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(54) **SELF-SAILING INTEGRATED VESSEL FOR CARRYING AND MOUNTING SUBMERGED TUBES OF UNDERWATER TUNNEL**

(57) A self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel, comprising a first ship body (1), a second ship body (2), connection structures (3, 5) are arranged between the first ship body (1) and the second ship body (2), the first ship body (1), the second ship body (2) and the connection structure (3, 5) are provided with hauling and hoisting devices; a loading space is formed between the first ship body (1) and the second ship body (2) and below the connection structure (3, 5), a to-be-installed member (8) is arranged in the loading space and is connected with

the ship; and the first ship body (1) and the second ship body (2) are provided with propelling power devices (7) and locating devices (9). The ship has self-propelled power for a long distance, can independently transport immersed tubes of various sizes of underwater tunnel without being hauled by other ships, and there is no need to close navigation lanes to other ships during the transportation, thus not affecting the passage of the other ships. The catamaran type ship has a higher stability, and anti-sinking and anti-capsizing capabilities.

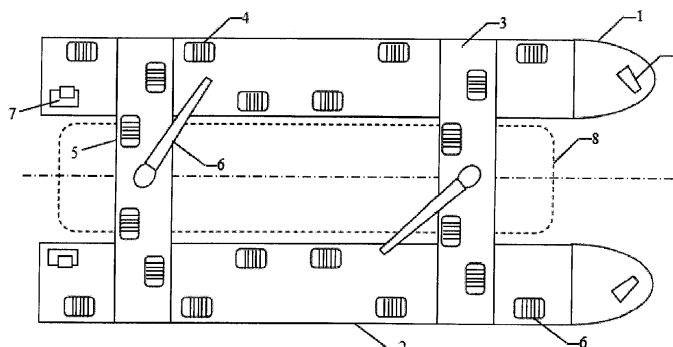


Fig. 1

Description

TECHNICAL FIELD

[0001] The present invention relates to a transportation equipment of cross-river and cross-ocean tunnel construction engineering and is applicable to transportation and installation of immersed tubes of cross-river and cross-ocean tunnels or similar to-be-installed members.

BACKGROUND OF THE INVENTION

[0002] At present, the immersed tunnel is a structural form usually adopted by cross-river and cross-ocean tunnels at home and abroad. After prefabrication, immersed tubes need to be transported to an installation site for installation. The traditional transportation method is realized by binding and fixing the immersed tube first, reserving a plurality of hauling and hoisting points and then equipping with a plurality of high-power towing ships to haul the immersed tube. During the transportation, the navigation lane needs to be closed, and other ships are prohibited from passing, which seriously affects the shipping traffic. Also, the traditional installation method cannot locate and install precisely without building a special installing ship. When the traditional installation method is adopted, the organizing of the marine activities is complicated and difficult, the construction period is long, the working efficiency is low and the construction cost is high.

SUMMARY OF THE INVENTION

[0003] In view of the problems existing in the transportation and installation process of the immersed tubes of cross-river and cross-ocean tunnels, a ship and equipment are provided, which integrates transportation and installation of immersed tubes or similar to-be-installed members and has a long-distance self-propelled navigation capability.

[0004] In order to solve the aforementioned technical problems, the present invention is realized via the technical solutions as follows.

[0005] A self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel, comprising a first ship body, a second ship body, a connection structure, hauling and hoisting devices, propelling power devices and positioning devices; the first ship body and the second ship body are parallel with each other, the connection structure is arranged between the first ship body and the second ship body, the first ship body, the second ship body and the connection structure are provided with the hauling and hoisting devices; a loading space is formed between the first ship body and the second ship body and below the connection structure, a to-be-installed member is arranged in the loading space and is connected with the ship; and the first ship body and the second ship body are provided with the propelling power devices and the locating devices.

[0006] Furthermore, the connection structure stretch across surfaces of the first ship body and the second ship body, and there is no less than one connection structure; when there is more than one connection structure, connection structures are distributed symmetrically about a longitudinal center line of the ship.

