United States Patent

Macrander

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[54] DEVICE FOR TRANSLOADING FLOATING CONTAINERS

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June 11, 1969 Germany ..... P 19 29 523.9
Mar. 19, 1970 Germany ..... P 20 13 082.9

[52] **U.S. Cl.** ..... **214/15 R,** 114/43.5, 254/172
[51] **Int. Cl.** **B65g 67/58**
[58] **Field of Search** 254/172, 173; 114/43.5; 214/13–15

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[57] **ABSTRACT**

A transloading system, especially for ships, in which a support frame has coupling devices for connection thereof to a container while a crane has winches from which cables lead downwardly to the support frame and over idlers thereon and then back up to drums on the crane. Drive motors reversibly actuate the winches while the drums can be biased in cable take-up direction while being prevented from moving in cable pay-out direction, or can be permitted to move in either direction. The drums provide the means for holding the cables taut when a floating container rises and falls due to wave action. Special coupling devices are shown to connect the support frame to the containers and a control system is provided to monitor the rise and fall of a floating container and initiate control actions in conformity therewith.

15 Claims, 18 Drawing Figures

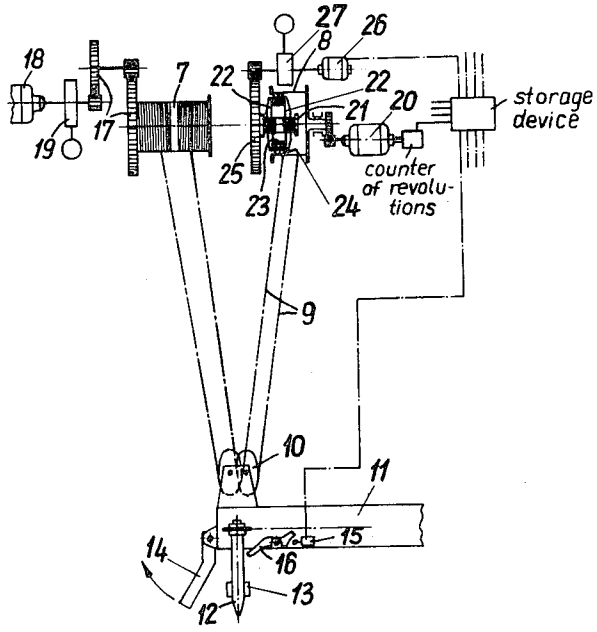

FIG.1

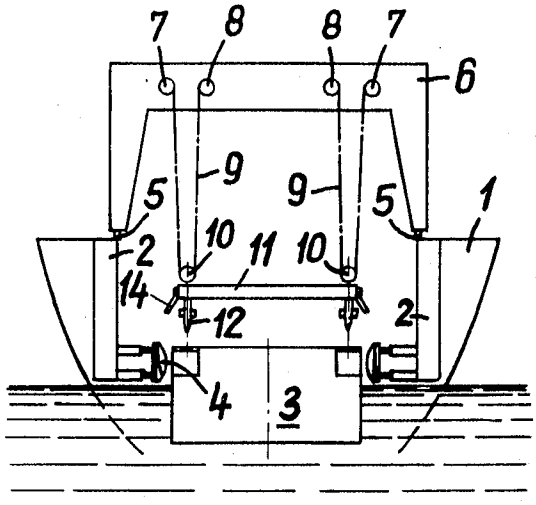

FIG.3

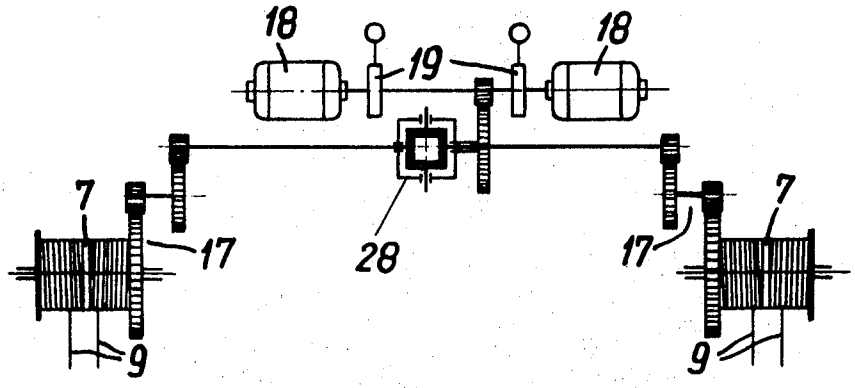

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FIG. 2

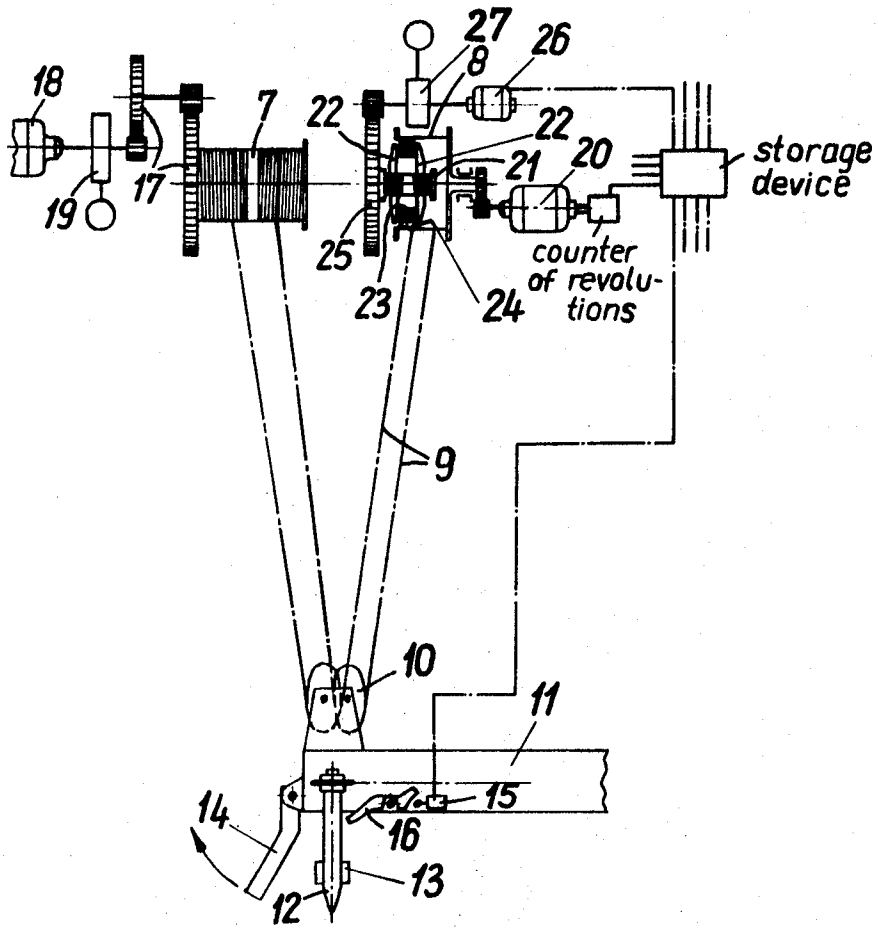

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FIG. 2a

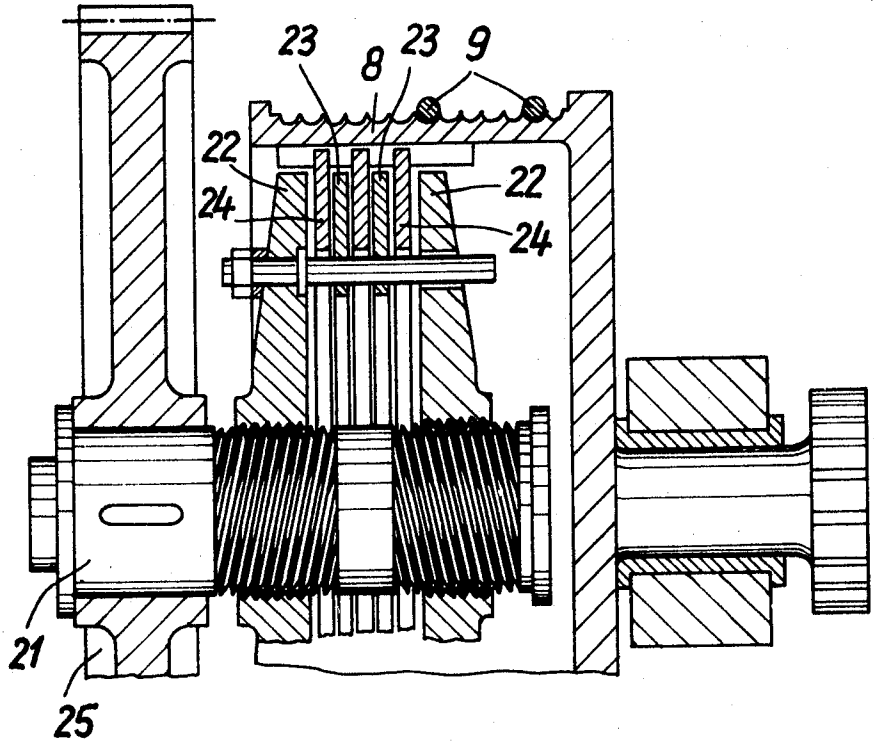
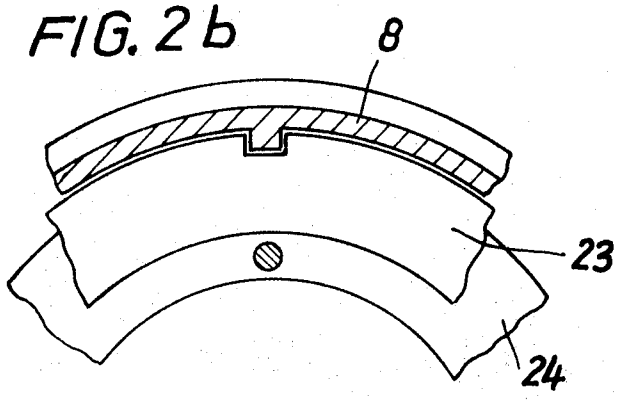


