axis of swivelling or slewing motion of the ramp, and recessed, sunk or embedded
80 into the ship's deck at the stern thereof. Such an arrangement may sometimes be somewhat inconvenient in view of the presence of a surface feature, discontinuity, irregularity or the like due to the
85 provision of the runway for the carriage in the ship's deck. Another embodiment of the invention minimises or eliminates such a drawback by providing a system for relative angular orientation of the
90 longitudinal vertical central plane of the ramp, thereby restoring the advantage of a substantially flat top surface of the deck without any surface irregularity, discontinuity or the like. For this purpose and
95 according to a further characterizing feature of the invention, said ramp includes means enabling it to swivel or slew alternately and separately about at least one
100 substantially vertical axis and preferably two relative vertical axes of rotation each having a stationary position, through at least two transversely spaced points of
its inboard end which are for instance adjacent to the extreme opposite corners of
105 said inboard end, said points forming points of pivotal connection of said ramp with the ship, and each one of said points may be releasably locked or held against
110 motion at one associated vertical axis of rotation whereas the other point of pivotal connection is freely displaceable about the former in concentric relation thereto, the relative horizontal axis of rotation of
said ramp extending through said points of pivotal connection.

115 According to still further characterizing feature of the invention, said ramp is connected removably, with both of said two points of pivotal connection, which are provided with two pivotal connecting members having a common horizontal axis of
120 pivotal connection, respectively, to two rotary pivots forming corresponding hinge supports or holders having their own vertical axes of rotation which are rotatably
125 fitted at a stationary location on said vehicle or ship, each one of the two points of pivotal connection being alternately displaceable separately, when disconnected from its corresponding pivot, in the hori-
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zontal plane of said common axis of pivotal connection, along a substantially circular arcuate path of travel about the other point of pivotal connection kept in stationary position wherein it is coupled to its associated pivot, so as to selectively enable the slewing of said ramp on the one hand with said other point of pivotal connection thereof about the vertical axis of rotation of the corresponding pivot and on the other hand about said common horizontal axis of pivotal connection of the two pivotal connecting members.

As known per se, the ramp may consist of three successive ramp sections pivotally interconnected in the longitudinal direction so as to make the ramp foldable or collapsible, with the intermediate ramp section being foldable back or swingable downwards against and along the innermost or inboard end ramp section, which is secured and suspended on both sides towards or adjacent to its outer or outboard end from a pair of handling wire ropes, respectively, reeved over loose guide pulleys or like idle sheaves pivotally connected to the tops of a pair of king posts or like masts of the ship, these wire ropes being taken up or wound up on a pair of winches, respectively. The outermost or outboard end ramp section serves as a supporting pad for bearing engagement with or resting on the quay. A ramp of such a kind is disclosed in co-pending British Patent Application 30829/73 (Serial No 1441464) based on the French Patent Application No: 72 23 373 filed on June 28, 1972 and first certificate of addition No: 73 19 511 filed on May 29 1973, and comprises at least one operating wire rope for controlling the relative upward swinging motion of the intermediate ramp section into an extended position at least approximately in aligned registering relation to the innermost end ramp section in the lowered working position thereof. This operating wire rope for relative extensions of said intermediate ramp section is connected through at least one guide pulley or sheave to the top of each aforesaid king post or mast so as to provide a stationary fastening point for said wire rope with a view to produce a tractive reaction force effective to achieve said relative extension of said intermediate ramp section during the gravity-operated downward swinging motion of the innermost end ramp section under the action of its own weight, which innermost ramp section is constantly suspended from its aforesaid handling wire rope. This device, as proposed in the aforesaid British Patent Application, exhibits the inconvenience that the longitudinal central relative vertical plane of the ramp has a stationary

angular position with respect to the longitudinal vertical central plane of the vehicle or vessel, so that it is not orientable at will in parallel relation to a horizontal plane. Another main object of the present invention is to adapt in combined relationship the ramp of the kind defined by said patent application to the slewing or swivelling ramp arrangement which is orientable about a vertical pivot axis, in accordance with the present invention.

The invention will be better understood and further objects, characterizing features, details and advantages thereof will appear more clearly as the following explanatory description proceeds with reference to the diagrammatic accompanying drawings given by way of non-limiting examples only illustrating variously presently preferred specific forms of embodiment of the invention and wherein:

— Figure 1 shows a fragmentary perspective view of the rearmost end portion of a ship moored slantwise near a quay and fitted with a ramp according to the invention placed in the lowered working condition in a central position in extension of the longitudinal axis of the ship and resting in bearing engagement on the quay;

— Figure 2 is a fragmentary view seen from the starboard side aft of the ship with the ramp in said working position;

— Figure 3 is a fragmentary top view of the rearmost end portion of the ship assumed to be moored alongside the quay in parallel relation thereto with the ramp arranged in slant working position to starboard, this Figure also showing the two other possible relative angular positions of the ramp;

— Figure 4 is an end view from astern as seen in the direction of the arrow IV of Figure 3, of the ship with the ramp in a slant working position to starboard;

— Figure 5 is a fragmentary view, drawn at a larger scale and in cross-section taken along the broken line V-V of Figure 6, showing the carriage or trolley for pivotal connection of the ramp to the ship, together with its guide rails mounted on the ship;

— Figure 6 is a fragmentary top view, looking in the direction of the arrow VI of Figure 5, showing the stern of the vessel with the ramp in the central lowered working position pivotally connected to its trolley movable on concentric curved guide rails;

— Figure 7 is a fragmentary view, similar to Figure 5, showing an alternative embodiment with an automotive trolley or truck;

— Figure 8 is a perspective view similar to Figure 1 and showing a modifica-

tion of the arrangement comprising a turn-table or the like;

— Figure 9 is a partial top view, with parts broken away, of the circled detail IX of Figure 8;

— Figure 10 shows a further embodiment according to a fragmentary top view of the innermost end portion of the ramp in the lowered working position thereof, mounted on the poop or stern of a vessel and provided with a system for varying the relative angular horizontal orientation by alternately slewing separately about either of a pair of separate vertical axes of rotation;

— Figure 11 shows, at an enlarged scale, an axial vertical section through a vertical pivot with combined hinged connection for swivelling in parallel relation to a horizontal plane, for each point of pivotal connection between the ramp and the ship;

— Figure 12 is a top view of an alternative embodiment of the system shown in Figure 10, showing a modification of the operating means controlling the slewing motion;

— Figure 13 is a top view, drawn at a smaller scale, of a foldable and pivotally connected ramp consisting of three ramp sections, in the extended and lowered working position thereof, pivotally connected to the ship through a pair of trucks movable within a circular arcuate runway provided on the vessel for allowing to selectively vary the relative horizontal angular orientation of the ramp;

— Figure 14 is a side view of the ramp of the previous Figure in its inoperative, folded and upward swung stowed position in a lashed condition on the ship;

— Figure 15 is an enlarged view from aft, i.e. as seen from the left-hand end of the vessel in the direction of the horizontal arrow XV in Figure 14, the illustration of the ramp having been omitted to show the structure located behind, i.e. before the ramp;

— Figure 16 is a fragmentary side view, drawn at a larger scale with parts broken away, of the adjacent mutually pivotally interconnected ends of the innermost end and intermediate ramp sections, respectively, showing in particular the buttressing device for locking the pivotal connection in a selectively adjustable manner;

— Figure 17 shows, at a larger scale, a separate top view of a carriage or trolley forming a wheeled bogie or truck and hinge support for the ramp;

— Figure 18 is a cross-section taken upon the line XVIII-XVIII of Figure 17, of a wheel-carrying axle of said truck;

— Figure 19 is a cross-section taken upon the line XIX-XIX of Figure 17, along the vertical axis of a horizontal roller

for lateral guiding of said truck;

— Figure 20 is a section taken upon the line XX-XX of Figure 17, showing a lug or leg portion of a clevis or yoke forming a bracket-like holder for the pivotal connection bearing of the ramp on the truck;

— Figure 21 is a fragmentary enlarged sectional view taken upon the line XXI-XXI of Figure 22 and showing the uppermost portion forming the top jib of the king post or like derrick mast from which the ramp is hanging and which is located to port side, said view showing a guide pulley for the operating wire rope controlling the relative extension of the intermediate ramp section and a swivelling stationary pulley block or tackle block for the ramp handling wire rope, the swivelling pulley associated with said stationary pulley block having been omitted;

— Figure 22 is a rear front or end view as seen from the left-hand side of said port side king post or derrick mast looking in the direction of the horizontal arrow XXII in Figure 21, said stationary pulley block having been omitted;

— FIGURE 23 is a fragmentary top view of the king post or derrick mast shown in Figure 22, illustrating the port side guide pulley for the operating cable controlling the relative extension of said intermediate ramp section;

— Figure 24 is a partial view in section taken upon the line XXIV-XXIV of Figure 22 and showing a swivelling guide pulley for the handling wire rope;

— Figure 25 is a top view of the device of Figure 24; and

— Figure 26 is a partial view in cross-section taken upon the line XXVI-XXVI of Figure 22 and showing the feather or lug for pivotal connection of said stationary pulley block to its vertical pivot.

According to the exemplary embodiment shown in Figures 1 to 4, a ship, denoted generally by the reference numeral 1 and of which the stern or poop only is shown, is moored near or adjacent to a quay 2 for example in slantwise orientation, so that the longitudinal direction of the ship is at an angle with the direction of the edge of the quay. The rear portion or stern of the ship is fitted with a movable access ramp 3 consisting of three successive ramp sections, namely an inboard or foremost ramp section 3a, a central or intermediate ramp section 3b and a rear-most or outboard section 3c, which are pivotally connected to each other in the longitudinal direction in substantially aligned or mutually registering extension of each other through pivot hinges or the like at 4, 4', respectively. The outermost or outboard ramp section 3c desirably ex-

hibits the shape of a bearing pad or like ground-engaging plate serving to support the ramp on the quay 2. The innermost end ramp section 3a is desirably made wider towards its innermost or inboard end with which it is pivotally connected at 5 to the vessel 1. This kind of construction exhibits the advantage of allowing a maximum compensation for the difference in level between the loading deck or flooring 6 of the ship and quays 2 of various heights or for a difference in level of the sea surface in view of the tides. The ramp sections 3a and 3b are desirably provided with guide railings or like protective devices 7 along their opposite longitudinal edges or sides.