[0007] Furthermore, the hauling and hoisting devices are winches and cranes; all the winches and the cranes are symmetrically arranged on the ship bodies and the connection structures to keep the catamaran structure stable; working radii of the cranes cover above the ship bodies and the to-be-installed member, and the working radii are disjoint with each other.

[0008] Furthermore, the to-be-installed member is an immersed tube.

[0009] Furthermore, the propelling power devices are respectively arranged at sterns of the first ship body and the second ship body.

[0010] Furthermore, the positioning devices are positioning anchors and windlasses; and the positioning anchors and the windlasses are respectively arranged at bows or sterns of the first ship body and the second ship body.

[0011] Compared with the prior art, the present invention has the beneficial effects that:

the ship has self-propelled power for a long distance, can independently transport the immersed tube of underwater tunnel or similar to-be-installed members of various sizes without being hauled by other ships, and there is no need to close navigation lanes to other ships during the transportation, thus not affecting the passage of the other ships. The catamaran type ship has a higher stability, and anti-sinking and anti-capsizing capabilities. Through the hauling and hoisting devices, positions of the immersed tube or similar to-be-installed member can be located precisely, and the immersed tube or similar to-be-installed member can be installed precisely by using hauling and hoisting devices cooperatively without assistance of other ships.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a schematic structural diagram of a top view of the present invention; and

FIG. 2 is a schematic structural diagram of a side view of the present invention.

[0013] Wherein: 1: first ship body, 2: second ship body, 3: first connection structure, 4: winches, 5: second connection structure, 6: cranes, 7: propelling power devices, 8: to-be-installed member and 9: positioning devices.

DETAILED DESCRIPTION OF THE INVENTION

[0014] The present invention is further described in details below with reference to the accompanying drawings and the specific embodiments.

Embodiment 1:

[0015] As shown in the accompanying drawings, a self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel comprises a first ship body 1, a second ship body 2, a first connection structure 3, a second connection structure 5, winches 4, cranes 6, propelling power devices 7 and positioning devices 9; the first ship body and the second ship body are parallel with each other, and the first connection structure and the second connection structure are arranged between the first ship body and the second ship body. There are two cranes in total, the cranes are respectively arranged at a middle point of the first connection structure and a middle point of the second connection structure, and working radii of the two cranes are disjoint each other; multiple groups of the winches are symmetrically arranged at the first ship body, the second ship body, the first connection structure and the second connection structure; a loading space is formed between the first ship body and the second ship body and below the first connection structure and the second connection structure, the to-be-installed member is arranged in the loading space and is fixedly connected to the ship through the winches and the cranes; and the propelling power devices and the positioning devices are arranged on the first ship body and the second ship body. The propelling power devices are located at the sterns of the ship bodies, and the positioning devices are located at the bows of the ship bodies.

Embodiment 2:

[0016] A self-propelled integrated ship for transporting and installing the immersed tubes of the underwater tunnel comprises a first ship body 1, a second ship body 2, a first connection structure 3, a second connection structure 5, winches 4, cranes 6, propelling power devices 7 and locating devices 9; the first ship body and the second ship body are parallel with each other, and the first connection structure and the second connection structure are arranged between the first ship body and the second ship body. There are four cranes in total, two cranes are respectively arranged at a middle point of the first connection structure and a middle point of the second connection structure, the other two cranes are arranged at the first ship body and the second ship body both between the first connection structure and the second connection structure, and working radii of the cranes are disjoint each other; multiple groups of the winches are symmetrically arranged at the first ship body, the second ship body, the first connection structure and the second connection

structure; a loading space is formed between the first ship body and the second ship body and below the first connection structure and the second connection structure, the to-be-installed member is arranged in the loading space and is fixedly connected to the ship through the winches and the cranes; and the propelling power devices and the positioning devices are arranged on the first ship body and the second ship body. The propelling power devices are located at sterns of the ship bodies, and the positioning devices are located at bows of the ship bodies.

