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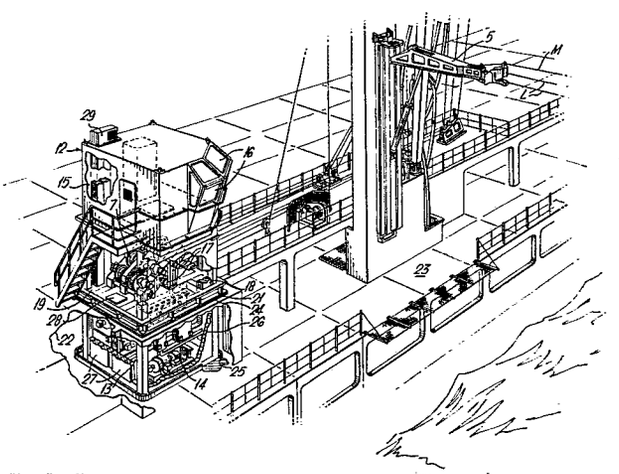
(54) Shipboard installation for use in solid and/or fluid transfer systems.

(57) A R.A.S. supply ship installation in which winches, power converters for supplying power thereto, and a control unit are located in a unitary structure which can be installed in the ship as a substantially complete unit.



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This invention relates to ship-board installations for use in systems employed for transferring solid loads such as stores or other equipment, and/or fluids such as fuel oil, from one ship to another whilst the ships are at sea, or between a ship and a marine oil-rig or platform. Such Replenishment-at-Sea (R.A.S) systems, as they are commonly referred to, consist essentially of a main installation on a supply ship, comprising a support arm for one or more lines carrying transfer equipment, winches for maintaining a predetermined tension in the line or lines and for controlling the movement of the transfer equipment, power units for the winches and control equipment therefor.

In the case of solid loads the transfer equipment may, for example, consist of a load traveller movable along a support line such as a jackstay between a swinging arm on the supply ship and a suitable terminal on the receiving ship or other structure, hereinafter referred to simply as the receiver, and for the bulk transfer of fluids the transfer equipment may consist of a flexible pipe supported either from trolleys on a tensioned line extending between the supply ship and the receiver, or from a derrick mounted on the supply ship and capable of being pivoted outwards towards the receiver.

Commonly the winches, the power supplies and the control equipment therefor are mounted at different locations on the supply ship, which is not only wasteful of space, but renders the fitting of the complete installation a somewhat lengthy task.

According to the invention an R.A.S. installation for a supply ship comprises a unitary structure accommodating winches, power converters for supplying power to the winches, and control equipment therefor, the unitary structure being installed in the ship as a substantially complete unit.

Such a structure has the advantage that it can be fabricated separate from the ship, and its installation as a complete unit can be carried out more speedily and efficaciously than the fitting of the individual units separately, as is at present the practice.

Conveniently the structure has an outwardly-directed flange around it and is supported by said flange in an opening in a deck, preferably on an intervening peripheral mat of resilient material, for example of rubber or the like, which also acts as a seal between the flange and the deck.

Where the winches are driven by hydraulic motors, the power converters may, for example, comprise electrically driven hydraulic pumps, and in the case where the winches are driven by electric motors the power conversion may be provided by suitable convertors or inverters connected to the ship's electrical supply.

In the case where the installation is located on a ship designed to carry a bulk supply of oil or other liquid which can give off highly flammable vapours the compartment accommodating the power converters is conveniently capable of being hermetically closed apart from a ventilating shaft or shafts terminating well away from the tank or tanks, for example at the top of the installation.

The unitary structure may, for example, have a first compartment accommodating winches, a second compartment accommodating power converters for supplying power to the winches, and a third compartment accommodating control equipment therefor, the unitary structure being installed in the ship as a substantially complete unit.

Preferably in such an arrangement the compartments are located one over the other in the structure which is economical of deck space, the third

compartment comprising a control cabin and being at the top of the structure.

However where deck space is not at a premium the winches, power converters and controls may be disposed at a single level in the structure, and although they may be located in separate compartments, two of them could, in this case, share a compartment, or the structure may be in the form of a single chamber accommodating winches, power converters and controls.