With reference to Figures 5 and 6 which show the system for movably connecting the ramp section 3a to the ship, this connecting system comprises a wheeled truck or trolley 8 including a frame 9 with a horizontal contour substantially in the shape of a segment of a circular annulus or like ring preferably substantially symmetrical with respect to the longitudinal centre line 10 of the ramp 3. This frame 9 carries for example at its upper portion at least one and preferably two clevis or like yokes 11 to which the ramp section 3a is pivotally connected at 5 by means of lugs or tongs 12 respectively fast with corresponding side frame members or the like of the ramp section 3a about substantially horizontal coaxial pivot axes extending at right angles to the longitudinal centre line 10 of the ramp. The frame 9 of the carriage 8 is mounted on carrying wheels or rollers 13 having substantially horizontal axes and located on either side of the frame for riding on or rolling in a curved guide track desirably consisting of a pair of guide rails in the shape of radially spaced concentric arcs of circumference 14 arranged astern of the ship 1 preferably in symmetrical relation to the longitudinal vertical centre plane 15 of the vessel while extending desirably over the major part of the locally available width of the ship at the rear portion thereof. Each rail consists for example of a sectional structural beam or girder with an I-shaped cross-sectional contour and the rollers 13 are adapted to run on the top surface of the inner bottom or lower flange of the associated sectional beam, the axle of each roller being directed in a radial direction, i.e. in a normal direction with respect to the track or runway. The frame of the carriage 9 is also provided on either side thereof with lateral guide rollers 16 having respective substantially vertical axes of rotation and engaging through rolling contact the inner vertical wall, respectively, of the web of each associated guide rail 14.

The truck 8 and its guideway 14 are desirably located lower down than or below the level of the deck or flooring 6 of the vessel served by the ramp 3, and for instance within a pit forming a step or like lower landing 17 or within a like recess in the ship's deck. The height of the carriage 8 is such that the top runway or carriage-way of the ramp 3 or at least the inner adjacent end of said ramp is substantially at the same level as the deck 6 of the vessel or aligned therewith. For providing surface continuity between the ramp 3 and the deck 6, at least one and preferably a plurality of transversely juxtaposed flaps or like hinged leaves 18 are pivotally connected separately at 19 to the adjacent inner end of the ramp section 3a, so that they may be folded back individually against said ramp or swung downwards onto the flooring or deck 6 of the vehicle, thereby to cover and span the pit 17 containing the trolley 8 and its guide track 14 while allowing vehicles to cross same or pass thereover.

Owing to the aforesaid extension of the guide rails 14, the trolley 8 is thus displaceable substantially from one side of the ship to the other while being guided through engagement on either side keeping the rollers 13 retained or entrapped between the overlying flanges of the guide rails.

To allow the handling operation of the ramp, the latter is secured on both sides at at least two intermediate points thereof, respectively, to at least two handling wire ropes or chains 21 taken or wound up on two winches 22, respectively, mounted on the ship as known per se. Each wire rope 21 is thus desirably reeved over a guide pulley 23 pivotally connected to an overhead or elevated structure of the ship or vehicle, such as for instance a derrick mast, king post or like standard or upright 24 fast with the ship, so that each pulley 23 may swivel about a substantially vertical axis, both pulleys 23 and therefore both derrick masts or king posts 24 being preferably located symmetrically with respect to the vertical medial or centre plane of the guide track 14. In a manner known per se, the stationary fastening points 20 of the handling wire ropes 21 are desirably secured adjacent to the outer end of the innermost ramp section 3a. This innermost ramp section 3a thus remains constantly suspended from the handling wire ropes 21 at least in its lowered working position and possibly also in most of its intermediate positions between its extreme lowered and raised positions, respectively. The swivelling pulleys 23 are desirably located towards the top of their respective supporting derrick masts or king posts 24 whereas the winches

22 are located at the bottoms or feet of these king posts.

Locking means are provided for holding the ramp 3 against motion in each or any
 5 relative angular position in the lowered and/or upwards lifted condition. For this purpose the truck 8 may be locked in any relative position on its guide rails 14 for instance through a locking arrangement
 10 with a stop bolt or like locking pin insertable through a corresponding hole 25 of the frame of the truck 9 into a stationary opening provided in a structure rigidly connected to the ship, such as for example
 15 the top or upper flange of a rail 14. To stop the ramp 3 in its vertically raised position 3A shown in dash-dotted lines on Figures 2 and 4, in which raised position the ramp 3 is in registering relation to the
 20 longitudinal centre line of the ship 1, there is provided at least one and preferably two suitable stop, rest or abutment means 26 rigidly connected for example to the superstructures 27 of the vessel 1 as well as at
 25 least one and preferably two locking members 28 which are for example mechanically, hydraulically, pneumatically or electrically operated possibly in an automatic manner and adapted to retain the ramp in
 30 the upwards lifted position, said locking members being located on the ramp and in particular on the section 3a thereof or on the ship. Moreover there are provided at least one and preferably two servo-
 35 motors or like actuators 29 for instance of the linear displacement ram type mounted together for instance on either side on the innermost end of the intermediate ramp sections 3b at the pivotal connection
 40 4 thereof and likely to be actuated to cause a limited relative rotation of one or each one of the two adjacent ramp sections about their pivotal connection 4 in the direction of lifting said pivotal connection, i.e. in the direction of moving
 45 both ramp sections 3a, 3b towards each other with their bottom faces.

Finally the ramp 3 is fitted with self-acting control means for keeping the hand-
 50 ling wire ropes 21 taut or stretched with a substantially constant tension in the lowered working position of the ramp, the power-operated winches 22 being preferably adapted to react to said control means
 55 which consist for instance of at least one and preferably two sensor members 30 (Figure 2) secured to the intermediate ramp section 3b towards the outer end portion thereof, for instance on either side
 60 of and underneath same, so that they may bear upon the quay 2 to detect any variation in the relative position between the ship or vehicle 1 and said quay and to act accordingly on the winches 22 for opera-
 65 ting the same in the proper direction of

rotation.

As shown in Figure 3, the ramp 3 may selectively assume in its lowered working condition at least three relative angular positions, namely a central position shown
 70 in dash-dotted lines at 3' in Figure 3 and in solid lines in Figure 1, wherein it is substantially registering with the longitudinal centre line of the ship in extension back-
 75 wards thereof and two lateral or slant positions, that is a starboard position shown at 3 in solid lines in Figure 3 and a port side position shown in chain-dotted lines at 3'' in Figure 3 which make each
 80 one for example an angle of about 40° between the respective longitudinal centre lines 10 and 15 of the ramp and ship in horizontal projection, respectively. The operation of the ramp is the following
 85 when assuming that it is initially in its central raised position 3a wherein its longitudinal centre line is located within the longitudinal vertical central plane of the ship. For lowering the ramp which is initially
 90 locked in abutting relationship at 28 against its stop means or buffers 26, the locking members 28 are caused to be unlocked either manually or through remote control and both power-operated winches
 95 22 are actuated together, i.e. synchronously in the proper direction of rotation to swing the ramp downwards until it is tilted at about 20° above the horizontal plane. In this sloping intermediate position, it is possible to change the relative angular position
 100 of the ramp with respect to the longitudinal centre line 15 of the ship by drawing or exerting a pull with the proper winch 22 on that handling wire rope which is located towards the side in the direction
 105 of which it is desired to slew the ramp while simultaneously paying out or slackening away the other wire rope or unwinding same by means of its associated winch 22. This dissymmetrical or unbalanced tractive force moves the truck 8 on its guide rails in the desired direction until the selected slant angular position is reached. The truck 8 is then locked in position by
 110 means of a lock bolt or like stop pin inserted through the aperture 25 of the truck for making it fast with the ship. The horizontal slewing motion of the ramp, i.e. the displacement of the carriage or trolley 8, could as well be possibly obtained by
 115 means of at least one motor or motor-speed reducer set 31 (Fig. 7) for self-contained propulsion, mounted on the truck 8 and driving at least some of the rollers 13 or actuating a system for driving
 120 through a gear 32 mounted on the frame 9 of the truck and meshing with a rack 33 with teeth having preferably vertical generating lines, which rack is mounted on the rails 14 (Figure 7).
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The rolling motion of the ramp is then continued through the simultaneous operation of the winches 23 until it rests with its outermost end bearing section 3c on the quay 2. In this position, the intermediate ramp section 3b bears with its opposite ends of the one hand on the outermost ramp section 3c through the medium of the pivotal connection 4' and on the other hand on the innermost ramp section 3a through the medium of the pivotal connection 4, the innermost end ramp section 3a resting on the one hand with its innermost end on its pivotal connection 5 and being on the other hand suspended at 20 by the handling wire ropes 21. In case of need a buttressing effect in the ramp may be achieved by operating the actuators 29 the cylinders of which are for example mounted on the ramp section 3a so that they exert with their respective piston rods a thrust or pushing force onto the intermediate ramp section 3b in order to slightly lift the pivotal connection 4 upwards and thereby to break slightly the angle between these two ramp sections.

To raise the ramp 3 to its inoperative upstanding stowed position 3A, it is merely required to carry out the aforesaid operative steps in their reverse order of succession, the upward swinging or raising motion being effected with the ramp returned to its central position, i.e. wherein it is in registering relation to the longitudinal centre line of the ship.