[0017] When the integrated ship of the present invention is in use, the position of the ship body is adjusted by utilizing the propelling power devices on the first ship body and the second ship body, so that the ship body is located above the immersed tube in a way of being parallel with the to-be-installed member; the to-be-installed member is hauled into the loading space below the connection structures by using the winches and the cranes above the connection structures cooperatively, the immersed tube is pulled vertically and fixed, and at the moment, the ship draught increases and the immersed tube floats in the water. Due to the propelling power for the ship bodies and the immersed tube provided by the propelling power devices of the first ship body and the second ship body, the ship and the immersed tube are transported to the position to be installed, the process can be independently accomplished by the self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel without assistance from other ships. After arriving at the appointed place, the horizontal position of the ship is fixed by using the positioning anchors and windlasses of the first ship body and the second ship body. The installation of the immersed tube is finished by cooperatively using the winches and the cranes to place down the immersed tubes vertically and adjusting the horizontal positions until the immersed tube arrives at the preset position. After the installation is completed, the positioning anchors are put away and the empty ship makes a return voyage to enter the next transportation and installation circulation.

[0018] The present invention is described in detail above, but what is mentioned above is merely better embodiments of the present invention and cannot be considered as limitation to the implementation scope of the present invention. All equal changes and improvements made in accordance with the scope of application of the present invention shall remain within the scope of the present invention.

Claims

1. A self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel, wherein comprises a first ship body, a second ship body, a connection structure, hauling and hoisting devices, propelling power devices and positioning

devices; the first ship body and the second ship body are parallel with each other, the connection structure is arranged between the first ship body and the second ship body, the first ship body, the second ship body and the connection structure are provided with the hauling and hoisting devices; a loading space is formed between the first ship body and the second ship body and below the connection structure, a to-be-installed member is arranged in the loading space and is connected with the ship; and the first ship body and the second ship body are provided with the propelling power devices and the locating devices.

2. The self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel of claim 1, wherein the connection structure stretch across surfaces of the first ship body and the second ship body, and there is no less than one connection structure. 15
3. The self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel of claim 2, wherein, when there is more than one connection structure, connection structures are distributed symmetrically about a longitudinal center line of the ship 20
4. The self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel of claim 1 or claim 2, wherein the hauling and hoisting devices are winches and cranes. 25
5. The self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel of claim 4, wherein all the winches and the cranes are symmetrically arranged on the ship bodies and the connection structures. 30
6. The self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel of claim 4, wherein working radii of the cranes cover above the ship bodies and the to-be-installed member, and the working radii are disjoint with each other. 35
7. The self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel of claim 1 or claim 2, wherein the propelling power devices are respectively arranged at sterns of the first ship body and the second ship body. 40
8. The self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel of claim 4, wherein the propelling power devices are respectively arranged at sterns of the first ship body and the second ship body. 45
9. The self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel 50

of claim 1 or claim 2, wherein the positioning devices are positioning anchors and windlasses.

10. The self-propelled integrated ship for transporting and installing immersed tubes of underwater tunnel of claim 9, wherein the positioning anchors and the windlasses are respectively arranged at bows or sterns of the first ship body and the second ship body. 55