Conveniently the installation is designed for use with combined solid and liquid transfer systems. In such a system there is conveniently provided a swinging arm for solid article transfer, and a derrick for supporting a flexible pipe or pipes for bulk fluid transfer, the latter being designed for operation alternatively in both the "conventional derrick" and "jackstay" modes, as will subsequently be described, depending upon the facilities on the receiver.

One embodiment of the invention will now be described by way of example with reference to Figures 1 to 6 of the accompanying schematic drawings, in which

Figure 1, illustrates diagrammatically a cross section through a supply ship showing two installations in accordance with the invention disposed on opposite sides of the ship,

Figures 2 and 3 represent a plan view and a side view respectively of the relevant part of the supply ship,

Figure 4 represents a perspective view, partly broken away, of one of the installations,

Figure 5 illustrates part of the supply ship showing two different modes of operation of a fluid transfer arrangement, and

Figure 6 shows part of the arrangement on an enlarged scale.

Referring to the drawings there is shown part of a supply ship having, in the mid part of the hull 1, an oil tank or tanks 2, and at one end of the tank section a hold 3 for carrying solid cargo.

The ship carries facilities for transferring both solid loads from the hold 3 and oil from the tanks 2, to other ships, and for this purpose has a plurality of transfer rigs 4 spaced apart above the oil tanks at each side of the ship.

Each of these comprises a swinging arm 5 for use in transferring solid loads, the arm being movable vertically in a frame 6 to enable it to raise a load before being pivoted upwards and outwards to an operating position as shown on the left hand side of Figure 1. In use the load is shared between two lines L forming a continuous loop, and both tensioning of the system and traversing of the load are achieved by winch drums 7, driven by hydraulic motors 17 (Fig 4). A separate line M monitors changes in distance between the supply ship and the receiver, and means are provided for controlling the operation of the winches automatically in response to changes in the distance to maintain a substantially constant tension in the lines for example as described in Patent Specification No. 1185771.

For the transfer of oil from the tanks 2 each of the transfer rigs 4 also incorporates a derrick 8, the two aft derricks in this example being operable in both "conventional derrick" and "jackstay" modes as will subsequently be described. Lines capable of supporting or controlling the movement of a flexible pipe or pipes 10, in accordance with the mode employed are arranged to pass through blocks 34 carried by the swan neck 35 at the top of the derrick mast 36.

These lines 9 (See Figure 5) are also

controlled by winch drums 7.

In accordance with the invention the winch drums 7 associated with a transfer rig 4 are located within the central compartment 11 of a three compartment unitary structure 12, shown more clearly in Figure 4. The structure is approximately square in plan view, the three compartments being located one above the other, with the lowest 13 of the compartments accommodating electric-motor-driven pumps 14 for driving the winch motors 17.

The upper compartment 15 of the structure comprises the control cabin and contains an operators console C, by which the movement of the swinging arm 5, and the derrick 8, and the operation of the winches can be controlled, the cabin being provided with windows 16 so positioned that an operator can observe the loading area at the base of the transfer rig, used for the transfer of solid loads, the upper part of the derrick used for transferring oil, and a receiving ship to which the transfer of a load and/or oil is being effected.

Cable trunking 18 extends between the lowest compartment 13, or "equipment trunk" and the control cabin 15, and hydraulic lines (not shown) extend between the pumps 14 in the equipment trunk and the motors 17 in the winch compartment 11. Although the term compartment has been used for the part of the structure accommodating the winches this is not intended to imply that the winches are necessarily enclosed; the compartment may accordingly be open on all sides although preferably protective plating as at 20 extends at least across the outboard side of the compartment as shown.

The structure is provided, approximately level with the floor 19 of the winch chamber 11, with an outwardly-directed peripheral flange 21 by which it is supported within an opening in a deck 22 immediately

above the loading deck 23. A mat 24 of resilient material is sandwiched between the flange 21 and the deck 22 to prevent vibrations produced in use of the equipment being transferred to the main structure of the ship.

The bottom of the equipment trunk 13 extends into an opening 25 in the loading deck 23, but may at this point be resiliently supported, if desired, against horizontal movements.