According to an alternative form of embodiment and when the ramp 3 in its fully extended or unfolded position exhibits a relatively large length hence assuming an excessive height in its upward swung upstanding position, it is possible to provide for the use of suitable devices or arrangements in order to fold the intermediate ramp section 3b for example downwards against the innermost end ramp section 3a so that the inner or bottom faces of both ramp sections are in mutually confronting relationship, i.e. opposite to or facing each other.

According to another alternative form of embodiment shown in Figures 8 and 9, the ramp may be pivotally connected to a substantially horizontal rotary turn-table 34 carrying the king posts or derrick masts 24 and the winches 22. This turn-table is operatively rotated in a reversible manner for instance through at least one prime mover or drive motor-speed reducing gear set 35 carried by the turn-table 34 and meshing with a stationary curved rack 36 with teeth having preferably substantially vertically extending generating lines and which is concentric to the turn-table. The respective positions of the motor-speed reducing gear set 35 and rack 36 could of

course be reversed, i.e. the rack could be carried by the turn-table and the motor-speed reducing gear set could be stationary.

According to the exemplary embodiment shown in Figure 10 illustrating the poop or stern of a vessel 101 to one deck 102 of which the inboard end 103 of the ramp 104 is attached, the latter is able to slew separately and alternately about two relative vertical swivel axes 105, 106, respectively, the positions of which may be alternately assumed by the transversely opposite corners of the innermost end 103 of the ramp 104, respectively, to be held there against rotation at the respective positions of these vertical swivel axes. These two vertical axes of rotation 105, 106 are desirably located substantially symmetrically with respect to the vertical longitudinal centre plane 107 of the ship. As shown in detail in Figure 11, each aforementioned corner of the innermost end 103 of the ramp 104, forming a point of pivotal connection thereof with the ship, carries a roller 108, 108' rotatably mounted in a fork or clevis 109 rigidly connected to the ramp 104 and having its horizontal axis of rotation 110 extending substantially at right angles to the vertical longitudinal centre plane 111 of the ramp 104, both rollers 108, 108' of the ramp being coaxially aligned along the geometrical axis 110 forming the common geometrical horizontal axis of rotation of the ramp. The roller 108 is displaceable on through rolling engagement with an associated runway 112 leading from the neighbourhood of the corresponding vertical axis of rotation 105 and extending rearwards in the shape of an arc of circumference concentric with the other vertical axis of rotation 106. Likewise the other roller 108' of the ramp is displaceable on through rolling engagement with an associated runway 112' starting from the neighborhood of the corresponding vertical axis of rotation 106 and extending rearwards in the shape of an arc of circumference concentric with said vertical axis of rotation 105. Both of these runways 112, 112' are provided on or within the deck 102 of the ship and are desirably symmetrical with respect to the vertical longitudinal centre plane 107 of the ship. The curvilinear length of each runway 112, 112' corresponds substantially to the maximum angular amplitude of travel of the ramp during its rotary motion about either of these two vertical axes of rotation 105, 106, respectively. Each vertical axis of rotation 105, 106 is embodied by a pivot 113, 114 forming a pivotal connection or hinge support for the ramp. As shown in Figure 11, each pivot 113, 114 for hinged connection consists desirably of a clevis, yoke or fork 115 for pivotal con-

nection of substantially U-shaped configuration, i.e. with upstanding parallel legs, which is integral with a depending shank or stem 116 rotatably mounted about its vertical longitudinal axis 105, 106 within a thrust bearing 117 forming a shaft-step rigidly secured to the ship 101 and for example embedded or sunk into the deck 102 thereof. The pivot 113, 114 is thus comparable with a hood or heel of a mast-crane, lifting or hoisting derrick or like rigging sheers. The shaft-step 117 consists of a body portion 118 enclosing a guide cage 119 for the pivot shank 116. This guide cage contains at its bottom portion a bearing disk or plate 120 with a top surface preferably shaped as a convex spherical dome on which is resting the terminal preferably spherically rounded convex surface at the bottom end of the pivot shank or stem 116. The bottom surface 121 of the yoke 115 is substantially flat and on a level or flush with the runway 112 or 112' corresponding to this pivot so as to be able to receive or accommodate the associated roller 108 or 108' which may rollingly move into said yoke 115 between both legs thereof while being supported on the bottom 121 thereof when the ramp has to swivel about the desired vertical axis of rotation 105 or 106.

Locking means are desirably provided for selectively connecting each roller 108 or 108' rigidly with its associated hinged connection pivot 113 or 114. These locking means are desirably provided on the yoke 115 of each pivot 113, 114. For this purpose, the axle 122, with which each roller 108, 108' is rotatably mounted in the associated fork or clevis 109 of the ramp, consists desirably of a tubular sleeve or bush-like hollow shaft open at both its opposite ends and said locking means consists of a removable stop-bolt or like locking pin 123 horizontally insertable in substantially coaxial relation to the common pivot axis 110 through said hollow shaft 122 while extending through a pair of coaxially opposite and horizontally registering or aligned holes 124 formed through both legs of the yoke 115. Upon its lowering and raising motion, the ramp 104 is then rotating about the stop bolt 123 forming a pivot axis for the ramp at the pivot-carrying yoke 115 involved. Each stop bolt or like locking pin 123 is desirably actuated for being retracted and extended by a reversible servo-motor such as a fluid pressure for example hydraulically operated actuator of the double-acting linear displacement type 125 carried by said yoke for example in coaxial relation to the lock bolt 123 which is then operatively connected to the piston rod of the cylinder 125 of said ram-type actuator.

To every relative angular working position of the ramp 104 about any one of the two vertical swivel axes 105, 106 corresponds a means for selectively locking or holding said ramp against motion in said position. Each such locking means (not shown) consists preferably of a roller-retaining yoke substantially similar to the pivot yoke 115 and associated with the corresponding runway 112, 112', respectively, i.e. the runway which is in concentric relation to the vertical axis of rotation involved at that point of said runway which corresponds to the instant position of the roller 108 or 108' resting on that runway. This retaining yoke is provided with preferably controlled or operated locking means such as a stop bolt or like locking pin similar to the bolt 123 and actuated by a pressure fluid operated actuator mounted on said retaining yoke to rigidly connect the roller involved with said retaining yoke.

Means (not shown) are also provided for selectively holding each aforesaid hinged connection pivot 113, 114 against motion when it does not support the corresponding roller 108 or 108' of the ramp so as to selectively keep the pivotal connection yoke 15 of the pivot involved angularly oriented so that the opening of the yoke is in substantially aligned or registering extension of the associated runway 112 or 112' or merges into same.

The slewing motion of the ramp 104 about one of the two vertical swivel axes 105 or 106 is desirably operated by at least one reversible servo-motor desirably consisting of a pressure fluid for example hydraulically operated actuator of the double-acting linear displacement type 126 having a substantially horizontally longitudinal centre line and pivotally connected with one end, in particular with the bottom or back end of its cylinder, to a stationary vertical pin 127 of the vessel and with the other end consisting in this instance of its piston rod to an intermediate and in particular middle point 128 of the innermost end 103 of the ramp 104 as shown in Figure 10. In the case of a single drive actuator 126, its stationary pivot point 127 is preferably located in the vertical longitudinal centre plane 107 of the ship. It should be pointed out that Figure 10 illustrates the ramp 104 in its position of maximum angular deviation about its vertical swivel axis 105. The operation of this system is then the following when assuming initially the ramp 104 located substantially in a position in extension of the ship, i.e. in aligned registering relation thereto so that the vertical longitudinal centre plane 111 of the ramp registers with the vertical longitudinal centre plane 107 of the ship. In

such a position both rollers 108, 108' are respectively engaged into the yokes 115 of the respective pivots 113, 114 and are locked therein by the corresponding lock bolts 123 inserted through the respective rollers by their associated drive actuators 125. In such a position, the lock bolts 123 and the geometrical centre line 110 are coaxially aligned along the line 129 extending at right angles to the vertical longitudinal centre plane 107 of the ship. In this initial configuration, each one of the two pivots 113, 114 is furthermore held against rotation by its associated locking means so that its pivot yoke 115 has its opening (between the legs) substantially aligned in registering relationship with the adjacent end of the corresponding runway 112, 112'. If it is then desired to slew the ramp 104 horizontally about the vertical swivel axis 105, the roller 108' of the ramp should be unlocked or released by causing the corresponding lock bolt 123 to be retracted through the action of the associated actuator 125 while holding the pivot 114 against motion in its angular position by its associated locking means. The other roller 108 of the ramp is left locked within its hinged connection yoke 115 of the associated pivot 113 and this pivot 113 is unlocked or released so as to be free to rotate about its vertical swivel axis 105. The control actuator 126, which in the initial or starting configuration was in its maximum retracted position in substantially coaxial relation to the longitudinal centre line 107 of the ship in Figure 10, is then operated to be extended or moved out so as to push or drive the ramp 104 horizontally backwards in the direction of the stern of the ship thereby causing the slewing motion of the ramp about the vertical axis of rotation 105. During this slewing motion, the roller 108' leaves the hinged connection yoke 115 of pivot 114 and rides freely on its associated runway 112'. When the ramp has reached the desired relative angular orientation, the operation of the actuator 126 is discontinued and the ramp 104 is held against motion in its instant relative angular position by locking the roller 108' through the local locking means associated with its instant position on its runway 112' whereas the pivot 113 is also held against motion in its instant angular position about the vertical swivel axis 105 by said locking means associated with this pivot. Thus it is seen that said locking means individually associated with each one of the pivots 113, 114, respectively, enables each pivot to be held against motion in any arbitrarily selected or predetermined relative angular position about its vertical axis of rotation 105 or 106. The successive operative steps just des-

cribed are to be carried out for causing the slewing motion of the ramp 104 about its vertical swivel axis 105 in the counter-clockwise direction with respect to Figure 10. It is obvious that a horizontal slewing motion of the ramp 104 in the reverse or clockwise direction is achieved by performing the aforesaid operating steps in their reverse order of succession with respect to that described. Likewise to achieve the horizontal slewing motion of the ramp 104 about the other vertical swivel axis 106, it is merely necessary to perform symmetrical operating steps with respect to those just described for the vertical swivel axis 105.

