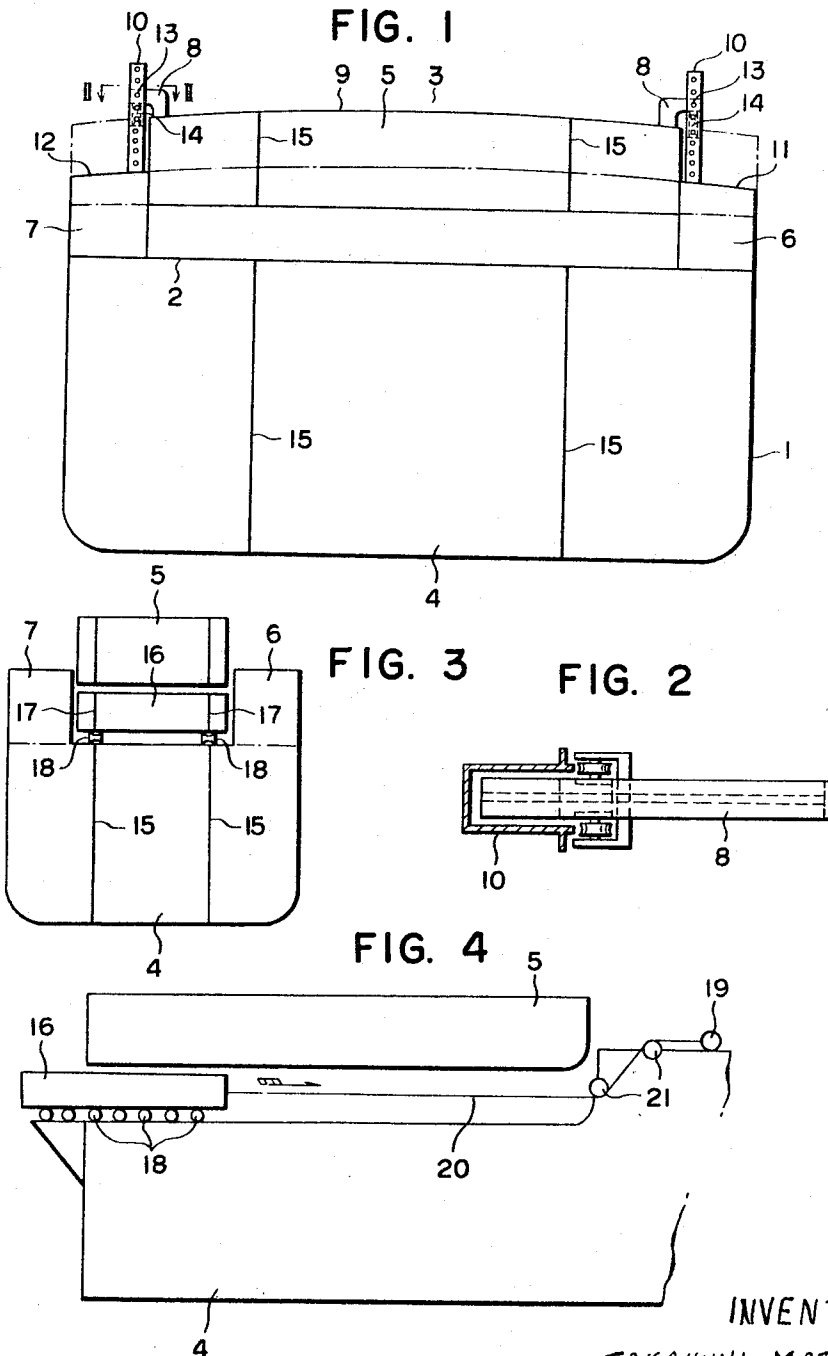


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TAKAKUNI MATSUSE
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JACKS, TO INCREASE THE DEPTH OF WATER
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METHOD FOR REBUILDING A HULL, BY THE USE OF JACKS, TO INCREASE THE DEPTH OF WATER

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1 Claim. (Cl. 114—77)

The present invention relates to a method for rebuilding a hull, especially for increasing the depth of the hull to increase the tonnage of the ship.