FIG. 2b



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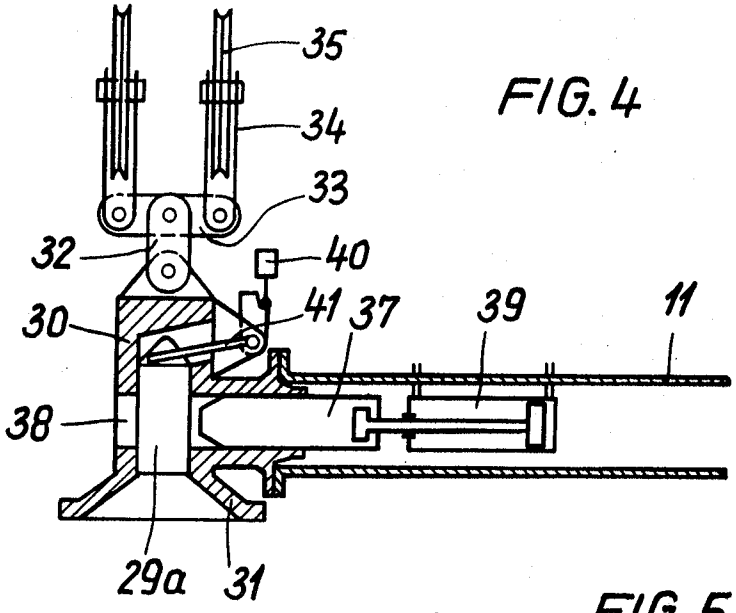
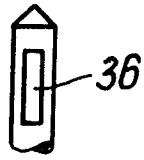