The equipment trunk 13 is conveniently a closed structure with sound absorbing walls 26, removable panels 27 being provided in one wall for removal and replacement of the pump units 14 should this be necessary. A hatch 28 in the floor of the winch compartment 11, provides access to the equipment trunk 13 for routine inspection and servicing.

Ventilation of the equipment trunk 11 is effected by means of ducts 29 extending to the top of the structure as shown more clearly in Figure 4.

The installation has six winch drums 7 of which three on one side control the lines for the solid load transfer arrangement and the three on the other side, one of which is stepped for a reason which will subsequently be explained, serve to control the jackstay and three hose troughs 32 used in the two configurations of the oil transfer arrangement.

The winch drums 7 may be arranged in pairs, the two drums of each pair being disposed coaxially and being driven by a common hydraulic motor 17 through clutch/brake units housed centrally between the drums, such that when the solids transfer rig is selected the oil transfer winch drums are declutched and braked and vice versa.

Alternatively however the winches are constructed from modular units as described in patent application No. 8102583, the winch drums of one unit being operatively connected to the swinging arm, for

the transfer of solid loads and the other being operatively connected to the derrick for the transfer of bulk liquids.

In such a case the drums of the individual units are preferably coupled to individual drive motors which may be either hydraulic or electric.

As explained above, for the transfer of oil, the aft transfer equipment can be used either in the "conventional derrick" mode as on the starboard side of the ship shown in Figure 5 or in the "jackstay" mode as on the port side.

In the former case the derrick mast 36 is lowered and the hose troughs 32 are supported directly from the lines 9, this mode of operation being the most suitable for the replenishment of the smaller sizes of receiving ships because the side pull associated with a jackstay is thereby avoided.

In the "jackstay" mode the derrick mast 36 remains in the vertical, housed position, and a jackstay 37, which passes over a pulley block 30 on a separate support arm 31, is used to carry runners 42 from which are supported the troughs 32. This configuration is the one adopted when a "Parker Hannifin" Probe/Receiver system is in use, and is suitable for the larger receiving ships which must, of course, be equipped with a Parker-Hannifin Receiver. In this mode of use a probe 39 fitted to the end of the pipe 10 and being supported by a trolley 40 traversable across the jackstay.

The jackstay winch is arranged to operate under the approximately "constant tension" conditions, and having been set by the operator at the required value will not normally need further attention during a transfer operation.

The arrangement illustrated has four hose troughs 32, and in use the recovery line 9.4 connected to the furthest trough (the No.4 trough) will normally

run slack as the trough will be located by the semi-rigid hose of the "Parker-Hannifin" probe assembly 39. The Nos. 2 and 3 hose troughs are attached to lines 9.2, 9.3 carried by respective parts of the stepped drum, and serve to position these troughs on the jackstay; accordingly in practice it is only necessary for one control to be adjusted by the operator to maintain these troughs in their correct positions with an occasional check to see that the recovery line is still slack.

The hose troughs 32 are conveniently provided with snatch blocks 42 shown more clearly in Figure 6, the blocks having removable guard plates 43 to enable them to be readily and rapidly fitted on to the jackstay 37 when it is required to change from the "conventional derrick" to the "jackstay" mode.

Although the arrangement as above described is employed for transferring oil from the supply ship to a receiving ship it will be appreciated that similar arrangement may also be used for transferring other liquids in bulk.

By arranging for the winches 7 pumps 14 and control cabin for each transfer rig to be housed in a unitary structure 12, not only is the installation of the equipment in the ship facilitated, but more space becomes available for the movement of loads being transferred.

Thus by supporting the structures 12 on a deck 22 above the loading deck 23, a clear covered passage 44 can be provided for the movement of fork-lift trucks or the like carrying stores or other equipment to be transferred to the respective loading areas from lifts 45 (Fig. 2) serving the holds.

Although in the arrangement described above the unitary structures 12 are associated with universal type transfer rigs 4 capable of transferring

solid loads and liquids, this need not necessarily be the case, and such a structure may also be used for the control and operation of rigs arranged to transfer only solid loads, or only liquids. One such rig and its associated control structure for use in transferring solid loads are shown at 46, 47 in Figures 2 and 3, and another rig and associated control structure for use in transferring bulk liquids are shown at 48 and 49.