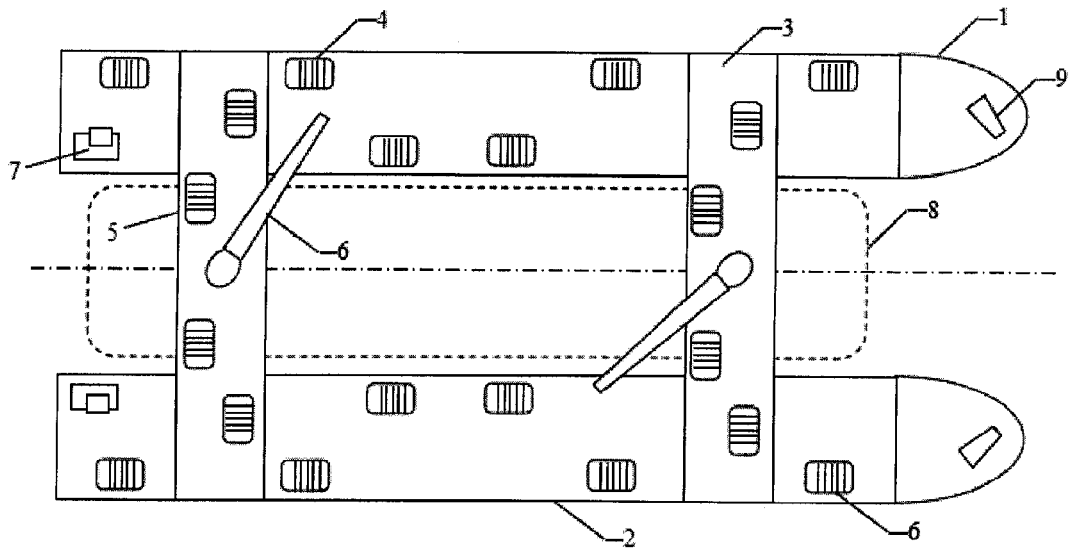


Fig. 1

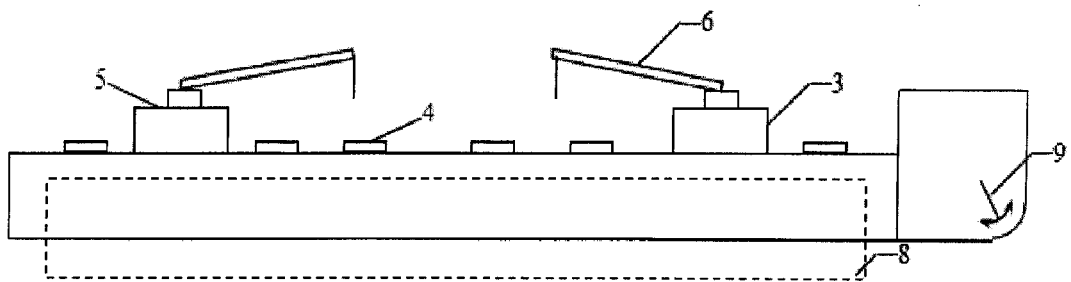


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2017/110395

A. CLASSIFICATION OF SUBJECT MATTER

B63B 35/03 (2006.01) i; B63B 27/08 (2006.01) i; B63B 27/16 (2006.01) i
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B63B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS, VEN, CNKI: 船, 双体, 二, 管, 起重, 吊, 牵引, 牵拉, 绞车, 绞盘, ship, hull, dual, double, twin, two, pipe, tube, crane, traction, winch

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 106516021 A (CCCC FIRST HARBOR ENGINEERING COMPANY LTD.), 22 March 2017 (22.03.2017), see claims 1-10	1-10
PX	CN 206187298 U (CCCC FIRST HARBOR ENGINEERING COMPANY LTD.), 24 May 2017 (24.05.2017), see claims 1-10	1-10
X	CN 102642601 A (SHANGHAI RICHTECH ENGINEERING CO., LTD.), 22 August 2012 (22.08.2012), see description, paragraphs 26-34, and figures 1-3	1-10
X	CN 202169997 U (TIANJIN DESAIL OCEAN MARINE ENGINEERING TECHNOLOGY CO., LTD.), 21 March 2012 (21.03.2012), see description, paragraphs 12-19, and figures 1-4	1-10
X	CH 598988 A5 (PICCARD, J.), 12 May 1978 (12.05.1978), see description, column 1, line 27 to column 2, line 48, and figures 1-5	1-10
A	US 6676334 B2 (DEEPWATER TECHNOLOGIES INC.), 13 January 2004 (13.01.2004), see entire document	1-10

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

“E” earlier application or patent but published on or after the international filing date

“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

03 January 2018

Date of mailing of the international search report

29 January 2018

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/110395

5	Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
	CN 106516021 A	22 March 2017	None	
10	CN 206187298 U	24 May 2017	None	
	CN 102642601 A	22 August 2012	CN 102642601 B	10 September 2014
	CN 202169997 U	21 March 2012	None	
	CH 598988 A5	12 May 1978	None	
15	US 6676334 B2	13 January 2004	US 2003226490 A1	11 December 2003
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Form PCT/ISA/210 (patent family annex) (July 2009)