FIG. 4

FIG. 5

FIG. 6



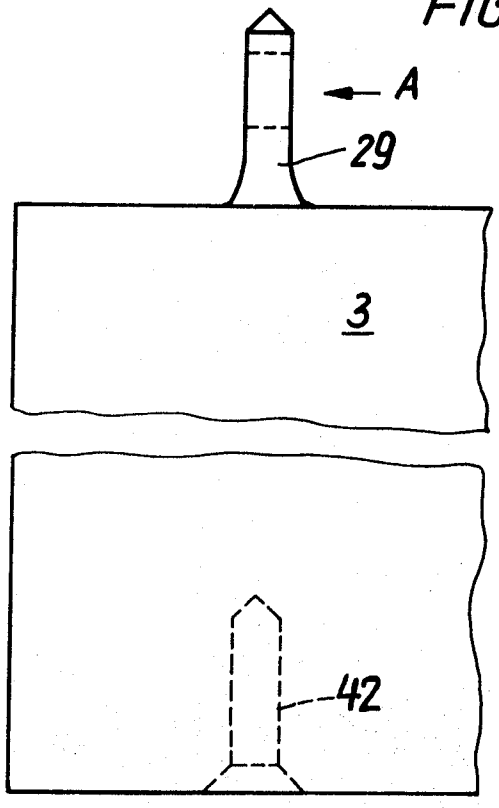


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FIG. 7

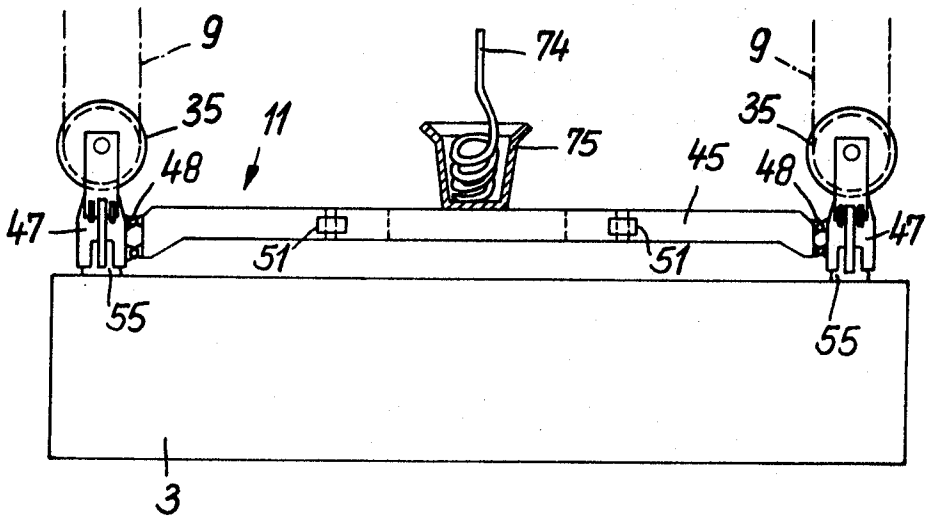

FIG. 8

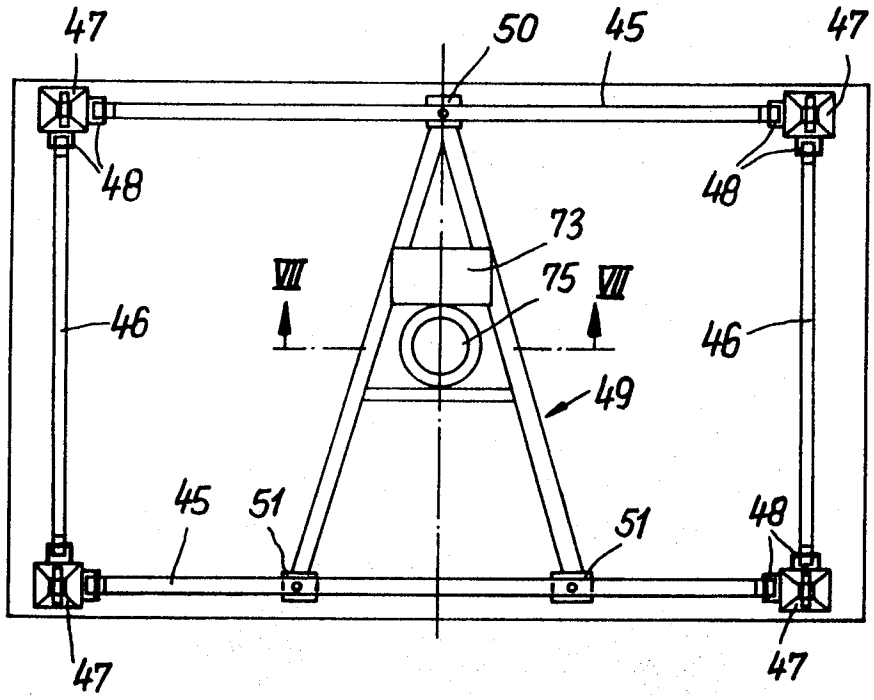

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FIG. 9

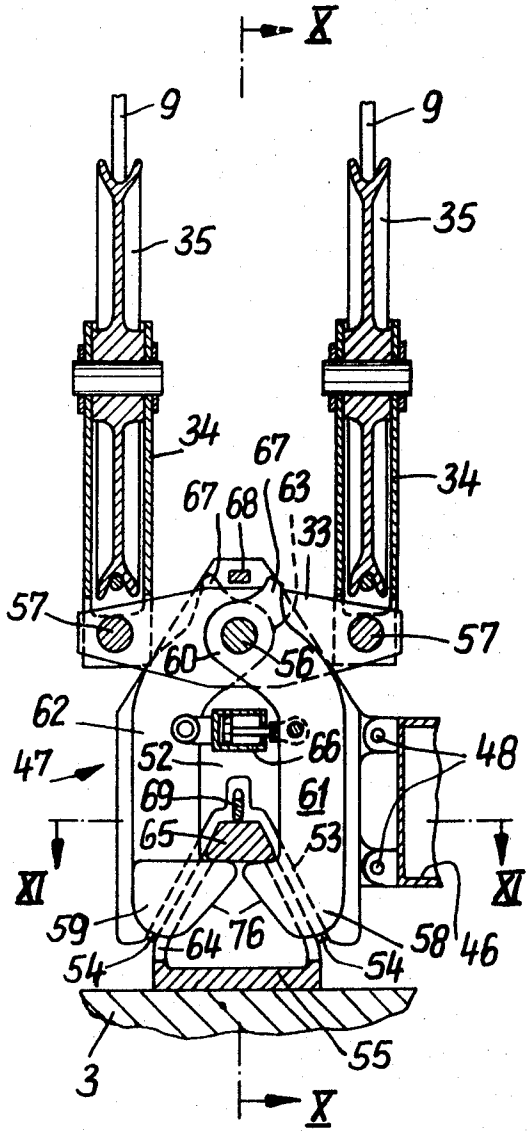

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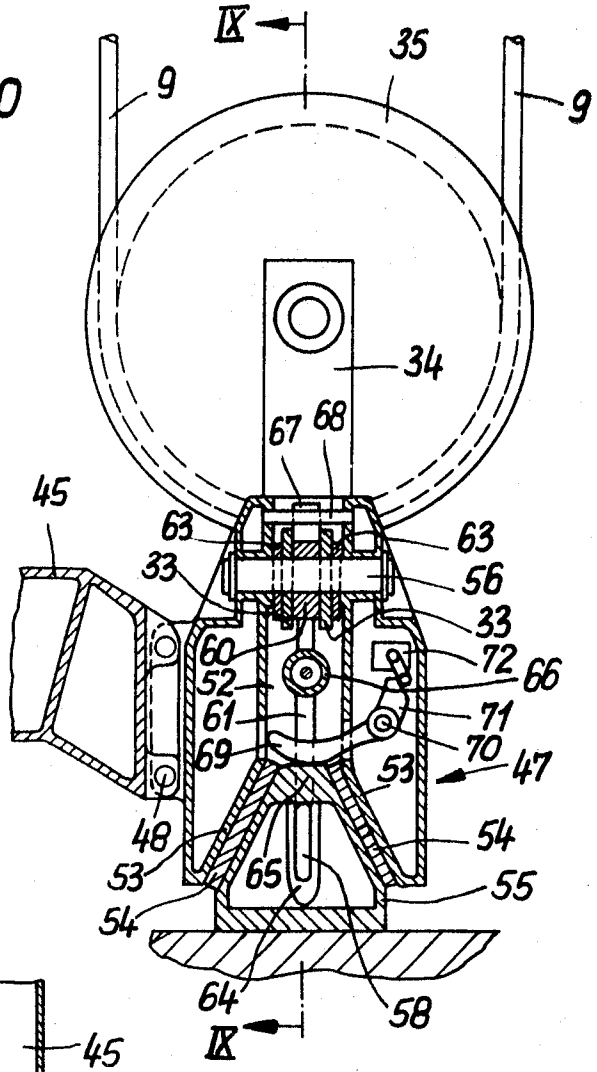
FIG. 10