CLAIMS

1. A replenishment-at-sea installation for a supply ship comprising a unitary structure accommodating winches, power converters for supplying power to the winches, and control equipment therefor, the unitary structure being installed in the ship as a substantially complete unit.

2. An installation according to Claim 1 wherein the unitary structure has an outwardly directed flange around it, and is supported by said flange in an opening in a deck of the supply ship.

3. An installation according to Claim 2 wherein a peripheral mat of resilient material is interposed between the flange and the deck, and also acts as a seal.

4. An installation according to Claim 1, 2 or 3 having a first compartment accommodating the winches, a second compartment accommodating the power converters and a third compartment accommodating the control equipment.

5. An installation according to Claim 4 in which the compartments of the unitary structure are located one over the other in the structure, with the third compartment being the top compartment of the structure.

6. An installation according to any preceding Claim in which the winches are driven by hydraulic motors and the power converters comprise electrically driven hydraulic pumps.

7. An installation according to any one of Claims 1 to 6 in which the winches are driven by electric motors and the power converters comprise electrical converters or inverters connected to the ships electrical supply.

8. An installation according to Claim 4 or 5 in which the compartment accommodating the power

converters is capable of being hermetically sealed apart from one or more ventilating shafts terminating at the top of the installation.

9. An installation according to any preceding Claim in which respective winches are operatively connected to a swinging arm for solid article transfer, and to a derrick supporting a flexible pipe or pipes for bulk fluid transfer.

10. An installation according to Claim 9 in which the derrick is selectively operable in either a "conventional derrick" or a "jackstay" mode.

11. An installation according to Claim 9 or 10 wherein the winch drums are arranged in pairs with the two drums of each pair disposed coaxially and being driven by a common motor through clutch/brake units housed centrally between the drums, one drum of each pair being operatively connected to the swinging arm and the other to the derrick.

12. An installation according to Claim 9 or 10 wherein the winches are constructed from modular units, the winch drums of one unit being operatively connected to the swinging arm, for the transfer of solid loads and the other being operatively connected to the derrick for the transfer of bulk liquids.

13. A unitary structure for a replenishment-at-sea installation substantially as shown in and as hereinbefore described with reference to Figure 4 of the accompanying drawings.