Figure 12 is similar to Figure 10 but shows an alternative embodiment of the drive means for rotating the ramp 104 about either of the vertical pivot axes 105, 106. In this modification, the single central drive servo-motor or actuator 126 controlling the slewing motion of the ramp 104 is replaced by a pair of reversible side-wise located servo-motors 130, 131 consisting desirably each one of a pressure fluid for example hydraulically operated actuator of the double-acting linear displacement type one end of which, such as the bottom or back end of the actuator cylinder is pivotally connected at 132, 133 to the stationary structure of the ship so as to be able to rotate about a vertical axis whereas the opposite end, i.e. in this instance the piston rod is pivotally connected at 134, 135 to a radial lever or crank arm 136, 137 rigidly connected to an associated pivot 113, 114 so as to be able to rotate same in either direction about its vertical swivel axes 105, 106. Thus an individual servo-motor is associated with each pivot 113, 114, respectively, and mounted in such a manner that its motion or displacement be kinematically consistent with that of the pivot to which it is connected. It is obvious that the operation of these two actuators 130, 131 is carried out in such a manner that, when one in a neutral condition and vice-versa. Each of them is active or operating, the other one is out of service or inoperative, i.e. one of the individual servo-motors 126 or 130, 131 may on the other hand serve as a means for holding the ramp 104 against motion in any relative angular position thereof about either one of the two vertical swivel axes 105, 106.

It is moreover of course necessary when causing the ramp 104 to slew horizontally by means of one or several individual drive servo-motors such as 126 or 130, 131 to operate at the same time the winches for the handling wire ropes of the ramp concurrently in a co-ordinated or synchronized manner so as to wind or take up

gradually (as the ramp 104 is horizontally slewing) the handling wire rope located towards the vertical swivel axis 105, 106 presently serving as a pivot for the ramp during the increasing angular deviation of the latter with respect to the longitudinal central direction 107 of the ship and at the same time to pay out or unwind the handling wire rope located on the opposite side, i.e. towards the other vertical swivel axis and vice-versa.

Instead of using one or several independent individual servo-motors such as 126 or 130, 131 to control the horizontal slewing motion of the ramp 104 about either of the vertical swivel axes 105, 106, it is also possible to use for this purpose the winches operating the handling wire ropes of the ramp according to the method set forth in the present invention which consists in winding or taking up the handling wire rope located on the side towards which it is desired to rotate the ramp 104 horizontally and paying out or unwinding at the same time the other handling wire rope which is attached on the opposite side to the ramp thereby effecting a so-called luffing operation by means of which the ramp is caused to slew in the desired direction through the tractive force exerted by one of the handling wire ropes during winding up, the slewing motion in the reverse direction being caused by a luffing operation in the opposite sense.

Figures 13 to 15 of the drawings illustrate the application of the principle of horizontal slewing of the ramp according to the present invention to the ramp of the kind described and shown in the aforesaid co-pending British Patent Application No. 30829/73 Serial No. 1441464 based on French patent application No. 72 23 373 filed on June 28, 1972 and its first certificate of addition No. 73 19 511 filed on May 29, 1973. The disclosure of this kind of ramp and the explanation of its operation for effecting its motions in parallel relation to a relative vertical plane having been given in full in the specification of said British patent application they will not be repeated integrally in the present specification since it suffices for the description of the details to refer back to said British patent application.

The ramp 104 according to Figures 13 and 14 consists of three successive ramp sections, namely an innermost end section 138, an intermediate section 139 and an outermost end section 140 pivotally connected to each other in mutual extension of or registering relation to each other about relative horizontal axes of rotation, that is the axis 141 between the innermost end and intermediate ramp sections 138, 139, respectively, and the axis 142 between

the intermediate and outermost end ramp sections 139, 140, respectively. The inboard end 103 of the innermost end ramp section 138 is pivotally connected with its two transversely opposite end sides about an axis of rotation 110 of a pair of wheeled carriages, trucks, bogies or trolleys 143 of which only one, namely the carriage located to port side, is shown in Figure 13. These trucks support the inboard end 103 of the ramp 104 and connect the latter to the vessel. These two trucks 143 ride together on and within a guiding runway 144 provided in the lower deck 102 of the ship at the stern thereof. This runway has the shape of a horizontal at least approximately semi-circular arc of circumference which is substantially symmetrical with respect to the relative vertical longitudinal centre plane 107 of the ship.

The lower deck 102 of the ship gives access to a hold 145 or a like closed space forming an enclosure to be loaded through a rear port opening 146 (see Figure 14) which may be selectively closed by a fluid-tight transverse port door 147 hingedly connected with its top end by a transverse horizontal pintle or like pivot pin 148 to the upper frame structure of the opening 146. This door 147 is operable by means of a pair of servo-motors such as pressure fluid for example hydraulically operated actuators 149 to be raised by being swung upwards into a substantially horizontal upper opening position or to be lowered by being swung downwards into an approximately upstanding closing position (shown in Figure 14). For this purpose, each one of the two actuators 149 mounted in parallel and operating synchronously is pivotally connected with one end to the stationary structure of the ship and with the opposite end to the door 147 while being located adjacent to the pivot pintle or hinge axis 148 of the door.

The pivot axis 141 between the innermost end and intermediate ramp sections 138, 139, respectively, is provided towards the underside or bottom face of these ramp sections so as to facilitate the folding back of the intermediate ramp section 139 by being swung downwards with its underside or bottom face applied against the corresponding underside or bottom face of the innermost end ramp section 138 in the upward raised and folded position of the ramp 104 as shown in Figure 14. The outermost end ramp section 140 serves as a bearing pad or like ground-engaging plate for resting on an outer platform or area such as a quay 150 (see Figure 13), a pier, a wharf, a bank, a shore or beach or even the top surface or deck of another ship or like vehicle placed alongside the vessel 101. The outermost end ramp section 140 is ex-

tended or projects inwards, i.e. beyond its axis 142 of pivotal connection with the intermediate ramp section 139 and towards the latter with a heel or like tail portion 5 desirably connected to the corresponding adjacent end portion of the intermediate ramp section 139 for example by means of a pair of parallel mounted hydraulic actuators 151 operating synchronously and adapted to selectively adjust the relative angular position of the outermost end ramp section 140 with a view to locating it properly with respect to the surface of the quay 150. The underside or bottom face 15 of the innermost end ramp section 138 is desirably provided with damping or shock-absorbing means 152 forming resilient buffers or like stop, rest or abutment means for the outermost end ramp section 20 140 when it is caused to bear against the innermost end ramp section 138 in the collapsed and raised configuration of the ramp (see Figure 14). The outer or free end of the outermost end ramp section 140 25 is provided with a transverse row of small juxtaposed pivoting flap elements 153 adapted to swing about their horizontal axis 154 of pivotal connection with the ramp section 140 and to form a trackway 30 for continuous gradual interconnection between the ramp 104 and the quay 150. Likewise a transverse row of similar pivoting juxtaposed connecting flap elements 155, which are however of larger size, is pivotally connected at 156 to the inboard end of the innermost end ramp section 138 so as to rest in sliding engagement onto the top surface of the deck 102 to form a continuous passageway for the 40 vehicles to be shipped or unshipped between the ramp 104 and the deck surface.

The intermediate ramp section 139 comprises a pair of rigid projecting arm-like booms or outriggers 157, 157' laterally 45 located on either side, respectively, and extending in substantially parallel relation to the longitudinal direction of the ramp section 139 beyond and above the pivotal connection 141 thereof with the innermost end ramp section 138. As shown in Figure 50 16, a buttressing device for the pivotal connection 141 is provided on the adjacent ends of the adjacent ramp sections 138, 139 and this buttressing device has been 55 fully described and shown in said British Patent Application No. 30829/73 (Serial No. 1441464). This buttressing device is adapted to selectively lock the pivotal connection 141 against motion in both relative directions of rotation thereof by thus 60 rigidly interconnecting both ramp sections 138, 139 so as to make them equivalent to a single stiff or rigid continuous beam. In the buttressed position, the ramp sections 65 138, 139 may make therebetween any fixed

angle adjustable at will. The buttressing device comprises, on the outer end of each side frame member of the innermost end ramp section 138, a hydraulic double-acting buttressing or pushing actuator 158 70 pivotally connected with its cylinder bottom or back end to the side frame member through a transverse horizontal pintle 159 whereas its piston rod carries a push or thrust head with a pair of horizontal opposite transversely aligned sidewise projecting pins 160 guided each one by a curvilinear guide slot 161 formed in a stationary structure of the associated side frame member and adapted to engage, in abutting relationship, in the outward extended position of the piston rod, a pair of corresponding transversely aligned abutment pads 162 rigidly connected to the inner adjacent end of the relevant or registering adjacent side frame member of the intermediate or adjacent ramp section 139. A pair of parallel swinging locking arms 163 is rotatably mounted on a transverse horizontal shaft 164 carried by each side frame member of the intermediate ramp section 139 and rotatable by a double-acting hydraulic actuator 165 pivotally connected with one end to the side frame member involved of the ramp section 139 and with the opposite end to the locking members 163. The locking arms 163 are adapted to be brought through swinging motion in engagement with the thrust pins 160 of the push head of the actuator 158 when these thrust pins are abutting against the abutment pads or like thrust plates 162 in order to make these thrust pins 160 rigidly fast with the abutment pads 162 thereby preventing the thrust pins from leaving, being disengaged or moving away from the pads. 95 100 105