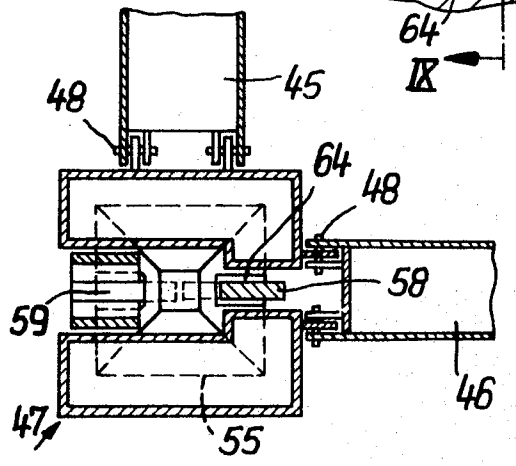


FIG. 11

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FIG. 12

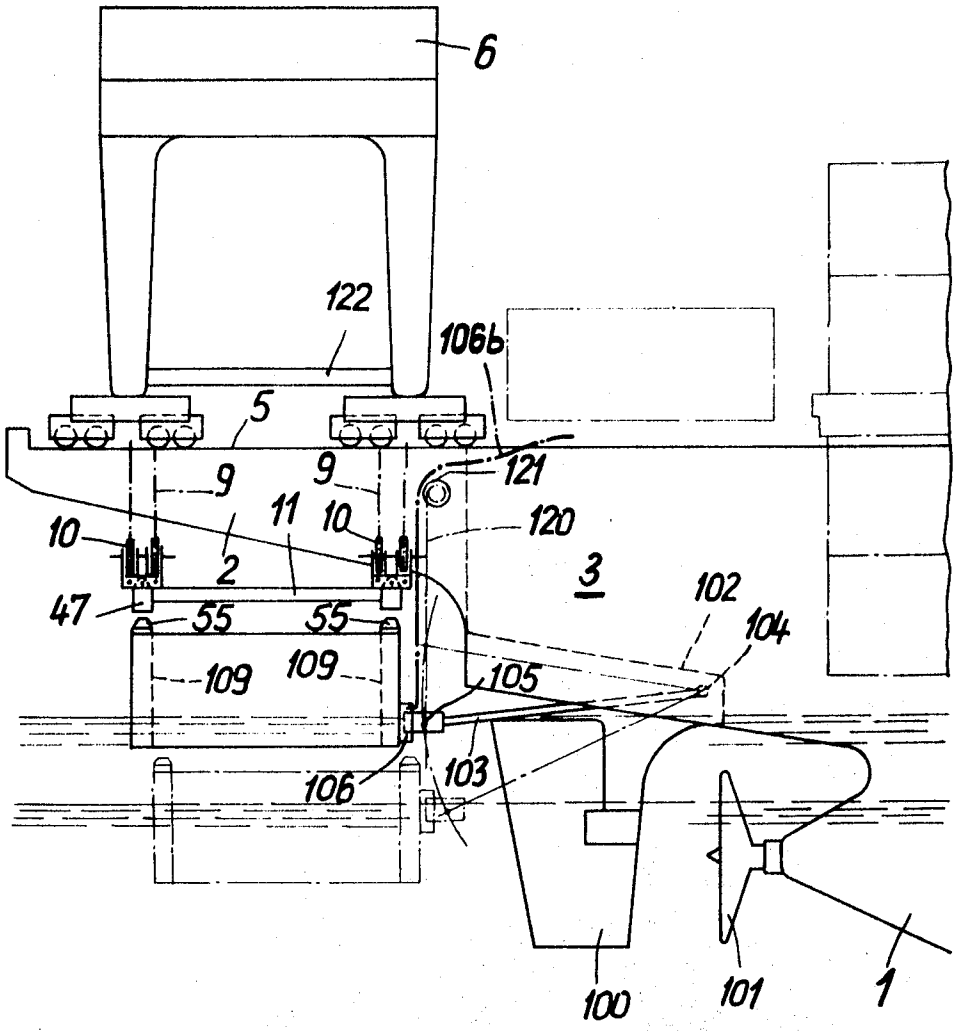

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FIG. 13

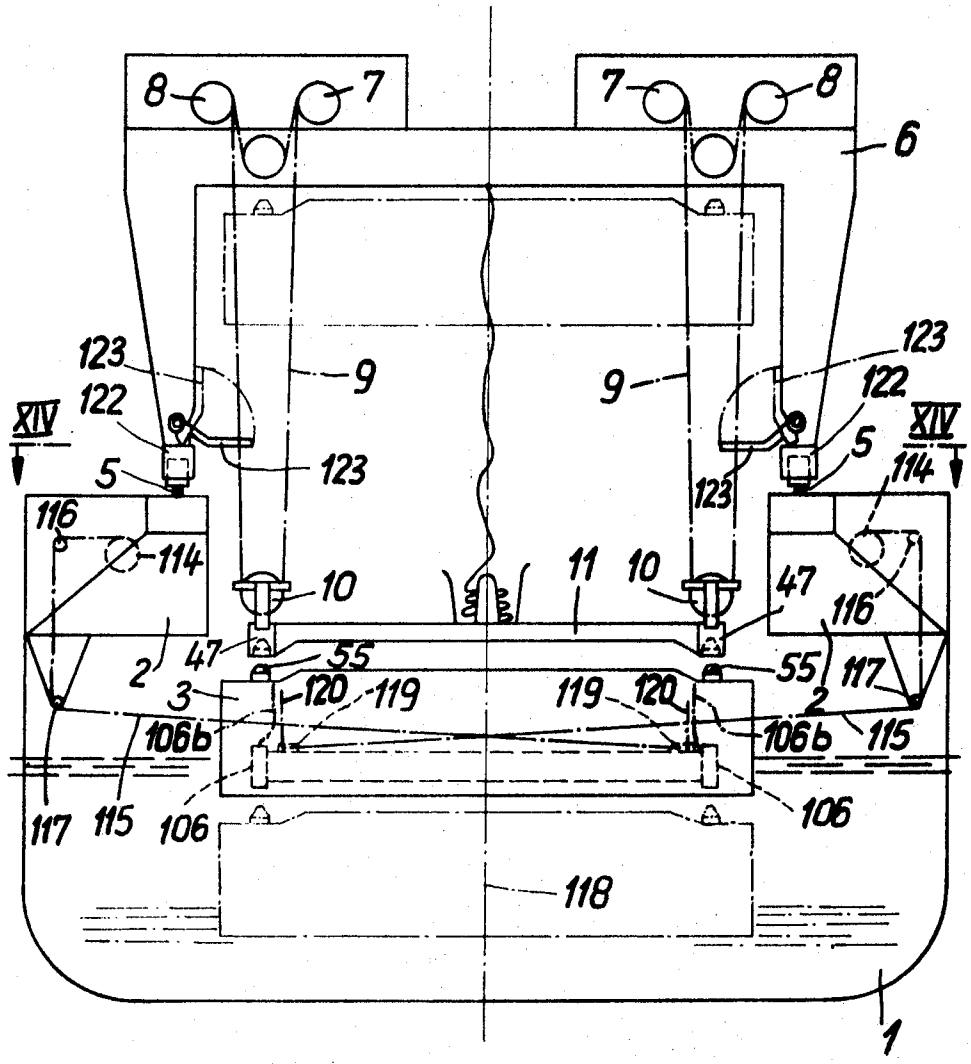

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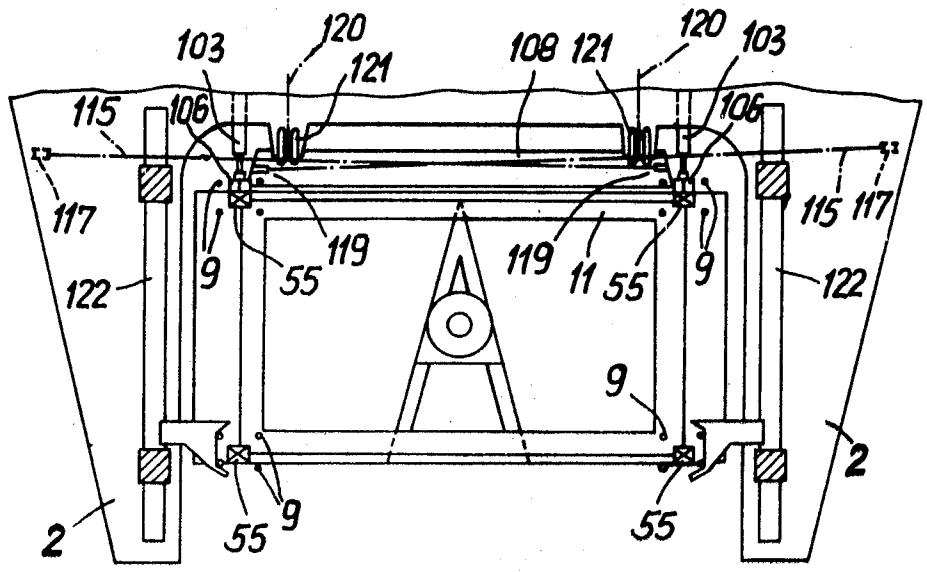
FIG. 14



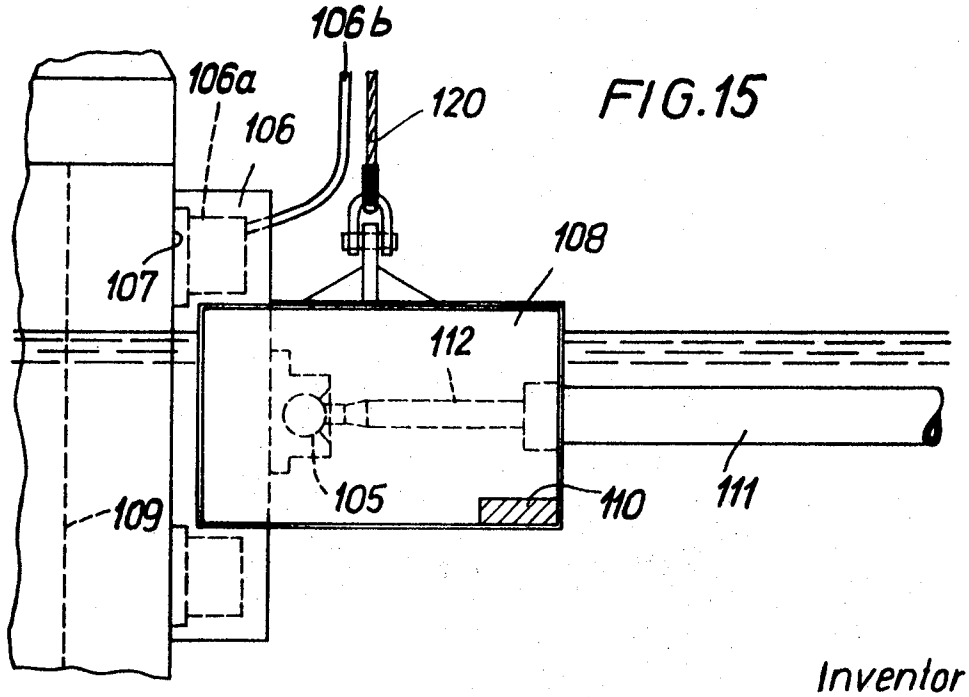


FIG. 15

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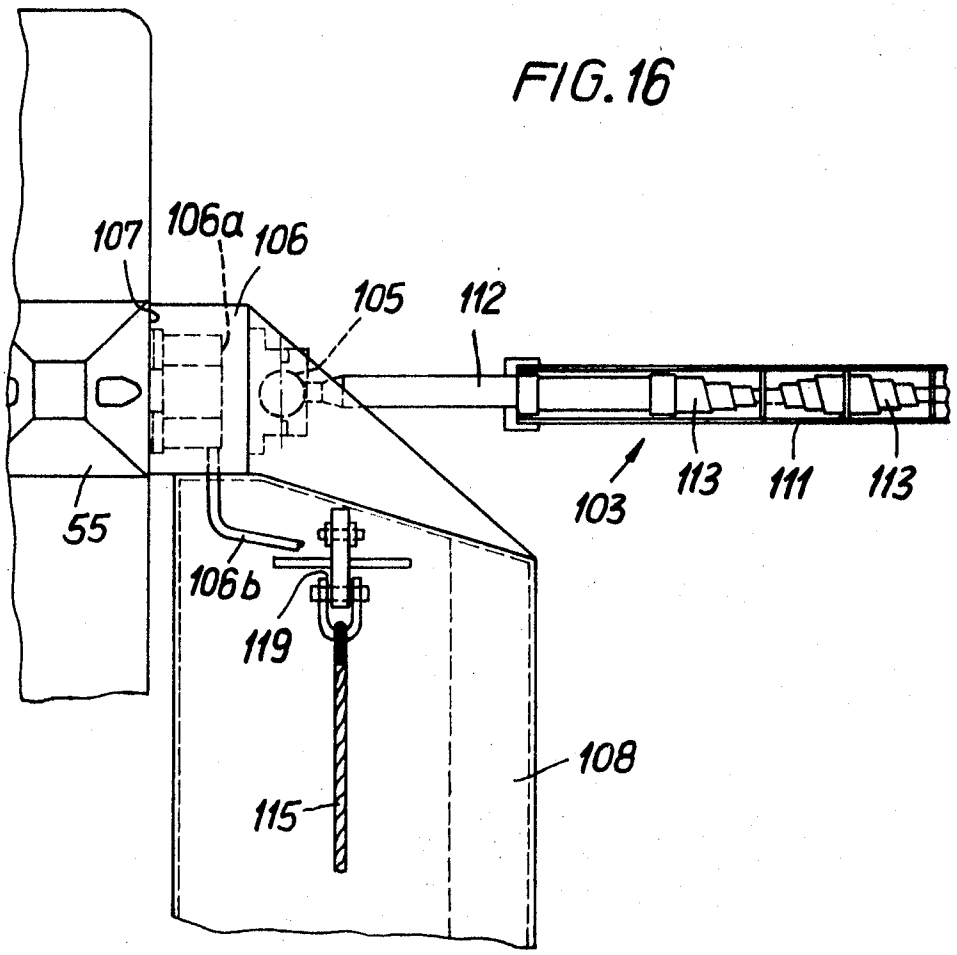
FIG. 16



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DEVICE FOR TRANSLOADING FLOATING CONTAINERS

The present invention relates to a device for transloading floating containers with a hoist which may be installed for instance on a ship and which comprises winches and a supporting frame that is carried by hoisting cables connected by means of a strand to the winch drums. Furthermore, the supporting frame is adapted to be coupled to the top side of a container which is to be lifted out of the water or to be lowered into the water, while a device is provided for holding the winch cables taut when a heavy sea prevails.

With a device of the above mentioned type which is known for instance from U. S. Pat. No. 3,361,274, the cables are during heavy seas kept in taut condition by journalling the upper blocks of each winch cable, a strand of which is passed in horizontal direction or at a slight incline to a winch drum, in a carriage which is guided on the framework of the hoist for displacement in vertical direction. Furthermore, an upwardly directed pulling force acts always upon said carriage inasmuch as a cable is passed over guide rollers which are mounted on the framework of the hoist at a greater height that the upper end of the displacement path of the carriage and has one end connected to the carriage while the other end is connected to a counterweight. The supporting frame has such a weight that as long as it is not carried by a container floating in the water below the hoist, the carriages are, in their lowermost position, held in vertical guiding means while the upwardly directed pulling forces exerted by the counterweights are overcome. When, however, the supporting frame is deposited on the floating container and the latter is lifted by a wave, the winch cables are correspondingly relieved. However, these cables do not become slack because the counterweights will pull the carriage in the vertical guiding means upwardly to such an extent that the cables remain tight.

A device of the above mentioned type has the drawback that the vertical guiding means of the carriages have to be so long that they will at least permit a guiding stroke which corresponds to the maximum wave crest to be expected. This calls for a corresponding height of the hoist which is designed in the form of a gantry crane.