Recently, in order to renew or increase the capacity of a ship on service, changing the class of the ship, lengthening the hull, and increasing the depth of the hull have been more popular. In case of rebuilding a hull by the conventional method for increasing the depth of the hull, the upper deck on that part of the hull which is subjected to rebuilding is, first, divided into small parts, which are either landed by means of a crane or the like or placed temporarily on that portion of the upper deck not subjected to such rebuilding. Next, new units or sections to be used for the increase of the hull depth are carried onto said part of the hull. After said units have been fixed in position, said small parts of the upper deck are carried back onto said fixed units by means of a crane, being joined thereto by welding. In this method, however, because of the limitation in capacity of a crane, a great number of units have to be cut off. Therefore, the total distance along which cutting is performed and the total distance along which welding is done become longer, respectively. As a result, the number of man-hours for such cutting, welding, and transporting is increased. The crane operation also requires considerable time. Accordingly, the rebuilding term will unfavourably be lengthened, and the rebuilding cost will necessarily increase.

An object of the present invention is to eliminate the disadvantages to which reference has been made.

Another object of the invention is to rebuild the hull of a ship to increase the depth of the upper middle hull, and which does not require that the upper middle hull be divided into small units.

A further object of the invention is to use commercially available jacks for lifting the upper middle hull, whose depth is to be increased, and to lessen the required working time of cranes.

Still another object of the invention is to provide a method for rebuilding the hull of a ship to increase the hull depth, and which may be performed even when the ship is floating.

Yet a further object of the invention is to provide a method for increasing the hull depth of a ship and in which the principal longitudinal members of the ship hull are not subjected to any changes during the first step of the rebuilding of the hull, so that no reinforcements are required to maintain the strength of the hull during the rebuilding.

According to the present invention, a method for rebuilding the hull of a ship, particularly for increasing the depth of the hull, is provided and is characterized in that the part of the hull to be subjected to rebuilding is divided into two parts, namely an upper middle hull and a U-shaped lower hull. A plurality of arms are fixed to the deck of the upper middle hull in rows extending longitudinally of the two longitudinal edges thereof, and in longitudinally spaced relation. An equal number of guide members are erected on the decks of the upper side parts of the U-shaped lower hull, each being adjacent one of said arms. These guide members are arranged to receive

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jacks supporting the arms, and are further formed to be releasably interconnected with the arms. The upper middle hull is then jacked up step-by-step, with the arms being retained and supported on the guide members between each jacking step. When the upper middle hull is at the desired elevation, a new unit or section is slid on rollers along the longitudinal bulk heads of the lower hull into the space provided by the jacking up of the upper middle hull. This new section is then joined with the upper middle hull and with the lower hull. The upper side parts of the U-shaped lower hull are then rebuilt in accordance with conventional methods.

Other features of the present invention will be, by way of example, explained with reference to the accompanying drawings, wherein:

FIG. 1 is a cross-sectional view of an upper part of a hull jacked up, showing an embodiment of the present invention,

FIG. 2 is an enlarged section taken along the line II—II in FIG. 1,

FIG. 3 is a cross-sectional view showing schematically the joining of a unit or section to be used for increasing the hull depth, and

FIG. 4 is a profile of the hull shown in FIG. 3.

Referring to FIGS. 1 and 2, a hull 1 which is subjected to rebuilding to increase the hull depth is divided, in the vicinity of mid-ship, into two parts, namely, a fore body and an after body. The hull 1 is, further, divided by cutting along a horizontal plane indicated by line 2 and along transversely extending vertical planes at each end of line 2 into two parts. These parts are an upper mid-ship hull 3 and a lower U-shaped hull 4 having upper side sections 6 and 7. This completes the first step of the method of rebuilding in accordance with the present invention.

In a second step, following such division of the hull, a preselected number of arms 8 are fixed along each longitudinal edge of the upper deck 9 of the upper mid-ship hull 5. These arms are aligned longitudinally of the hull and are in longitudinally spaced relation with each other. An equal number of guide members 10 are fixedly erected on the respective upper decks 11 and 12 of the upper side sections 6 and 7 of the U-shaped lower hull 4, each guide member 10 being adjacent a respective arm 8. Guide members 10 have channel-shaped cross sections facing toward and receiving the horizontally extending portions of arms 8. The flanges of guide members 10 are formed with uniformly spaced apertures 13 therealong for a purpose to be described.

Jacks 14 are inserted into the channel sections of guide members 10, and initially rest on the upper decks 11 and 12 in engagement with the under sides of the horizontal portions of arms 8. The jacking up of hull mid-section 5 is effected in a step-by-step manner. Thus the upper hull mid-section 5 is lifted up a predetermined amount, and then pins are inserted through holes 13 in arms 10 and through a hole (not shown) in the outer end of the horizontal portion of each arm 10. In the event a single lifting or jacking step is not sufficient to raise hull mid-section 5 to the required height above the lower hull, jacks 14, in the retracted condition, are reset in engagement with the under surfaces of the horizontal portions of arms 8, and with the jacks being supported on pins extended through the apertures 13. Such step-by-step operation is continued until hull mid-ship section 5 has been raised to a height sufficient for placing the new section, unit, or block 16 thereunder.