The lower deck 102 is topped for example with a superstructure or like erection consisting of a pair of overlying intermediate decks 166 and 167, respectively, and of an upper deck 168 on which are erected both king posts or like derrick masts 169, 169' in symmetrical relation to the longitudinal vertical centre plane 107 of the ship and from which is suspended the outer end of the innermost end ramp section 138 by both side frame members thereof. Each king post is desirably built or set with its base into the upper platform deck 168. The 126 lower intermediate deck 166 comprises towards the stern, a pair of horizontal overhanging stages or galleries 170 arranged in substantially symmetrical relation to the longitudinal vertical centre plane 107 of the ship and carrying a pair of pressure fluid for example hydraulically operated pushing actuators 171 directed backwards or aft in parallel horizontal relationship and pivotally connected with their forward 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215 220 225 230 235 240 245 250 255 260 265 270 275 280 285 290 295 300 305 310 315 320 325 330 335 340 345 350 355 360 365 370 375 380 385 390 395 400 405 410 415 420 425 430 435 440 445 450 455 460 465 470 475 480 485 490 495 500 505 510 515 520 525 530 535 540 545 550 555 560 565 570 575 580 585 590 595 600 605 610 615 620 625 630 635 640 645 650 655 660 665 670 675 680 685 690 695 700 705 710 715 720 725 730 735 740 745 750 755 760 765 770 775 780 785 790 795 800 805 810 815 820 825 830 835 840 845 850 855 860 865 870 875 880 885 890 895 900 905 910 915 920 925 930 935 940 945 950 955 960 965 970 975 980 985 990 995

ends to the stationary deck structure. These two pushing actuators located at the same level are placed substantially in front of both side frame members, respectively, of the innermost end ramp section 138 in the raised or upstanding position thereof to freely bear against these side frame members, respectively, with the forward ends 172 of these pushing actuators 171. The overhanging stage portion 170 of the intermediate deck 166 also carries a pair of lashing or locking appliances 173 adapted to be extended rearwards in parallel horizontal relationship through the innermost end ramp section 138 in the raised upstanding position thereof for catching or gripping hold with their rear ends 174 of the intermediate ramp section 139 in its position folded back and downwards against the innermost end ramp section 138 for keeping the former firmly in abutment against the latter.

The upper platform deck also carries a pair of keeper or retaining devices 175 similar to the appliances 173 and arranged like the latter for catching or gripping hold of the innermost end ramp section 138 in the raised upright position thereof so as to keep same firmly applied in abutting relationship against corresponding stop or buffer means 175a fast with the deck structure 167. These various devices co-operate with the ramp 104 in its upward lifted and folded or collapsed configuration when it assumes such a relative angular position that the longitudinal vertical centre plane 111 of the ramp registers with the longitudinal vertical centre plane 107 of the vessel.

Figures 17 to 20 show a wheeled truck or carriage forming a running trolley or bogie 143 of the ramp and details or parts thereof, respectively. Each truck comprises a frame 176 of box-like structure having an arcuate horizontal contour in the longitudinal direction to conform to the curvature of the guiding runway 144 containing the trucks. This frame 176 is mounted on a pair of wheel-carrying axles 177 mounted each one for example rigidly and non-rotatably in transverse relationship within the frame 176 and locked therewith for example by a pair of vertical keeper pins or like stop bolts 178 formed each one with an inner duct or bore providing lubricating means for the wheel train. As the curvature of the frame 176 corresponds substantially to that of the runway 144, the axles 177 are directed radially, respectively, so that their longitudinal centre lines meet or intersect with their theoretical extensions at the centre of curvature of the track 144 when the truck is mounted thereon. On each one of the opposite ends of each axle 177 is

rotatably mounted a travelling wheel or like runner 179 revolving freely or loosely about an antifriction collar, bushing or sleeve 180 mounted on the corresponding end of the axle 177 involved (see Figure 18). At each one of the opposite longitudinal ends of the truck or carriage 143 is mounted a horizontal wheel for lateral guiding 181 adapted to rotate freely or loosely on a vertical axle 182 carried between two horizontal overlying cantilever flanges or jaws 183 forming a supporting bracket or clevis, each wheel 181 being preferably loosely mounted on a bushing or sleeve made from anti-friction material 184 fitted on the vertical axle 182 (see Figure 19). As shown in Figures 17 and 20, the top face of the frame of carriage 176 is provided with a pair of transversely spaced parallel lugs 185 directed slantwise with respect to the arcuate longitudinal centre line 186 of the carriage and forming a clevis for pivotal connection for the corresponding lateral end 186 of the innermost end ramp section 138 (see Figures 13 and 14). Both lugs 185 are formed with two coaxially aligned through-holes 187 adapted to receive or accommodate the mounting of a swivel bearing or like tilting or self-aligning bearing, not shown, for pivotal connection. It is obvious that each truck may comprise more than two axles provided with carrying travelling wheels or runners and the ramp 104 may be connected to more than two carriages or trucks such as 143.

The carrying travelling wheels or runners 179 of each truck 143 rest through rolling engagement onto the lower horizontal surface forming the bottom of the runway 144 whereas the horizontal wheels for lateral guiding 181 are in rolling contact with a pair of mutually opposed or confronting parallel vertical curved walls, respectively.

Referring again to Figures 13 to 15, it is seen that a pair of preferably hydraulic powered handling winches 188, 188' are mounted on the back overhanging stage of the upper platform deck 167 substantially at the feet of the respective king posts 169, 169' while being somewhat offset transversely towards the longitudinal vertical centre plane 107 of the ship with respect to both king posts 169, 169' to take into account the available space within the ship. Due to this transverse offset, each winch is mounted on a base or pedestal transversely sloping downwards and outwards so that the central transverse plane of the corresponding winch drum be at least approximately aligned with the top of the associated king post. The innermost end ramp section 138 is suspended from two handling wire ropes 189, 189'

taken or wound up on the two winches 188, 188', respectively, each king post 169, 169' terminates at its upper end into a substantially rearwards directed top jib or like projecting arm 190, 190'. Each king post 169, 169' carries a guide pulley or sheath 191, 191' for the handling wire rope 189, 189' extending from the associated winch 188, 188'. As better shown in Figures 12, 13, 15 and 16, each guide pulley 191, 191' is pivotally mounted with its shell or strap 192 on a shaft 193 for pivotal connection with the associated king post 169, 169'. The lengthwise direction of each pivot shaft 193 is preferably substantially at right angles both to the axis of rotation 194 of the guide pulley 191, 191' and to the axis of rotation of the drum of the associated winch 188, 188'. The geometrical pivot axis of the pivot shaft 193 is preferably substantially tangential at least to the associated guide pulley 191, 191' at a point 195 (see Figure 24) of tangential engagement (with the innermost rope seating in the swallow of the grooved sheave) of the lead-in run of the handling wire rope 189, 189' extending from the drum of the associated winch 188, 188' and coaxial at least with the adjacent portion of this wire rope run. Figures 15 and 22 show that the plane, extending through the swivel axis of the pivot shaft 193 at right angles to the axis of rotation 194 of each guide pulley 191, 191' is sloping with respect to the vertical direction along an angle of tilt corresponding substantially to the angle of rake (with respect to a horizontal plane) of the axis of rotation of the drum of the corresponding winch 188, 188', so as to be at right angles to the axis of rotation of said drum and to always contain the run of the handling wire rope 189, 189' leading from said drum. To keep the centre line of that portion of this run of handling wire rope, which is adjacent to the guide pulley 191, 191', in substantially aligned registering relation to the geometrical centre line of the pivot shaft 193 of the associated guide pulley, this run of wire rope passes preferably over a loose or idler guide pulley or like fairlead 196, 196' (see Figures 22 and 24) preferably of substantially biconical shape and substantially tangential to the centre line of the pivot shaft 193 of the associated guide pulley and positioned below the latter. Each idler guide pulley 196, 196' is loosely mounted for free rotation on a shaft 197 having a stationary location and extending in substantially parallel relation to the axis of rotation of the drum of the associated winch 188, 188', and carried by a supporting bracket 198 (between the two parallel jaws or co-extensive plates thereof) fast with the associated king post

169, 169'. In view of such an arrangement when the guide pulley 191, 191' swings about its pivot shaft 193 to follow the horizontal rotary slewing motion about the geometrical vertical swivel axis 199 (see Figure 13) through the travelling of the trucks 143 along their common runway 144, that portion of the run of the handling wire rope 189, 189', which extends between each idler pulley 196, 196' and the associated guide pulley 191, 191', always remains in coaxial relation to the centre line of the pivot shaft 193 of the guide pulley, so that this portion of the wire rope run retains a stationary position in space and merely revolves on itself about its longitudinal centre line thereby offering the advantage of reducing the fatigue or strain (through mechanical twisting stress) of the handling wire rope to a least value in this area. Referring to Figure 13, it is seen that the vertical geometrical axis 199 of slewing motion of the ramp 104 is defined by the intersection of the longitudinal vertical centre plane 111 of the ramp with the longitudinal vertical centre plane 107 of the vessel. This vertical geometrical axis 199 of slewing motion also forms the axis of revolution of the cylindrical surfaces defining the walls of the runway and guide track 144 of the carriages 143 which runway forms a kind of channel or trough concentric with the axis 199 which is thus the centre of circular curvature of the guideway 144.

It should be appreciated in this connection that the relative rotary slewing motion of the foldable or collapsible ramp 104 with three ramp sections 138, 139, 140 about a vertical swivel axis could as well be carried out by means of the arrangement shown in Figures 10 to 12 instead of making use of the trucks or trolleys 143 travelling in the runway and guide track 144.