A further drawback of the above mentioned heretofore known device consists in the following. When the supporting frame deposited on the floating container has been coupled to the container, and when the container is subsequently to be lifted out of the water by means of the cable winches, the lifting speed is, in view of the considerable weight of the container, lower than the speed at which the container is lifted through a crest. Consequently, the winch cables will, when the container during the period of starting the winch drive is in a valley of a wave, first not yet be loaded by the weight of the container. The winch cables are in this instance held tight only by the counterweights which pull the carriages by means of the upper blocks in the vertical guiding means upwardly to such an extent as it is called for by the preponderance of the rising velocity of the wave crest over the pulling-in velocity of the winch cables. However, as soon as the wave crest is succeeded by a wave valley, the container, which now moves the high speed downwardly, will pull the carriage downwardly against the resistance of the counterweights because the lifting effect of the cable winches can occur only when the carriages have arrived at the lower end of the vertical guiding means and thus form a counterbearing or support for the winch cables. This, however, is accompanied by a considerable shock because the carriages deposit themselves at a considerable speed upon the lower end abutments of the vertical guiding means and since at the very instant the pulling forces exerted by the winch drums become effective in the winch cables. Such shock also occurs when the container at the time the winch drives are turned on is on a wave crest and therefore the carriages are by the counterweights in the vertical guiding means pulled upwardly to a corresponding extent. Immediately after the winch drives have been turned on, the carriages are, by the winch cables which on one hand are pulled in by the winch drums and on the other hand are pulled downwardly by the container, moving downwardly on the water at high speed moved to the lower end abutments of the vertical guiding means so that they abut in a shock-like manner while at the same instant the winch cables are put under load by the weight of the container. Such shock-like loads are, of course, harmful to the device inasmuch as they may cause a break of the cables, damage the bearing means or cause other damages to the crane. The above mentioned heretofore known device is therefore satisfactory only in quiet water or at rather low sea movements.

It is, therefore, an object of the present invention to provide a device of the above mentioned general type which, however, will overcome the drawbacks outlined above.

It is another object of this invention to provide a device as set forth in the preceding paragraph which will permit a satisfactory lifting of containers out of the water or lowering the containers into the water even in heavy seas.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 is an end view of a container floating in the water and shows the stern of a ship equipped with the device according to the invention.

FIG. 2 diagrammatically illustrates a view of a corner of a supporting frame and also shows the pertaining cable winch as well as a pertaining holding device. 6 FIG. 2*a* shows on a considerably larger scale than FIG. 2 a right-hand upper portion of FIG. 2.

FIG. 2*b* shows a section along the line II*b*–II*b* of FIG. 2*a*.

FIG. 3 diagrammatically illustrates two cable winches with driving units.

FIG. 4 illustrates a vertical section through a corner of a supporting frame of a modified construction.

FIG. 5 is a side view of a portion of a container in a design corresponding to the supporting frame of FIG. 4.

FIG. 6 shows the upper portion of FIG. 5 as seen in the direction of the arrow A.

FIG. 7 illustrates a section taken along the line VII–VII of FIG. 8 and, more specifically, illustrates a vertical section through a cable pot and also shows a supporting frame with suspension cables and a container suspended thereon.

FIG. 8 is a top view of FIG. 7 while omitting the block rollers.

FIG. 9 is a section taken along the line IX–IX of FIG. 10 and shows a corner of the supporting frame with the pertaining suspension means and an abutment member of the container.

FIG. 10 illustrates a section taken along the line X–X of FIG. 9.

FIG. 11 is a section taken along the line XI–XI of FIG. 9.

FIG. 12 shows a side view of the stern of a ship with a floating container and with a device for transloading such container.

FIG. 13 is a rear view of the ship, of the container and of the device according to the invention.

FIG. 14 represents a section taken along the line XIV–XIV of FIG. 13.

FIG. 15 is a cross section through a rigid intermediate member between two supports showing one support in view and showing parts of a rod and of a container.

FIG. 16 is a top view of the arrangement of FIG. 15.

The above outlined objects have been realized by a wave following drum to which each winch cable is connected by means of another strand of the block system so that it can be wound off from and wound onto said drum. The said wave following drum has associated therewith a pull motor which is so connected to said drum as to tend to wind up the cable strand while the winding-off of the cable strand can be prevented by a free-wheel holding device. Advantageously, the free-wheel holding device is equipped with a brake and with a load pressure blocking coupling, and an auxiliary motor is adapted after disengagement of the brake to act at high speed upon a part of the load pressure blocking coupling connected to said brake

so as to wind off the cable strand from the wave following drum.

According to one embodiment of the invention, the connection and disconnection of the supporting frame with and from the containers is effected by simple means in a particularly reliable manner by the fact that coupling members mounted on the supporting frame are provided with bores for receiving upwardly extending studs on said containers, and transverse openings therein in which latches are guides which are adapted to be passed through recesses of the studs. Furthermore, feeler members extend in or beyond the upper ends of the bores of the coupling members and are operatively connected to switches which are adapted in response to the feelers being adjusted by the studs entering said bores to put into action driving means for passing the latches through the extensions of the studs. For instance, the coupling members may be in the form of swingable bells which are suspended on the block rollers and are provided with pyramidal hollow chambers. The corresponding pyramidal abutment members are each provided with a slot adapted to be engaged by two hooks which are mounted in the bell in the form of a pendulum, after said hooks have been spread to such an extent that that part of the abutment member which is located above the slot will be able to pass between said hooks.

According to the present invention, provision is made that also when considerable movements occur between the floating container and the ship in view of heavy seas and wind, it will be assured that the supporting frame is reliably coupled to the container while collisions between the floating container and the ship, especially the rudder of the ship and the ship propeller will be excluded. This will be realized by the fact that for supporting a floating container, movable supports are arranged in approximately horizontal direction on the ship or the like which are displaceable in vertical direction and are so arranged that the container when engaging said supports will occupy a position which is suitable for lifting the container out of the water and depositing the container on the ship, and vice versa. Preferably, two supports are by means of a rigid intermediate member held horizontally spaced from each other at a distance which approximately equals the distance between two connecting members provided on the longitudinal container for coupling the supporting frame. In this way, a particularly favorable absorption of the supporting forces is made possible. The floating container is expediently so connected to said supports that the latter will be able to follow the movements of the container in upward and downward direction when the container moves upwardly and downwardly on the waves. This connection has to be made ineffective when the container is to be lifted out of the water. To this end, the supports are designed as magnets which can selectively be energized and deenergized.

In order to assure that the supports will, independently of the waves, always automatically occupy the proper position of height for keeping the floating container in readiness for docking, the rigid intermediate member between the support is designed as a floating body. The said supports may for their upward and downward movements slide for instance on vertical guiding means mounted on the body of the ship. A particularly simple and reliable guiding of the supports in the direction of height may, however, be realized by supporting the supports on the ship or the like by rods in joints which permit a swinging of the rods upwardly and downwardly.

Referring now to the drawings in detail and in particular to FIGS. 1, 12 and 14, the stern of the ship 1 is provided with supports 2 which in the manner of a fork extend rearwardly. A container 3, which is able in loaded condition to float in the water, may, by means of a tug boat, be so moved in to the space between said supports 2 that its vertical longitudinal central plane approximately coincides with the vertical longitudinal central plane of the ship. In order to prevent the container from carrying out any material horizontal movements, guards 4 are provided which are adapted from the lower edges of the support 2 to be moved hydraulically to those portions of the side wall of the container 3 which protrude from the water.

The supports 2 have mounted thereon rails 5 on which a gantry crane 6 is adapted to move. Crane 6 has four cable winches with drums 7 as shown in FIG. 1 and is furthermore equipped with wave following drums 8 which will be described further below. The winch cables 9, which are adapted on one hand to be wound off and onto the winch drum 7 and on the other hand are adapted to be wound off or onto the wave following drums 8, pass below block rollers 10 which are mounted at the corners of a rectangular supporting frame 11 and more specifically the top side thereof. From the corners of the supporting frame 11, coupling studs 12 protrude downwardly and taper to a point. These studs 12 are rotatably journalled in the supporting frame 11 for rotation about their vertical axes and have bayonet extensions 13. Furthermore, the supporting frame 11 is provided with corner guiding means 14 known per se.

When the supporting frame 11 is, by means of cable winches, deposited upon the container 3, the coupling studs 12 enter corresponding bores which are provided in the reinforced corners of the container. When the supporting frame 11 rests on all four corners upon the container 3, a motor is, by means of a switch 15, turned on by means of which the four coupling studs are, through the intervention of a chain turned about their vertical axes in such a way that the bayonet extensions 13 pass behind corresponding bayonet extensions in the container so that the supporting frame 11 and the container 3 are firmly coupled together. The switches 15 are actuated by levers 16 which are so arranged in the supporting frame 11 in the vicinity of the coupling studs 12 that one arm each protrudes downwardly with regard to the bottom side of the supporting frame 11 as long as the supporting frame 11 has not yet been deposited on the container. The switches 15 are furthermore actuated by levers 16 in such a way that the levers 16 can, when the supporting frame rests on the container, be pivoted in such a way that they actuate the switches 15.

As will be seen from FIG. 2, each winch cable 9 (for each corner of the supporting frame 11 there are provided for instance two parallel winch cables) has one end connected to the winch drum 7 while the other end is connected to the wave following drum 8. The winch drums 7 are, through counter gears 17, operatively connected to a motor 18 the shaft of which is equipped with a holding brake 19. The wave following drum 8 is, through a bearing stud at one end face and through a counter shaft, in driving connection with a pull motor 20. When motor 20 is turned on, it will exert upon the drum 8 a torque so as to wind the winch cable 9 upon these drums. This torque is of such a magnitude that it will be overcome by that portion of the weight of the supporting frame 11 which acts at this corner in the cables 9.

That end face of drum 8 which is located opposite to the motor 20 is open. From this side a shaft 21 pertaining to the load pressure blocking coupling extends into the interior of the drum 8, shaft 21 being provided with counter-running threads. Nuts in the form of two discs 22 are mounted on said threads while between said discs 22 coupling discs are provided. A group 23 of these discs is non-rotatable relative to the discs 22, whereas the discs 24 of the other group which are located between said first mentioned discs and the discs 22 are non-rotatable relative to the wave following drum 8.