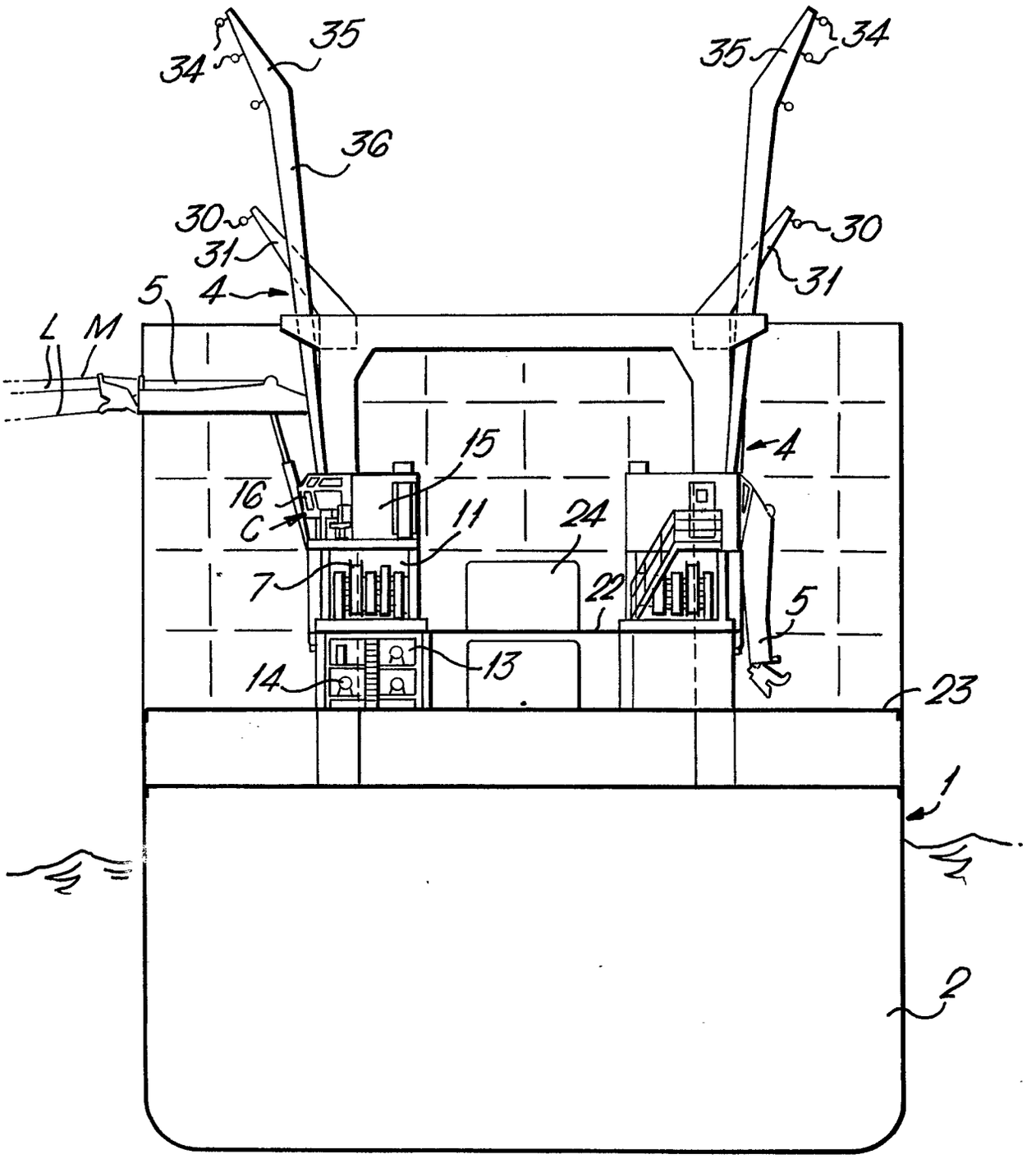
14. A supply ship incorporating at least one installation as claimed in any one of Claims 1 to 12.

15. A supply ship incorporating a plurality of installations as claimed in Claim 5, in which the lower compartment of the unitary structure of each said installation depends into the space between the supporting deck and the deck below, some of the installations being disposed on one side of the ship and others on the other side of the ship, so that

a central covered passage extends along said lower deck between the structures.

16. A supply ship incorporating a plurality of installations as claimed in Claim 5 and substantially as shown in and as hereinbefore described with reference to Figures 1 to 6 of the accompanying drawings.

Fig.1.