Each king post 169, 169' further carries a stationary pulley-block or tackle-block 200, 200' (see Figures 14, 15, 21, 22 and 26) supporting three parallel pulleys 201 rotatably mounted in coaxial relationship on a substantially horizontal common shaft 202. Each stationary pulley block 200, 200' comprises, at its upper portion, a pair of parallel lugs 203 forming a clevis or like fork or yoke for pivotal connection through which the pulley block is pivotally connected by means of a substantially horizontal pintle 204 to a bracket 205 rotatably mounted on a vertical pivot shaft 206 carried by a stationary support 207 rigidly connected to the associated king post 169, 169'. Each pulley block 200, 200' comprises, at its bottom end, a lug 208 pivotally mounted for swinging about a substantially horizontal pintle 209 located beneath an end pulley of the pulley

block and serving as a stationary fastening point at 210 to the end of the handling wire rope 189, 189'. Each stationary pulley block 200, 200' may thus freely swivel about a pair of orthogonal pivot axes or pintles 204, 206 of which pintle 206 is at least approximately perpendicular to the pivot axis 110 of the ramp 104.

As shown in Figures 13 and 14, the outer end of each side frame member of the innermost end ramp section 138 carries a movable pulley block 211, 211' including for instance four pulleys rotatably mounted in parallel coaxial relationship on a preferably substantially horizontal common shaft 212. At its lower portion each movable pulley block 211, 211' carries a lug or the like 213 pivotally connected through a pintle 214, extending at right angles to the centre line of the common shaft 212 of the sheaves of the pulley block, to a movable clevis 215 pivotally connected to a for example yoke-shaped or fork-like support 216 fast with the corresponding side frame member of the ramp section 138 by means of a substantially horizontal pintle 217 extending transversely of the ramp, i.e. parallel with the horizontal axis of rotation 110 of the ramp section 138. Each movable pulley block 211, 211' is thus free to swivel angularly about a pair of orthogonal pivot pins or pintles 214 and 217 parallel with and perpendicular to the geometrical horizontal axis of rotation 110 of the ramp, respectively.

Each handling wire rope 189, 189', leading from its associated winch drum 188, 188' is thus reeved successively at first over the fair-lead or idler pulley 196, 196' and the associated guide pulley 191, 191' mounted on the corresponding king post 169, 169' and then successively and alternately over the four respective sheaves of the movable pulley block 211, 211' and over the three respective sheaves of the stationary pulley block 200, 200' to be eventually made fast with its end at the stationary fastening point 208 of the pulley block 200, 200'. The number of sheaves such as 201 carried by each stationary pulley block 200, 200' and movable pulley block 211, 211', respectively, depends on the magnitude of the selectively predetermined power or tractive force reduction ration which should be achieved by the reeving consisting of the pair of mating pulley blocks 200, 211 or 200', 211'. This number may therefore be different from that stated herein for each pulley block.

As shown in particular in Figures 13 and 14, the relative rotary motion of the intermediate ramp section 139 about its hinge axis 141 of pivotal connection with the innermost end ramp section 138, in parti-

cular in the direction of raising or unfolding as an extension of the ramp section 138, is operated by at least one operating wire rope 218 controlling such relative unfolding and passing successively over a pair of guide pulleys 219, 219' (Figs. 13, 21) mounted endwise of the jib arm 190, 190', respectively, provided at the tops of both king posts 169, 169'. Both runs of the wire rope 218, which lead from the guide pulleys 219, 219', respectively, towards the ramp 104, are reeved each one possibly several times successively and alternately over a pulley block 220, 220' respectively carried by the free end of each projecting boom 157, 157' rigidly connected to the intermediate ramp section 139 and over a pulley block 221, 221' carried by a bracket 222, 222' fast with the outside of the associated side frame member of the innermost end ramp section 138, which brackets are transversely sidewise projecting outwards so that each pair of pulley blocks 220-221, 220'-221' be in alignment or registering relationship in a same vertical plane substantially parallel with the longitudinal vertical centre plane 111 of the ramp, these pairs of pulley blocks being preferably substantially symmetrical with respect to the longitudinal vertical centre plane 111 of the ramp. By way of non-limiting merely illustrative example only, each pulley block 220, 220' includes for example a pair of coaxial parallel sheaves and each pulley block 221, 221' is reduced for instance to one single pulley so that the corresponding run of the wire rope 218, leading from the corresponding guide pulley 219 or 219' passes successively at first over the first sheave of the pulley block 220, 220' and then over the single pulley of the pulley block 221, 221' and afterwards over the second sheave of the pulley block 220, 220' to return to the pulley block 221, 221' so as to be attached with the dead end of the wire rope to a stationary fastening point 223 of the pulley block 221, 221' or to a stationary structure integral with the innermost end ramp section 138. The attachment of the free dead end of each run of wire rope 218 to its corresponding stationary fastening point such as 223 is preferably accomplished through a self acting means for tensioning the wire rope to haul it taut according to the process which has already been described in the aforesaid British patent application No 30829/73. (Serial No. 1441464).

As shown in Figures 14, 15 and 21 to 23, each upper guide pulley 219, 219' for the wire rope 218 controlling the relative unfolding is pivotally connected by its shell 224 by means of a substantially horizontal pintle 225 extending at right angles

to the rotary shaft 226 of the pulley, to a corresponding fork-like or yoke-shaped supporting clevis 227 fast with the end of the jib 190, 190' of the associated king post 169, 169'. The mounting of each pulley 219, 219' as well besides as those of all the assemblies mounted on the king posts 169, 169' and the winches 188, 188' are preferably substantially symmetrical with respect to the longitudinal vertical centre plane 107 of the ship so that the horizontal pintles 225 are coaxially aligned in perpendicular relation to that plane. Each pulley 219, 219' is thus free to swivel about its horizontal pintle 225 for following the relative motions of the ramp 104 and projecting booms 157, 157'.

Each guide pulley 219, 219' is desirably provided with rope-guide means 218 so as to retain the run of wire rope leading in tangentially on the pulley, said run of wire rope leading tangentially from the pulley substantially in the same middle plane extending at right angles to the shaft 226 of the pulley. For this purpose these guide means desirably consist for each guide pulley 219, 219' of a pair of tubular guide sleeves 228, 229 through each one of which is threaded the corresponding run of wire rope 18 so that the latter slidably extends therethrough. Each guide sleeve 228, 229 carries a pair of opposite, transversely coaxially aligned radial trunnions, gudgeons or like stud pins 230 (see Figures 22 and 23) with which it is journaled between two parallel swinging holding arms 231, 232 pivotally mounted on the shaft 226 of the associated pulley 219, 219', on either side of this pulley, respectively, so that each guide sleeve 228 has the longitudinal centre line of its bore constantly directed in a radial direction meeting the axis or rotation or centre line of the shaft 226 of the pulley hence always located in the middle plane extending at right angles to said axis of rotation of pulley shaft 226.

The ramp 104 allows the loading and unloading of wheeled vehicle by provided a direct passageway from the outside quay 150 to the loading deck 102 of the ship whatever the instant relative position of the vessel with respect to the quay. When the ship is berthed alongside of the quay, the ramp 104 may assume any one of the three following main positions:

- 1) Astern and rearwards of the poop in aligned extension of the longitudinal vertical centre plane 107 of the ship;
- 2) in a slant position to port side, the ramp having slewed for instance through about 40° around its vertical swivel axis towards the port side from the longitudinal vertical centre plane of the vessel;
- 3) in a slant position to the starboard side, the ramp having slewed through about

40° around its vertical swivel axis towards the starboard side from the longitudinal vertical centre plane of the ship.

When the ship is at sea, the ramp is vertically folded back against the transom stern or rear superstructure or like deck erection aft of the ship in sea-going stowed position so that the longitudinal vertical centre plane 111 of the ramp registers with that 107 of the ship. To avoid any possible skidding or slipping of the wheels of vehicles rolling on the carriage-way of the ramp, the carriage-way or runway surface of the ramp, intended for the passage of wheeled vehicles, is desirably provided with a right lining or covering such as made from chequered metal sheet or plate or also from expanded metal or the like. The handling operation of the ramp is performed as follows.

a) First case: the ramp is used in the position longitudinally aligned in registering relationship with the stern of the ship. In this instance the operation of the innermost end ramp section 138 is carried out by both handling cables or wire ropes 189, 189' actuated by both hydraulically powered winches 188, 188'. The beginning of the downward swing or lowering motion of the ramp about its horizontal pivot axis 110 is started or initiated owing to the thrust exerted on the innermost end ramp section 138 simultaneously by both substantially horizontal push ram-type actuators 171 located on the lower intermediate deck 166, which ram-type actuators are also usable as damping or shock-absorbing devices for the ramp at the end of the raising operation. The unfolding of the assembly of intermediate and outermost end ramp sections 139, 140, respectively, during the lowering step is automatically achieved by the operating wire rope 218 controlling said relative unfolding, due to the fixed fastening point reaction provided by the guide pulley 219, 219'. When the outermost end ramp section 140 engages the quay 150, its correct position relative thereto is achieved by both adjusting actuators 151. Before starting the lowering operation of the ramp, it is necessary to unlock it previously by releasing it from its lashing appliances 173 and 175 respectively, mounted on the intermediate deck 166 and platform deck 167, respectively.

The raising operation of the ramp is performed by accomplishing the aforementioned steps in their reverse order of succession;

b) Second case: the ramp is used in slant position or in a position angularly deviated by 40° to port side or to starboard side. The lowering operation is effected in three steps:

1) The lowering operation is the same as in the first aforementioned case until the innermost end ramp section 138 is tilted for instance at an angle of about 15° upwards relative to a horizontal plane thereby allowing the actuation and locking of the buttressing device 159-165 shown in Figure 16 (the structure and operation of which has been set forth in the aforementioned British patent application. The innermost end and intermediate ramp sections 138, 139 are lifted upwards at their common hinged connection 141 through the pushing action exerted by the buttressing ram-type actuators 158 to keep the ramp lifted off above the quay surface and spaced therefrom during the slewing motion of the ramp about its vertical swivel axis 199.