Shaft 21 is, through a transmission 25, drivingly connected to an auxiliary motor 26 the shaft of which is provided with a holding brake 27. The direction of the pitch of the threads on shaft 21 is so selected that when the cables 9 are loaded by a load in lowering direction, the discs 22 will in view of the disc flange on shaft 22 be screwed toward each other so that the discs 23 and 24 will frictionally engage each other and hold the drum 8 fast provided that the brake 27 is closed and thus the driving gear 25 and shaft 21 are held stationary.

In this condition, the drum 8 will, when the load is suspended, form a fixed point for the cables 9. If in view of the lifting of the container through a wave crest, the cables 9 are relieved, said cables 9 will be held taut by the effect of the tightening motor 20 because in this instance, in view of the reversal of the direction of the force, the discs 22 will on the

counter-running threads of shaft 21 move away from each other and will eliminate the frictional connection between the discs 23 and 24 with the exception of a small amount.

The above function will thus occur when shaft 21 is held stationary by the brake 27. As soon as with the brake 27 disengaged, the auxiliary motor 26 will, with regard to drum 8, rotate in lowering direction, the discs 22 and 23 will in view of the effect of the thread on shaft 21 move away from each other and the disc clutch 23, 24 will be held in disengaged condition. In this instance, the drum is disengaged from the driving gear 25 with the exception of a small friction between the discs. However, the drum 8, in view of the tightening motor 20, can be driven in the direction for winding of the cable. In this condition, the cables 9 can in view of the container being moved by the waves be wound on and off provided that the vertical speed of the drooping of a wave and thereby of the container does not exceed the lowering speed on axis 21 as it is inherent or determined by the auxiliary motor 26.

When the container 3 is, from the position shown in FIG. 1, lifted out of the water and is to be loaded into the ship 1, the following procedure is followed:

First the supporting frame 11 is, by means of the cable winches, lowered to such an extent that it moves closely above the container 3 when the latter is lifted by wave crests. First the ordinary difference in height of the wave crests is observed and at a suitable time when the container is again lifted by a wave crest, the supporting frame 11 is lowered onto the container. To this end, the holding brake 27 is disengaged, and simultaneously the auxiliary motor 26 is turned on. The motor 26 then brings about that the shaft 21 is rotated at higher speed in the direction which corresponds to the winding off of cable 9 from the wave following drum 8. The pull motor 20 is turned off during this procedure. Consequently, the winch cables 9 at the four corners of the supporting frame 11 move under the weight of said frame very quickly off the drums 8 so that the supporting frame 11 is quickly deposited on the container while the coupling pins 12 engage the corresponding bores of the container. As described above, thereupon immediately the coupling pins 12 will, through the intervention of the lever 16 and switch 15, be turned in such a way that a firm bayonet connection will be established at all four corners.

Simultaneously, the pulling motors 20 are turned on. If now the container 3 by means of the supporting frame 11 is lifted off the waves and is lowered, the winch cables 9 remain taut because the motors 20 will wind up these cables always as far as possible upon the wave following drum 8. The auxiliary motors 26 rotate at full speed in lowering direction so that the load pressure blocking couplings 21–24 are kept disengaged.

The movement of the container upwardly and downwardly on the waves is measured by ascertaining the rotations of the rotor of the motors 20. From the thus ascertained values, by means of a differential receiver, the stroke is ascertained which the center of gravity of the container carries out during its upward and downward movement on the waves. Expediently, a plurality of measurements are stored so that the optimum position of height of the container on a crest, in other words, the highest point of the center of the container can be ascertained. When this optimum position of height of the container is subsequently reached again, the holding brake 27 is quickly closed and the auxiliary motor 26 is turned off. Simultaneously, the motors 18 for the winch drums 7 are turned on for lifting. Consequently, the container 3 is lifted off the wave crest. The wave following drum 8 is by the holding brake 27 prevented from turning in the direction of winding off the winch cables 9. The motors 20 will remain in turned-on condition while the container 3 is being lifted out of the water so that the winch cables 9 will remain taut if a subsequent wave should lift the container faster than is effected by means of the cable winches.

If the container being lifted is not held precisely horizontally, this can easily be corrected by controlling the motors 18 of the cable winches accordingly. Of the four winch drums 7, two are connected by a common drive through the intervention of a differential transmission 28 as will be seen from FIG. 3 so that a three-point suspension of the container is obtained.

When the container 3 is lifted by means of the cable winches beyond the height of the deck, it is moved over the loading chamber of the ship 1 by means of the gantry crane 6 moving on rails 5 and is thereupon lowered into the loading or cargo space. The disengagement of the supporting frame 11 from the container is effected by turning back the coupling pin 12.

When a container is unloaded from the ship and, to this end, is to be deposited on the water, the container coupled to the supporting frame 11 is first by means of the gantry crane supported by the supports 2 lowered by means of the cable winches to such an extent that even with crest waves occurring it will not immerse into the water. The operator waits for the passage of a plurality of crest waves in order to ascertain the rhythm at which a maximum wave crest occurs. This observation may be measured by means of a float or water stand indicator and may be stored. At the instant when the highest wave crest occurs, the container is quickly lowered onto the water by opening the holding brake 27 and turning on the auxiliary motors 26. In this connection, the winch cables 9 are always unwound from the wave following drums 8 in conformity with the lowering the containers into the wave valleys because the load pressure blocking couplings are opened and the auxiliary motors 26 rotate in the lowering direction. When the container is lifted with the wave crests, the cables 9 are held taut by means of the motors 20.

When the container moves upwardly and downwardly on the waves, its movement is carefully observed and when the container reaches its highest position on a wave crest, the coupling studs are turned to such an extent that the supporting frame 11 is disconnected from the container. Thereupon, the motors 18 of the cable winches are made effective in the lifting direction and the holding brakes 27 are closed so that the supporting frame will be hoisted.

According to FIGS. 4 and 5, the connection of a container with the supporting frame 11 is effected by means of coupling studs or pins 29 which extend upwardly from the container at the corners thereof and end in a point. These pins 29 will, when the supporting frame 11 is lowered, fit into bores 29*a* which are located at the corners of the supporting frame in corner pieces 30 thereon. For facilitating the introduction of these pins, each corner piece 30 has its bottom side provided with a funnel-shaped opening. 31. The corner pieces 30 are, by means of links 32, equalizing levers 33 and suspensions 34, suspended on the shafts of two block rollers 35.

Each coupling pin 29 has a slot 36. When the coupling pin has completely moved into the bore 29a of the respective corner piece, a flat wedge 37 is, in an upright position, introduced into the slot 36. This wedge 37 is displaceably guided in a transverse opening 38 of the corner piece 30. For purposes of displacement, there may, for instance, be provided a hydraulic cylinder piston system 39. For purposes of actuating this device, there is provided a switch 40 which is under the influence of an angle lever 41. One arm of this lever 41 extends as feeler through a transverse opening into the upper portion of the bore 29*a* of the corner piece 30. When the coupling pin 29 reaches its end position in the bore 29*a*, it pivots the angle lever 41 in such a way that the switch 40 is actuated and consequently by means of the device 39, the flat wedge 37 is passed through the slot 36 of the pin 29.

Each container 3, which in conformity with FIG. 5, is provided with an upwardly extending coupling pin 29, has its bottom side provided with bores into which, when the containers are stacked one upon the other, the upwardly extending coupling pin 29 of the respective lower container may enter with play.

In conformity with FIGS. 7 and 8, the two longitudinal sides of the rectangular supported frame 11 are formed by two supports 45 and the narrow sides are formed by two supports 46. One support 45 and 46 each are interconnected at the corners of the supporting frame by a bell 47. This is effected by means

of two superimposed transverse bolts **48** which are inserted with play into bores of eyes provided on the supports **45, 46** or on the bell. The supporting frame **11** furthermore is provided with an A-shaped structure **49** which has its tip connected to one support **45** by means of a plug bolt coupling **50** and, more specifically, to the center portion of said one support **45**, whereas the two oppositely located ends of said A-shaped structure are connected to one support **46** by means of plug bolt couplings **51**. This A-shaped structure or framework brings about that the supporting frame, with the exception of the slight deviations inherent to the mentioned play, retains a rectangular shape.

Each of the four bells **47** forms a sheet metal box in the form of a prism having a substantially square-shaped base surface and a truncated cone thereon. The bell has a hollow chamber **52** which merges with a downwardly open chamber that in the matter of a pyramid widens in the downward direction. At the inclined walls **53** of said chamber **52** there are provided linings **54** of an elastic material. In conformity with the showing of FIGS. **9** and **10**, the bell **47** is mounted on a connecting member **55** which is located on the container **3** and has the shape of a truncated pyramid. The pyramid surfaces of the connecting member **55** are parallel to the inclined walls **53** in the interior of the bell **47**. Consequently, the linings **54** are tightly engaging said pyramid surfaces.

The bell **47** is suspended on two cables which are looped around two block rollers **35**. The bell **47** is suspended on the shafts of the rollers **35** by means of a compensating lever **33** comprising two metal sheets. Lever **33** is rotatably journalled in the upper portion of bell **47** by means of a bolt **56**. The ends of the compensating lever **33** are by bolts **57** connected to two suspensions **34** which are mounted on the shafts of the rollers **35**.