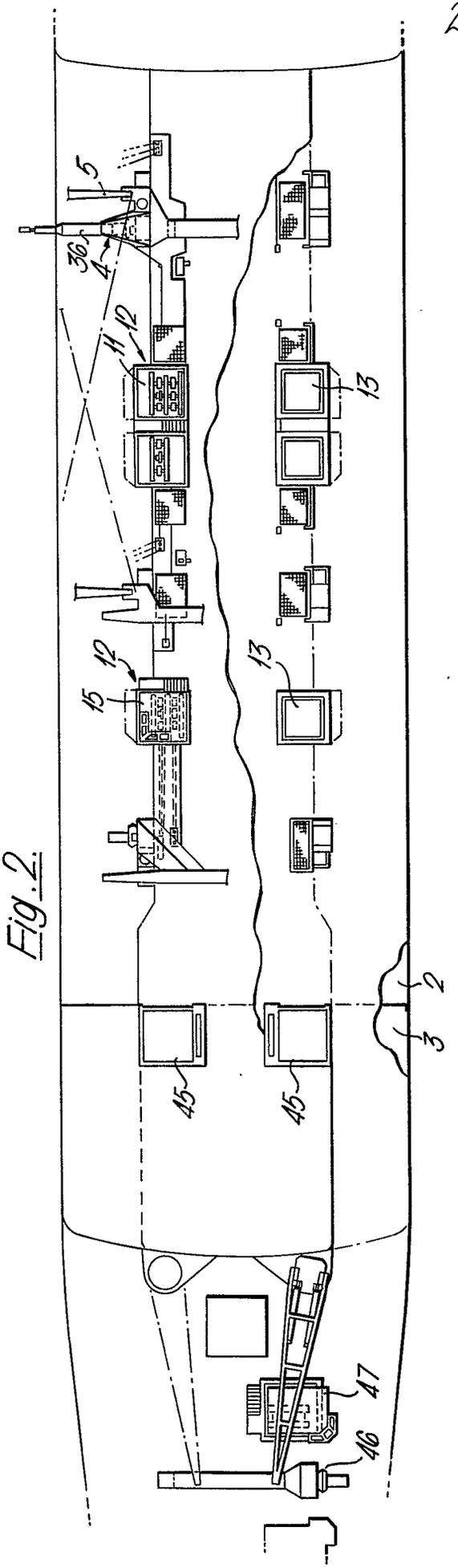

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Fig.2.

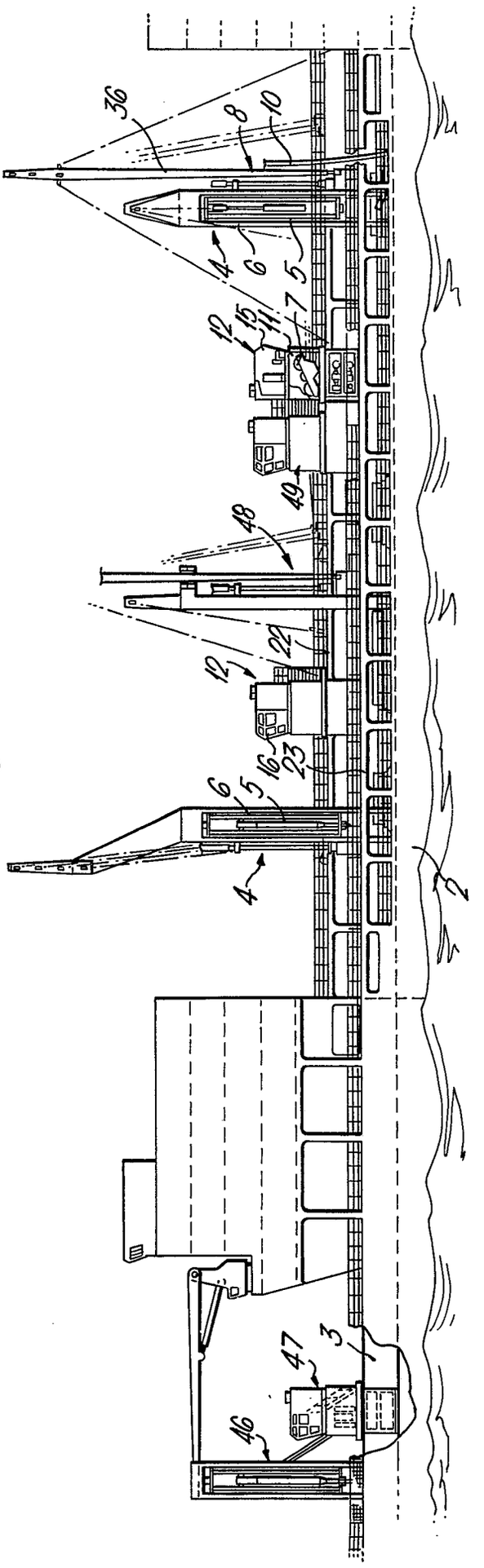
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Fig.3.