2) The slewing operation of the ramp 104 about its vertical swivel axis 199 (or about one of the vertical swivel axes 105, 106 of Figures 10 and 12) is performed by actuating the main hydraulically powered handling winches 188, 188' in opposite directions to achieve a luffing effect of the ramp by means of its handling wire ropes 189, 189' towards the desired side until the ramp is angularly deviated by about 40° towards the desired side from the longitudinal vertical centre plane 107 of the ship.

3) The presentation of the ramp on the quay is effected as in the first case.

The raising operation of the ramp is also accomplished in three steps or stages according to an order of succession of operative steps which is reversed with respect to that of the lowering operations of the ramp. The operation is controlled for example manually. To achieve a proper raising operation, there is provided a remote-control system adapted to check and report that the ramp is properly centred in registering alignment with the longitudinal vertical centre plane 107 of the vessel. For this purpose a regulating and adjusting device is desirably provided at the level of the platform deck 167 of the ship, for example at the positions 175a, such devices consisting in particular of sensors and the like locating and indicating devices adapted to become operative at the end of the raising step.

All the hand operated control members for the operator are desirably arranged in an assembly on a central control desk 233 located on the rearward overhanging stage of the platform deck 167 substantially in registering relation to the longitudinal centre line of the ship.

When using the ramp 104 as an access ramp in particular in the shipping position wherein the ramp 104 rests on the quay 150 through its outboard or outer-

most end ramp section 140, both ramp sections 138 and 139 are rigidly interconnected by said buttressing device 159-165. During the shipping operations, the handling winches 188, 188' are adjusted so as to retain a determined specific tension in the handling wire ropes 189, 189' from which the ramp is partially suspended so as to limit the pressure exerted upon the quay by the ramp, the ramp sections 138 and 139 of which are mutually buttressed and behave as a rigid integral beam or stiff girder. A position detector 234 forming a feeler or sensor member mounted on the intermediate ramp section 139 (see Figure 14) preferably in the vicinity of the pivotal connection 141 with the innermost end ramp section 138 checks and adjusts automatically the distance between the ramp 104 and the quay when the quay level approaches an upper position falling within a predetermined minimum and maximum limit. This detector means 234 which is adapted in particular to engage the quay surface, controls or actuates the buttressing actuators 158 automatically in the proper direction to cause them to be either extended or retracted for causing depending upon the case the relative position of the common hinge connection 141 to be lifted or lowered, respectively. When the admissible pressure on the quay is equal to or higher than a predetermined limiting value, the adjusting of the ramp in relation to the quay in accordance with the draft of the vessel or with the actual condition of the tide is provided for by a fully automatic control or regulating action. If the pressure on the quay has to be limited to a predetermined value below said limiting value, such an adjustment requires a manual control action by adjusting the tension imparted to the handling wire ropes 189, 189' by the winches 188, 188'. A special auxiliary control is provided for this purpose on the platform deck 167 together with a length of remote-control cable for example of about 10 meters, such a control operating in the same manner as the main control.

The use of the ramp is quite flexible and enables loading and unloading operations to be performed with a maximum angle of list for example of $\pm 5^\circ$ and a maximum angle of trim for example of $\pm 2^\circ$. When the ship is at sea, the ramp is folded back against the back transom superstructure, the ramp section 139 being applied against the ramp section 138 whereas the outer most end ramp section 140 with its hinged end flaps 153 is applied against the damping or shock-absorbing stop or buffer means 152. The lashing or locking is carried out by four locking devices arranged in two lower and upper pairs 173, 175, 130-

respectively, which are operated for example manually and at least the pair of lower devices 173 of which include a locking system with a rod which catches or
 5 grips the intermediate ramp section 139 upon moving through the innermost end ramp section 138.

An inner safety device is provided to prevent actuation of the back port door 147
 10 into open position and vice-versa. A sound-giving or audible and visual warning before the intermediate ramp section 139 engages the quay 150. This warning device is complementary to the automatic position detector 234 mentioned hereinabove. An alarm device is provided for preventing the use of the ramp with an inclination thereof higher than a predetermined specific value.

20 WHAT WE CLAIM IS:—

1. A movable device forming an access ramp to interconnect a vehicle such as a ship and an outside platform, said ramp being pivotally connected to the vehicle rearward
 25 end or ship's stern so as to be swingable upwards into an inoperative substantially upstanding position stowed on said vehicle at the aft end thereof and downwards into an operative outward projecting working position in fully overhanging relationship,
 30 wherein the improvement consists in that said ramp comprises means for variable connection to said vehicle so that it may be slewed in parallel relation to a horizontal plane about at least one substantially vertical geometrical swivel axis whereby in its lowered configuration, the relative angular position of its longitudinal direction is selectively adjustable with respect to said
 35 vehicle.

2. A device according to claim 1, wherein said ramp is pivotally connected with its innermost end to at least one truck movable along a guiding runway provided on said
 45 vehicle along a substantially flat curved path of travel having substantially the shape of an arc of circumference.

3. A device according to claim 2, wherein said truck is provided with a frame of arcuate configuration in parallel relation to a horizontal plane and includes travelling carrying wheels and wheels for bilateral guiding co-operating in engaging relationship with a pair of concentric curved rails,
 55 respectively, forming said guiding runway.

4. A device according to claim 2, wherein said truck and its runway are located below the level of the floor of said vehicle and in which the adjacent inner end
 60 of said ramp is pivotally connected to a plurality of transversely juxtaposed flap elements which may be folded back against said ramp or downwards onto said floor of said vehicle to cover and span said truck
 65 and its runway for restoring the continuity

of passageway between said ramp and said floor.

5. A device according to claim 2, wherein said ramp is attached on both sides at two intermediate points thereof to two
 70 handling wire ropes, respectively, winding up on two winches each handling rope passing on a guide pulley pivotally connected to a post of said vehicle so that it may swivel about a substantially vertical axis,
 75 both pulleys being located in symmetrical relation to the vertical plane bi-sectioning the angle representing the maximum amplitude of slewing motion of said ramp.

6. A device according to claim 5,
 80 wherein said ramp consists of three successive ramp sections hingedly interconnected in the longitudinal direction, the outermost end section serving as a bearing pad resting on the quay whereas the innermost end section
 85 is secured to said handling wire ropes towards its outer end and wherein in at least said lowered working position of said ramp, said innermost end ramp section remains always suspended from said handling ropes
 90 and is provided with at least one ram-type actuator of the linear displacement type mounted in common on said innermost end and intermediate ramp sections, respectively, at the pivotal connection thereof for but-
 95 tressing both ramp sections according to a selectively adjustable angle formed therebetween

7. A device according to claim 6, comprising self-acting control means for
 100 keeping constant the tension imparted to said handling cables in said lowered working position of said ramp, said winches being adapted to react to said control means which consist of at least one sensor member
 105 secured to said intermediate ramp section for bearing engagement with said platform with a view to detecting any variation in the relative position of said vehicle and platform.
 110

8. A device according to claim 1, comprising locking means for holding said ramp against motion in any relative angular position about its vertical axis of slewing motion and by at least one stationary stop means for
 115 limiting the upward swinging motion.

9. A device according to claim 2, wherein said truck is self-propelled.

10. A device according to claim 1, wherein said ramp is pivotally connected to
 120 a powered turn-table carrying also said posts and winches.

11. A device according to claim 1, wherein said ramp comprises means enabling said ramp to slew alternately and separately at two vertical swivel axes having
 125 stationary locations, respectively, through at least two points of pivotal connection to said vehicle, said points being transversely spaced on the innermost end of said ramp
 130



respectively, which are operated for example manually and at least the pair of lower devices 173 of which include a locking system with a rod which catches or
5 grips the intermediate ramp section 139 upon moving through the innermost end ramp section 138.

An inner safety device is provided to prevent actuation of the back port door 147
10 into open position and vice-versa. A sound-giving or audible and visual warning before the intermediate ramp section 139 engages the quay 150. This warning device is complementary to the automatic position detector 234 mentioned here-
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25 end or ship's stern so as to be swingable upwards into an inoperative substantially upstanding position stowed on said vehicle at the aft end thereof and downwards into an operative outward projecting working position in fully overhanging relationship,
30 wherein the improvement consists in that said ramp comprises means for variable connection to said vehicle so that it may be slewed in parallel relation to a horizontal
35 plane about at least one substantially vertical geometrical swivel axis whereby in its lowered configuration, the relative angular position of its longitudinal direction is selectively adjustable with respect to said
40 vehicle.

2. A device according to claim 1, wherein said ramp is pivotally connected with its innermost end to at least one truck movable along a guiding runway provided on said
45 vehicle along a substantially flat curved path of travel having substantially the shape of an arc of circumference.

3. A device according to claim 2, wherein said truck is provided with a frame of
50 arcuate configuration in parallel relation to a horizontal plane and includes travelling carrying wheels and wheels for bilateral guiding co-operating in engaging relationship with a pair of concentric curved rails,
55 respectively, forming said guiding runway.

4. A device according to claim 2, wherein said truck and its runway are located below the level of the floor of said vehicle and in which the adjacent inner end
60 of said ramp is pivotally connected to a plurality of transversely juxtaposed flap elements which may be folded back against said ramp or downwards onto said floor of said vehicle to cover and span said truck
65 and its runway for restoring the continuity

of passageway between said ramp and said floor.

5. A device according to claim 2, wherein said ramp is attached on both sides at two intermediate points thereof to two
70 handling wire ropes, respectively, winding up on two winches each handling rope passing on a guide pulley pivotally connected to a post of said vehicle so that it may swivel about a substantially vertical axis,
75 both pulleys being located in symmetrical relation to the vertical plane bi-sectioning the angle representing the maximum amplitude of slewing motion of said ramp.