Journalled on the bolts **56** are two hooks **58,59** of which hook **58** has a hub **60** which extends around the bolt **56** between the two plates of the compensating lever **33** while a leg **61** forming the hook extends downwardly. The other hook **59** has two legs **62** which, by means of hubs **63**, are journalled on bolt **56** between a plate of the compensating lever **33** and an inner wall of the bell **47**. In the particular position shown in FIGS. **9** and **11**, the hooks **58,59** extend from opposite sides into a transverse slot **64** of the connecting member **55**. The horizontal top sides of the hook protrusions engage the bottom side of the part **65** of connecting member **55** which part is located above the slot **64**.

For purposes of spreading the hooks **58** and **59** apart, there is provided a hydraulic cylinder piston system **66**, the piston rod of which is by means of a fork pivotally connected to the leg **61** of the hook **58**, whereas the cylinder is connected to the joint bolts on the two legs **62** of the hook **59**. From the hubs **60** and **63** of the legs **61, 62** thumbs **67** extend upwardly. These thumbs will, in the illustrated coupling position, be equally spaced from a transverse latch **68** arranged in the upper portion of the bell **47**.

In the illustrated coupling position, the two hooks **58** and **59** are coupled by means of the hydraulic device **66**. For purposes of disconnecting the container from the bells **47**, the hydraulic devices **66** are so actuated that the hooks **58,59** are spread apart and thus move out of the slot **64** of the connecting members **55**. The spreading movements of the hooks **58** and **59** are limited by the fact that the thumbs **67** abut the transverse latches **68**.

In order to assure that when placing the bells **47** onto the connecting members **55**, the hooks **58,59** are automatically moved into coupling position, a feeler lever **69** is, within said bell **47**, pivotally mounted by means of a joint bolt **70**. Bolt **70** extends into the hollow chamber **52** in such a way that as long as the bell **47** has not yet engaged the connecting member **55**, said bolt **70** will be located lower than the uppermost surface of the connecting member **55** in the position illustrated in FIGS. **9** and **10**. Accordingly, at the end of the depositing movement of the bell, the feeler lever **69**, which will then engage the top side of the connecting member, is pivoted upwardly. During this movement, an upwardly extending arm **71** of the feeler lever is pivoted and thereby a switch **72** arranged in the bell is actuated. This brings about that pressure fluid is conveyed to the hydraulic device **66** in such a way that this device will move the previously spread hooks **58, 59** into the closing position shown in FIG. **9** and will hold said hooks in this position.

The pressure fluid for the hydraulic devices **66** in the four bells **47** of the supporting frame is supplied by a pump unit **73** which is mounted on the structure **49**. The electric drive motor for the pump of this unit is supplied with current by a cable **74** which hangs downwardly from the carriage carrying the supporting frame **11** and which, when the supporting frame is lifted, is in the manner of a screw deposited within a cable basket **75** mounted on the structure **49**. In contrast thereto, when the supporting frame is lowered, the cable **74** is more or less lifted out of the cable basket. However, it is also possible, instead of the cable basket **75**, to provide a cable drum on the structure **49** onto which drum the cable is increasingly wound by a pull motor when the supporting frame **11** is lifted, whereas during a lowering of the supporting frame **11** the cable **74** is, against the resistance of said motor, increasingly wound off the drum.

The hooks **58, 59** have their bottom side provided with inclined surfaces **76**. These surfaces will, when the bell **47** is lowered onto the connecting member **55**, engage two inclined pyramidal surfaces of the connecting member in such a way that the hooks **58,59** will, during the further lowering of the bell **47**, be spread in the necessary manner if the hooks **58, 59** should not have been sufficiently spread before.

Inasmuch as the transverse bolts **48**, by means of which the supports **45, 46** are connected to the bells **47**, are with a play plugged into the bore of the connecting eyes, the four bells **47** will, when being deposited upon the connecting members **55**, be able to adapt themselves to said connecting members so that minor lack of precision in the spacing of the centers of the bells **47** from each other or of the connecting members **55** can be compensated for.

According to the showing of FIGS. **12–14**, the container **3** is floating below the chamber confined by the two supports **2**. According to the illustration shown in full lines, the container **3** is supported by a wave crest, whereas according to the showing in dot-dash lines, the container **3** is supported by a wave valley.

In order to assure that the floating container **3** will not be pushed by waves and wind in forward direction against the stern of the ship whereby it might damage the rudder **100** or the propeller **101** of the ship, the ship body is provided with means described further below for supporting the container in approximately horizontal direction.

In two recesses **102** located in the stern of the ship on both sides of the vertical longitudinal central plane of the ship and open in downward direction, there are provided two bars or rods **103** each having its front end journalled in joints **104** with axes extending transverse to the ship. The rear ends of the two rods **103** are in bolt joints **105** (FIGS. **15** and **16**) connected to two magnets **106**. These magnets have vertical engaging surfaces **107** representing the pole shoe surfaces. The magnets **106** are, by an intermediate member, rigidly connected to each other, which intermediate member is formed by a floatable sheet metal box **108** closed on all sides. This box **108** has such buoyancy that the magnets **106** supported thereby will always protrude to a considerable extent from the water. The length of the box **108** is so dimensioned that the central spacing between the magnets **106** when measured in horizontal direction equals the distance on a longitudinal side of container **3** between the center lines of the connecting members **55** from each other. Therefore, the container is able by means of the steel supporting columns **109** to engage the surfaces **107** of magnets **106**, said columns **109** extending below the connecting members **55** within the longitudinal wall of the container in downward direction.

The magnets **106** are in the manner of crane-load magnets provided with energizing coils **106***a*. The current is supplied to the magnets **106** by cable **106***b*. The magnetic force created by the exciting current brings about that the magnets **106** stick to the columns **109** and, more specifically, in the lower region thereof which immerse into the water.

Within the sheet metal box **108** on that side which faces away from the container, there is provided a counterweight **110** which acts counter to the weight of the magnets **106** and the ball joints **105** with the adjacent parts of the bars **103** so that the box **108** will not be tilted or edged about a horizontal transverse axis, in other words, so that the upper and the lower confining plate of the box will be located horizontally.

Each bar **103** comprises a central portion **111** formed by a pipe and two rods telescopically guided therein. One of said rods is journalled in the ball joint **105** on one of the magnets **106**, whereas the other rod is, by means of joint **104**, connected to the body of the ship. In the interior of the central portion **111**, there are provided conical springs **113** which have the tendency to move the rods **112** outwardly and which ordinarily press the same under a preload against the abutments of the central member **111**. This preload is overcome when the container **3**, by means of a shock, hits the magnets **106** so that the rods **112** immerse deeper into the central member **111**.

Within the box-shaped support **2** there are provided cable winches **114** (FIG. **13**), the cables **115** of which are passed over guiding rollers **116,117** in a direction transverse to the vertical longitudinal central plane **118** of the ship and while crossing each other extend to the connecting points **119** at the ends of the box **108**.

The box **108** has furthermore connected thereto two cables **120** which extend in vertical direction to guiding rollers **121** and from there pass to non-illustrated winches in the interior of the stern of the ship.

Flat arms **123** are, slightly above the beams **122** on both sides of the framework of gantry crane **6**, mounted in such a way that they can be pivoted in joints with axes extending parallel to the longitudinal direction of the ship. The arms **123** are adapted from the position indicated in dot-dash lines in FIG. **13** in which they are folded upwardly, to be folded into the gate opening **6** until they engage abutments as shown in FIG. **13** in full lines and also in FIG. **14**. In this position, two strands of the lifting cables **9** which lead to those corners of frame **11** which face away from the stern of the ship, engage the inner edges of trapezoidal recesses of arms **123** when the supporting frame **11** is lowered deeply. In this way, the supporting frame **11** is prevented from carrying out any material pendulum movements which would interfere with the placing of the supporting frame on the floating container.

Containers **3** to be loaded onto the ship are successively by means of tug boats moved to the stern of the ship until they engage the magnet **106** below the chamber between the supports **2**. In this connection, it is assumed that the cables **120** are disconnected from the sheet metal box so that the latter is free-floating. Consequently, the rods **103**, depending on the height position of the floating container **3**, can in joints **104** swing upwardly and downwardly. The container **3** is, by rods **103**, prevented from approaching the stern of the ship more than is necessary so that a collision with the rudder **100** of the ship or the ship propeller **101** will be safely avoided. Any possible push in horizontal direction is absorbed by the preloaded springs **113**. The magnets **106** are so energized that they will stick to the respective supporting column **109**.

By means of the winches **114**, thereupon the box **108** together with the floating container **3** is aligned transverse to the ship in such a way that it will be located as symmetrically as possible with regard to the vertical longitudinal central plane **118** of the ship.

Thereupon, the supporting frame **11** is placed upon the container **3** which moves upwardly and downwardly on the waves and is locked to said container whereupon the container by hoisting means or gantry crane **6** is lifted out of the water and after a corresponding movement of said crane on rails **5**, is lowered into the cargo space of the ship. Prior to lifting the container out of the water, the magnets **106** are deenergized so that they will release the container.