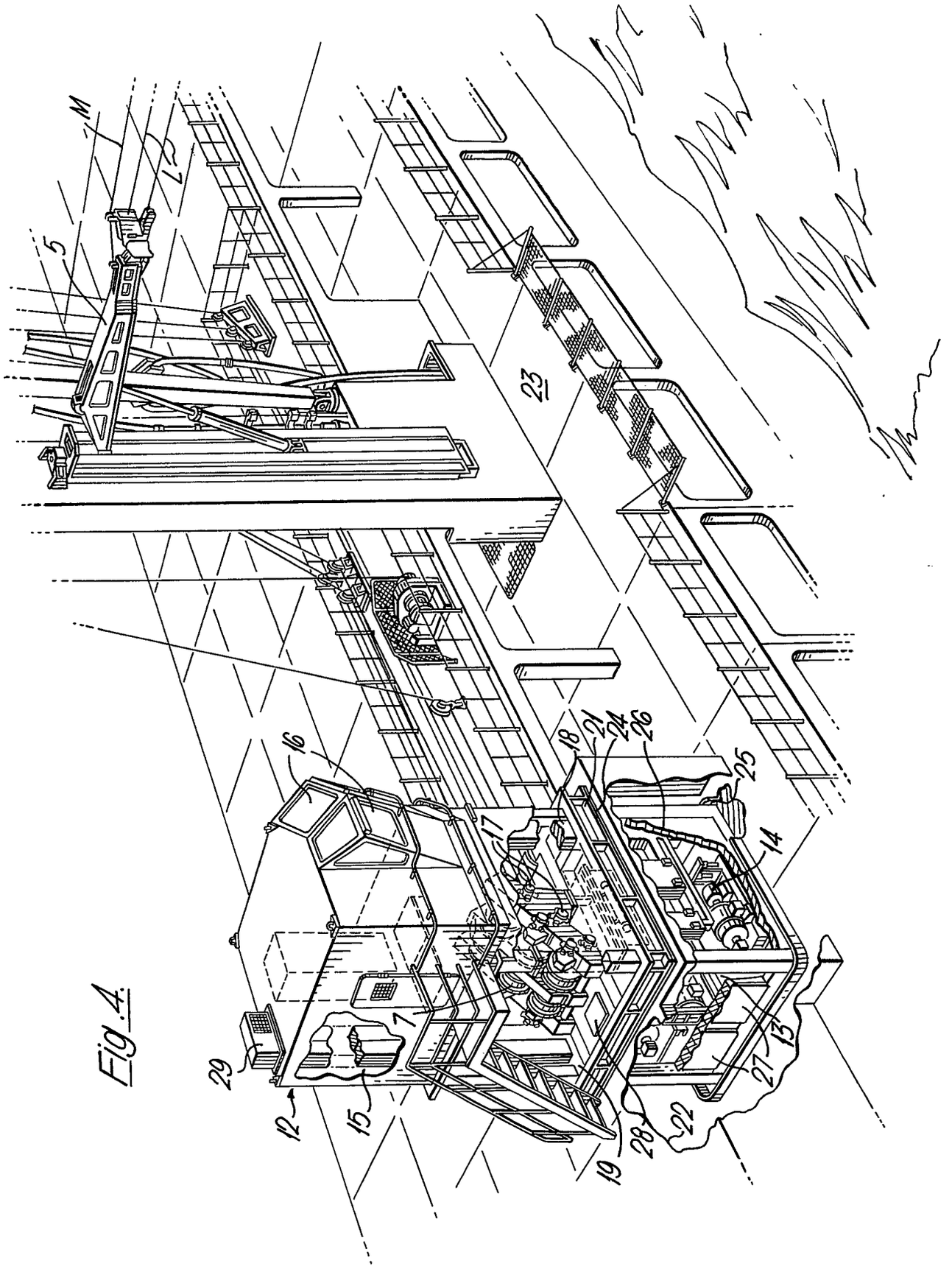

Fig.4.