The section or unit 16, which has been designed and finished beforehand in accordance with the rebuilding schedule, is transported by means of a crane or the like to the entrance to the space between elevated hull section 5 and lower hull 4. Rollers 18 are placed beneath section 16 in alignment with the longitudinal bulk heads 17

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of the section 16 and in alignment with the longitudinal bulk heads 15 of the lower hull 4. By means of a winch and a cable 20, the section 16 is then pulled into position beneath the elevated section 5. The rollers 18 are then removed and the lower side of section 15 is united with the lower hull 4. The section 5 is then lowered onto the section 16 and the jacks and arms 18 are released so that section 5 may be united to the upper surface of section 16. The arms 8 and guides 10 are then removed.

In a further step, the upper side sections 6 and 7 of the U-shaped lower hull 4, after being cut transversely into smaller units, are removed for insertion of rebuilding sections therebeneath, using a known method involving cranes. This completes the rebuilding of the hull.

According to the method of the present invention stated above, it is necessary only to divide the upper hull 3 into the least number of sections. Therefore, the total length along which cutting is performed is substantially reduced, while easier joining of the inserted section 16 can be obtained. Besides, the larger section 5 being supported, by jacking, on the smaller side sections 6, 7, it is unnecessary to use a crane for the carrying of the divided parts of the upper hull section 5. The space which would be necessary for said parts to be temporarily placed on the ground or on the upper deck becomes unnecessary.

Further, according to the method of the invention, the lifting of the upper hull mid-section 5 is performed by means of the jacks 14, which push upward the arms 8, and are kept at the determined height on the guide members 10 by means of pins holding the jacks. The arms being thus engaged with the guide members, said lifting is easily and properly performed, and, moreover, smoothly and accurately without any transverse or longitudinal shifting. On the other hand, the inserting and fixing of the added section 16 is performed, through the rollers 18, on the longitudinal bulkheads 15 in the lower hull 4, and this eases the work substantially. Still further, according to the method of the invention, the upper hull mid-section 5 divided from the upper part of the hull is provided with many equipments thereon, and yet lifted with these equipments still fixed. Therefore, the outfitting work can be performed together with the hull work. Moreover, damage to the upper hull construction can, favourably, be prevented because of the upper hull not being subjected to cutting into smaller parts.

As described above, according to the present invention, the rebuilding of the hull to increase the depth of the hull can be smoothly and accurately performed by the use of simple installations either in a ship brought alongside a quay or in a dry dock. Besides, a remarkable decrease in the number of man-hours and also a substantial shortening of the term of work can be obtained. This will bring, favourably, the reduction of the rebuilding cost.

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As stated, the jacks 14 may be any commercially available jacks suitable for the purpose. The jacks actually illustrated, at least partly, in the drawings, are those sold under the name of "Riken Yuatsu Power Jacks" (Riken Oil Pressure Power Jacks) and manufactured by Riken Seiki Kabushiki Kaisha (Riken Precise Machine Manufacturing Co., Ltd.) of Japan.

It is to be understood, of course, that numerous modifications may be made without departing from the spirit and scope of the present invention as set forth in the appended claim.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

A method of rebuilding the hull of a ship to increase the depth of the hull, said method comprising, the steps of dividing the original hull to form an upper central hull section extending longitudinally of the ship and a U-shaped lower hull section having upper side portions extending longitudinally adjacent the longitudinal edges of the upper middle hull; affixing a plurality of arms to the upper deck of the central hull section extending in rows with each row being along one longitudinal edge of the upper hull section; erecting an equal number of upwardly extending guide members on the upper decks of the upper side sections of the lower hull, each adjacent one of said arms; mounting jacks on said upright guide members in engagement with said arms; operating said jacks to lift said upper central hull section step-by-step; between each jacking step, restraining said arms against downward movement along said upright guide members; when said upper central hull section is at an elevation sufficient to provide for movement of a new central hull section therebeneath, mounting said new central hull section on rollers in engagement with the longitudinal bulk heads of said lower hull section and beneath the longitudinal bulk heads of said new upper central hull section; moving said new upper central hull section beneath said lifted upper central hull section along the longitudinal bulk heads of said lower hull section; uniting said new upper central hull section with said lower hull section; lowering said lifted upper hull section onto said new upper central hull section and uniting said two central hull sections; and then rebuilding the side hull sections of said U-shaped lower hull section.

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