When a container by means of the gantry **6** is withdrawn from the cargo space of the ship **1** and is to be lowered onto the water, the crane **6** is first moved to the outermost end of the rails **5** on supports **2**. When, subsequently, the container has been lowered onto the water, it is pulled until it engages the magnet **106**, said pulling being effected by corresponding movement of crane **6**. When the container is then held by the magnets **106**, the supporting frame **11** is disconnected from the container and pulled upwardly. In this predetermined position of the floating container, the latter is then pulled away by a tug boat or the like while the magnets are deenergized. When the means for supporting the floating container are not necessary, or are not in use, said means are, by cables **120**, lifted so that the box **108** with the magnets **106** can be connected to the stern of the ship above water level.

It is, of course, to be understood that the present invention is, by no means, limited to the particular showing in the drawings but also comprises any modifications within the scope of the appended claims.

What is claimed is:

1. A device for handling containers, especially for use as a crane in load transfer near water and relative to a pier, a ship and the like, comprising a main frame, a support frame, elements of coupling means on the support frame for interfitting cooperation with complementary elements of coupling means on a container to connect a container to said support frame, winch means and drum means on the main frame and cables leading from the winch means to the support frame and about idlers thereon and back to said drum means, main motor means for reversibly driving said winch means to effect raising and lowering movements of said support frame, auxiliary motor means connected to said drum means energizable for biasing said drum means in cable take up direction, said auxiliary motor means exerting a torque on the drum means less than that imposed thereon by the weight of said support frame whereby the cables are held taut when the support frame rises and falls due to wave action, holding means operatively connected to said drum means and selectively operable to permit rotation of said drum means in cable take up direction by said auxiliary motor means while preventing rotation of said drum means in cable pay-out direction or for permitting rotation of said drum means in either direction, said holding means comprising a free wheeling coupling having one side connected to the drum means, a selectively operable brake connected to the other side of said free wheeling coupling, said coupling permitting rotation of said drum means in one direction only when said brake is actuated, and a holding motor connected to said other side of each coupling and operable when said brake is released to drive said other side of said free wheeling coupling in cable pay-out direction.

2. A device according to claim **1**, in which said drum means is hollow and is open at one end, said free wheeling coupling being disposed inside said drum means and being connected with said brake and holding motor through the open end thereof.

3. A device according to claim **2**, in which said free wheeling coupling is in the form of a disc clutch and comprises first disc means connected to the drum means to rotate therewith, a shaft coaxial with the drum means forming the connection of the free wheeling coupling with said brake and holding motor, second disc means carried by said shaft and including a pair of discs on opposite sides of said first disc means and threads of respectively opposite band connecting said pair of discs wit h said shaft.

4. A device for handling containers, especially for use as a crane in load transfer near water and relative to a pier, a ship and the like, comprising a main frame, a support frame, elements of coupling means on the support frame for interfitting cooperation with complementary elements of coupling means

on a container to connect a container to said support frame, winch means and drum means on the main frame and cables leading from the winch means to the support frame and about idlers thereon and back to said drum means, main motor means for reversibly driving said winch means to effect raising and lowering movements of said support frame, auxiliary motor means connected to said drum means energizable for biasing said drum means in cable take up direction, said auxiliary motor means exerting a torque on the drum means less than that imposed thereon by the weight of said support frame whereby the cables are held taut when the support frame rises and falls due to wave action, holding means operatively connected to said drum means and selectively operable to permit rotation of said drum means in cable take up direction by said auxiliary motor means while preventing rotation of said drum means in cable pay-out direction or for permitting rotation of said drum means in either direction, said elements of coupling means on said support frame being actuatable into locked position with the complementary elements on a container, a drive for simultaneously actuating said elements on the support frame into locking position, and control means on the support frame operable in response to the interfitting of all of the said elements on the support frame with the corresponding elements on a container to actuate said drive in locking position, said elements of coupling means on said support frame comprising studs projecting downwardly therefrom and adapted for being received in sockets in a container, said studs locking in said sockets upon rotation of the studs, said drive being operable for rotating said studs.

5. A device for handling containers, especially for use as a crane in load transfer near water and relative to a pier, a ship and the like, comprising a main frame, a support frame, elements of coupling means on the support frame for interfitting cooperation with complementary elements of coupling means on a container to connect a container to said support frame, winch means and drum means on the main frame and cables leading from the winch means to the support frame and about idlers thereon and back to said drum means, main motor means for reversibly driving said winch means to effect raising and lowering movements of said support frame, auxiliary motor means connected to said drum means energizable for biasing said drum means in cable take up direction, said auxiliary motor means exerting a torque on the drum means less than that imposed thereon by the weight of said support frame whereby the cables are held taut when the support frame rises and falls due to wave action, holding means operatively connected to said drum means and selectively operable to permit rotation of said drum means in cable take up direction by said auxiliary motor means while preventing rotation of said drum means in cable pay-out direction or for permitting rotation of said drum means in either direction, means for energizing said auxiliary motor means in response to the coupling of said support frame to a container, vertical movements of the center of gravity of a container coupled to said support frame being ascertained from the rotation of said auxiliary motor means and said brakes and holding motors being controlled in conformity therewith.

6. A device according to claim **5**, in which pulses are derived from said auxiliary motors upon rotation thereof and a storage device is provided for storing said pulses.

7. A device for handling containers, especially for use as a crane in load transfer near water and relative to a pier, a ship and the like, comprising a main frame, a support frame, elements of coupling means on the support frame for interfitting cooperation with complementary elements of coupling means on a container to connect a container to said support frame, winch means and drum means on the main frame and cables leading from the winch means to the support frame and about idlers thereon and back to said drum means, main motor means for reversibly driving said winch means to effect raising and lowering movements of said support frame, auxiliary motor means connected to said drum means energizable for biasing said drum means in cable take up direction, said auxiliary motor means exerting a torque on the drum means less than that imposed thereon by the weight of said support frame whereby the cables are held taut when the support frame rises and falls due to wave action, holding means operatively connected to said drum means and selectively operable to permit rotation of said drum means in cable take up direction by said auxiliary motor means while preventing rotation of said drum means in cable pay-out direction or for permitting rotation of said drum means in either direction, said elements on said support frame comprising downwardly opening socket-like members, said elements on the container comprising upstanding members receivable in the socket-like members, openings in the sides of said members, and hooks pivoted on the socket-like member and having end parts adapted to enter said openings and lock said socket-like member and upstanding members together.

8. A device according to claim **7**, in which each socket-like member includes a feeler engageable by the corresponding upstanding member, each feeler controlling the actuation of the respective hooks.

9. A device according to claim **7**, in which each socket-like member includes elastic lining means for engagement with the lateral surfaces of the corresponding upstanding member.

10. A device according to claim **7**, in which said support frame has side and end rails and said socket-like members are swivelly connected to the corners of the frame.

11. A device according to claim **10**, in which the rails are connected together with lost motion at the corners of the frame and an auxiliary frame is provided connected to said support frame and retaining it in substantially rectangular shape.

12. A device according to claim **11**, which includes a power supply for actuating the hooks of said socket-like members and mounted on said auxiliary frame, a power cable leading to said power supply, and a device for storing lengths of power cable and also mounted on said auxiliary frame.

13. A device for handling containers, especially for use as a crane in load transfer near water and relative to a pier, a ship and the like, comprising a main frame, a support frame, elements of coupling means on the support frame for interfitting cooperation with complementary elements of coupling means on a container to connect a container to said support frame, winch means and drum means on the main frame and cables leading from the winch means to the support frame and about idlers thereon and back to said drum means, main motor means for reversibly driving said winch means to effect raising and lowering movements of said support frame, auxiliary motor means connected to said drum means energizable for biasing said drum means in cable take up direction, said auxiliary motor means exerting a torque on the drum means less than that imposed thereon by the weight of said support frame whereby the cables are held taut when the support frame rises and falls due to wave action, holding means operatively connected to said drum means and selectively operable to permit rotation of said drum means in cable take up direction by said auxiliary motor means while preventing rotation of said drum means in cable pay-out direction or for permitting rotation of said drum means in either direction, supporting means adapted for connection to a ship and operable to engage a container floating in the water and hold the container in spaced relation to the ship, said supporting means being vertically movable relative to the ship, said supporting means comprising a pair of laterally spaced rods, an intermediate member extending laterally between the outer ends of said rods and fixedly interconnecting said outer ends of said rods, and electromagnets on the outer ends of said rods adapted to engage magnetic regions o said container.

14. A device according to claim **13**, in which said intermediate member is bouyant and holds the outer ends of said rods near the surface of the water.

15. A device for handling containers, especially for use as a crane in load transfer near water and relative to a pier, a ship and the like, comprising a main frame, a support frame, ele-

ments of coupling means on the support frame for interfitting cooperation with complementary elements of coupling means on a container to connect a container to said support frame, winch means and drum means on the main frame and cables leading from the winch means to the support frame and about idlers thereon and back to said drum means, main motor means for reversibly driving said winch means to effect raising and lowering movements of said support frame, auxiliary motor means connected to said drum means energizable for biasing said drum means in cable take up direction, said auxiliary motor means exerting a torque on the drum means less than that imposed thereon by the weight of said support frame whereby the cables are held taut when the support frame rises and falls due to wave action, holding means operatively connected to said drum means and selectively operable to permit rotation of said drum means in cable take up direction by said auxiliary motor means while preventing rotation of said drum means in cable pay-out direction or for permitting rotation of said drum means in either direction, two cables being provided at each of two corners of said support frame, and guide means engaging the two cables at each said corner to inhibit swaying of a container, each said guide means comprising a plate notched on one edge to receive the cables to be guided thereby, and means pivotally supporting each plate to permit movement of the plate out of the path of the support frame.

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