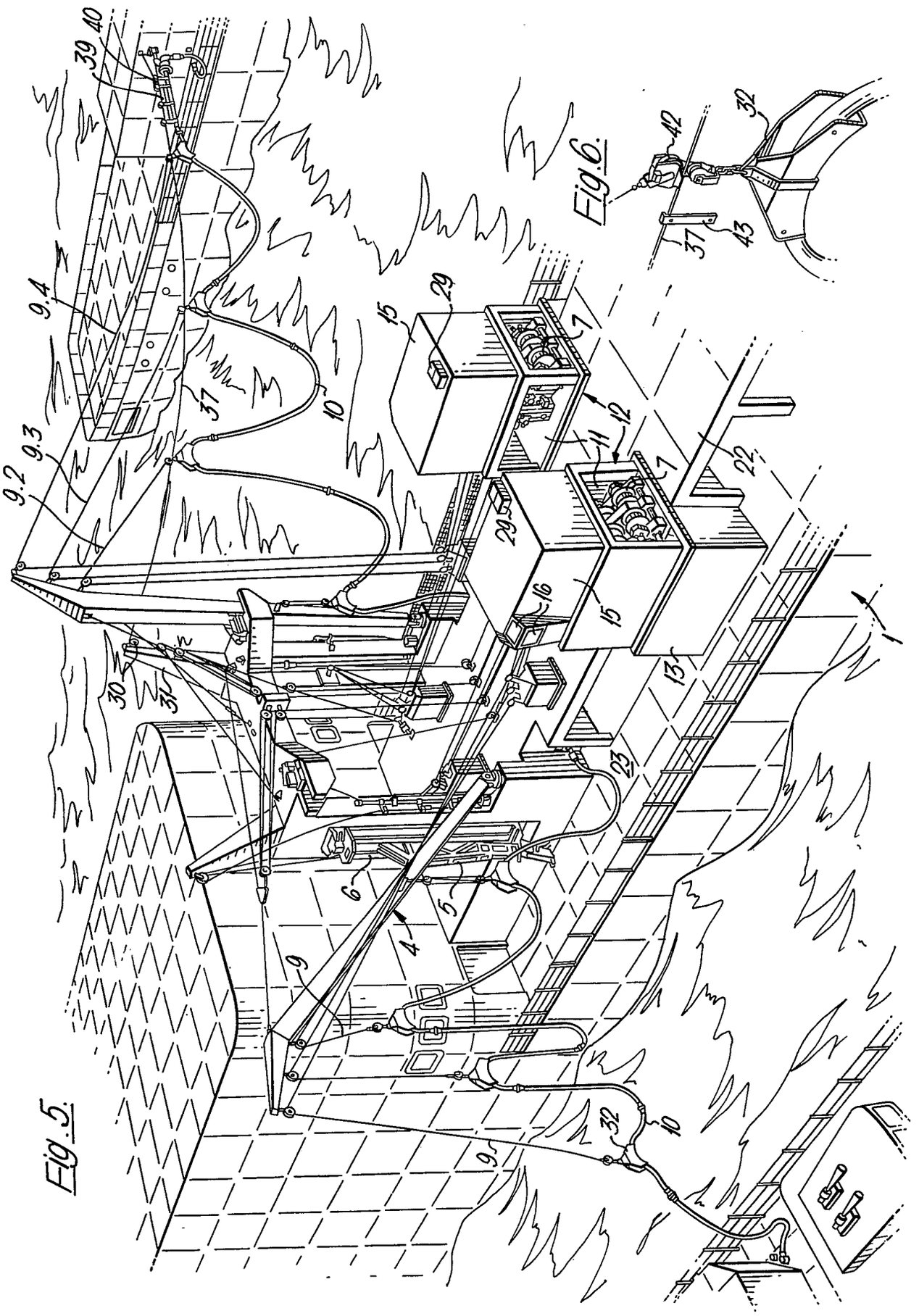
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Fig.5.

Fig.6.

European Patent Office

EUROPEAN SEARCH REPORT

0050420
Application number
EP 81 30 4299

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	DESIGN ENGINEERING, July 1978 Edit. Morgan-Grampian Ltd. London, GB "Advances in cable traction systems", pages 55-58. * Page 55, figure 1 * --	1,6,7, 9-14, 16
DA	GB - A - 1 185 771 (GENERAL ELECTRIC)	
A	DE - B - 1 245 785 (SIEMENS)	
A	NAVAL ENGINEERS JOURNAL, vol. 82, no. 4, August 1970, K.J. MITCHELL "Replenishment at sea", pages 52-62. ----	

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

B 63 B 27/18

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

B 63 B

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
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A: technological background
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T: theory or principle underlying the invention
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D: document cited in the application
L: document cited for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	19-01-1982	DE SCHEPPER

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