6. A device according to claim 5, wherein said ramp consists of three successive ramp sections hingedly interconnected in the longitudinal direction, the outermost end section serving as a bearing pad resting on the quay whereas the innermost end section is secured to said handling wire ropes
85 towards its outer end and wherein in at least said lowered working position of said ramp, said innermost end ramp section remains always suspended from said handling ropes and is provided with at least one ram-type actuator of the linear displacement type mounted in common on said innermost end and intermediate ramp sections, respectively,
90 at the pivotal connection thereof for buttressing both ramp sections according to a selectively adjustable angle formed therebetween.

7. A device according to claim 6, comprising self-acting control means for keeping constant the tension imparted to said
100 handling cables in said lowered working position of said ramp, said winches being adapted to react to said control means which consist of at least one sensor member
105 secured to said intermediate ramp section for bearing engagement with said platform with a view to detecting any variation in the relative position of said vehicle and platform.

8. A device according to claim 1, comprising locking means for holding said ramp against motion in any relative angular position about its vertical axis of slewing motion and by at least one stationary stop means for
115 limiting the upward swinging motion.

9. A device according to claim 2, wherein said truck is self-propelled.

10. A device according to claim 1, wherein said ramp is pivotally connected to a powered turn-table carrying also said posts and winches.

11. A device according to claim 1, wherein said ramp comprises means enabling said ramp to slew alternately and separately at two vertical swivel axes having
125 stationary locations, respectively, through at least two points of pivotal connection to said vehicle, said points being transversely spaced on the innermost end of said ramp
130



and positioned adjacent to the opposite extreme corners thereof, and wherein each one of said points of pivotal connection may be releasably held against motion at the position of an associated vertical swivel axis whereas the other point of pivotal connection is freely displaceable in concentric relationship about the former, the geometrical horizontal axis of rotation of the hinged connection between said ramp and said vehicle extending through said points of pivotal connection.

12. A device according to claim 11, wherein said ramp is releasably connected in a disconnectable manner with at least both aforesaid points of pivotal connection which are respectively provided with two hinge members having a common horizontal geometrical axis of rotation, to two rotary pivots forming corresponding hinge holders having an own vertical axis of slewing motion, rotatably mounted at stationary locations on said vehicle, each one of said two points of pivotal connection being alternately displaceable separately, when disconnected from their corresponding pivot, in the stationary relative horizontal plane of said common horizontal axis of hinged connection along a path of travel in the shape of an arc of circumference about the other point of pivotal connection retained in a stationary position when coupled to its associated pivot, so as to selectively enable said ramp to rotate on the one hand through the other point of pivotal connection thereof about the vertical corresponding pivot axis of slewing motion and on the other hand about said common horizontal geometrical axis of hinged connection of both hinge members

13. A device according to claim 12, wherein both aforesaid pivots are located in substantially symmetrical relation to the relative vertical longitudinal centre plane of said vehicle.

14. A device according to claim 12, wherein each aforesaid hinge member consists of a travelling roller mounted on said ramp at one aforesaid corresponding point of pivotal connection thereof said roller having its substantially horizontal axle directed substantially at right angles to the relative vertical longitudinal centre plane of said ramp in substantially coaxial relationship with said common horizontal geometrical axis of hinged connection, each roller being alternately displaceable separately together with said ramp on an arcuate track leading from said pivot associated with said point of pivotal connection said track being concentric with the vertical pivot axis of slewing motion associated with the other point of pivotal connection whereas locking means are provided for selectively locking each roller to the associated pivot.

15. A device according to claim 14, wherein each aforesaid pivot consists of a clevis integral with a substantially vertical shank mounted for rotation about its longitudinal vertical axis of slewing motion within a thrust block forming a footstep-bearing carried by said vehicle, the bottom of said clevis being substantially on a level in flush relationship with and gradually merging into the trackway of said roller corresponding to said pivot, so as to be able to receive and accommodate said roller moving into said clevis between both legs thereof to be supported thereby, said locking means being provided on said clevis.

16. A device according to claim 15, characterized in that the axle of each aforesaid roller consists of a hollow shaft forming a tubular sleeve open at both of its opposite ends and said locking means consist of a removable stop bolt horizontally insertable through said hollow shaft to extend through coaxially a post and horizontally aligned through holes formed in both legs of said clevis, said stop bolt being caused to be retracted and extended by a reversible double-acting pressure fluid operated actuator of the linear displacement type carried by said clevis.

17. A device according to claim 15, wherein a selective locking means is associated with every relative angular working position of said ramp about either one of said vertical pivot axes of slewing motion for holding said ramp against motion in said angular position, each locking means consisting of a yoke for retaining the corresponding travelling roller of said ramp, said yoke being associated with said track which is concentric with said pivot axis for slewing motion, at that point of said track which corresponds to the actual instant position of said travelling roller resting on said track, said retaining yoke being provided with locking means for locking said travelling roller to said retaining yoke.

18. A device according to claim 15, further comprising individual locking means for selectively holding each aforesaid pivot against motion in its actual instant angular swivelling position.

19. A device according to claim 11, further comprising at least one reversible drive servo-motor for controlling the slewing motion of said ramp about either of said vertical pivot axes of slewing motion, said servo-motor consisting of a double-acting pressure fluid operated actuator of the linear displacement type with a substantially horizontal longitudinal centre line, said actuator being pivotally connected with one end thereof to a stationary point of said vehicle and with its other end to an intermediate point of the innermost end



of said ramp.

20. A device according to claim 12, wherein each aforesaid pivot is coupled to an individual reversible drive servo-motor for controlling the slewing motion of said pivot, said servo-motor consisting of a double-acting pressure fluid operated actuator of the linear displacement type with a substantially horizontal longitudinal centre line, said actuator being pivotally connected with one end thereof to a stationary point of said vehicle and with its opposite end to a radially projecting crank arm fast with said pivot.

21. A device according to claim 2, wherein said ramp is pivotally connected towards its opposite transverse corners of its innermost end through swivel-bearing means to at least a pair of travelling trucks provided each one with a pair of axles supporting carrying travelling side wheels and with a pair of horizontal wheels for lateral guiding having each one a vertical axis of rotation, said horizontal wheels being mounted at the lengthwise opposite ends, respectively, of the truck frame.

22. A device according to claim 11, wherein each aforesaid post supports a guide pulley for said handling wire rope leading from the associated winch, said guide pulley being mounted for swivelling motion about a pintle pivotally connecting same to said post, said pintle extending at right angles to the respective shafts for rotary motion of said guide pulley and of the drum of said winch and having its geometrical pivot centre line substantially tangential at least to said guide pulley at the point of tangential engagement of that run of said wire rope which leads from said winch, said pintle being substantially coaxial with at least the adjacent portion of said run of said rope, said run of said rope passing on an idler pulley arranged in tangential relation to the geometrical centre line of said pintle and having its axis of rotation positioned at a stationary location in parallel relation to the axis of rotation of said winch drum.

23. A device according to claim 2, wherein each aforesaid handling wire rope, corresponding to one aforesaid post, passes successively from said guide pulley to a movable pulley-block having a substantially horizontal common axis of rotation for the pulleys thereof, said movable pulley block being secured to said ramp and free to swivel about a pair of orthogonal pivot axes extending respectively in parallel and perpendicular relation to the geometrical horizontal axis of hinged connection of said ramp, said handling rope passing then on a stationary pulley block having a stationary fastening point for the dead end of said rope, which stationary pulley block

is connected to said post and free to swivel about a pair of orthogonal pivot axes one of which is at least approximately perpendicular to said geometrical axis of hinged connection of said ramp.

24. A device according to claim 22, wherein said ramp consists of at least two successive hingedly interconnected, first inner and second outer ramp sections, and said second ramp section may be folded back downwards against said first ramp section, whereas there is provided an operating wire rope for controlling the relative unfolding motion of said second ramp section, said rope being successively reeved over a pair of guide pulleys pivotally connected each one to an associated aforesaid post through a substantially horizontal pivot shaft extending at right angles to the axis of rotation of said guide pulley, whereas those two lengths of said wire rope, which lead from said guide pulleys respectively, towards said ramp, pass each one several times successively and alternatively on a movable pulley block mounted on said second ramp section and on a stationary pulley block mounted on said first ramp section to be made fast with its dead end at a fixed point of said stationary pulley block through a means for automatically tensioning and taking up the slack of said rope.

25. A device according to claim 24, wherein each aforesaid guide pulley comprises guide means for keeping that run of said wire rope, which leads tangentially into said guide pulley and that run of said rope which leads tangentially from said pulley substantially in a same centre plane of said guide pulley, which plane is perpendicular to the axis of rotation of said guide pulley.

26. A device according to claim 25, wherein each aforesaid guide pulley comprises a pair of hollow cable-guide members through which both runs of said wire rope slidably extend, respectively, while being tangential to said guide pulley, each cable-guide member being rotatably mounted between two supporting arms rotatably mounted endwise on the shaft of said guide pulley.

27. A device according to claim 24, including a third outermost end ramp section for resting on said outside platform, said third ramp section being hingedly connected to said second ramp section and carried by the latter, wherein damping and shock-absorbing means are provided on the underside of said first ramp section to form a resilient buffer-like stop mean for said third ramp section in the folded configuration of said ramp.

28. A device substantially as described and represented in the appended drawings.



29. An access ramp for a vehicle, which
is arranged for attachment to an end of
a vehicle so as to be rotatable in relation
to the vehicle both in the vertical sense
5 and in the horizontal sense, the rotation in
the vertical sense enabling the ramp, in
use, to be moved between an upright,
stowed position and a lowered, outward
projecting, fully overhanging operative
10 position in which it provides access to the

vehicle, the rotation in the horizontal sense
enabling the orientation of the ramp in
relation to the vehicle to be varied to suit
different dispositions of the vehicle in rela-
tion to a loading/offloading area.

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For The Applicants:
EDWIN C. AXE & CO.
Chartered Patent Agents
113 Kingsway
London WC2B 6QP