

[54] **APPARATUS AND METHOD FOR REMOVING AND/OR ADDING COLUMN SECTIONS TO A COLUMN OF A MARINE STRUCTURE**

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[51] Int. Cl. **E02b 17/00, B23p 19/00**

[58] Field of Search **61/46.5, 53.5, 72.3; 175/9, 175/8, 7; 29/429; 214/1 P, 6 F; 187/178**

[56] **References Cited**

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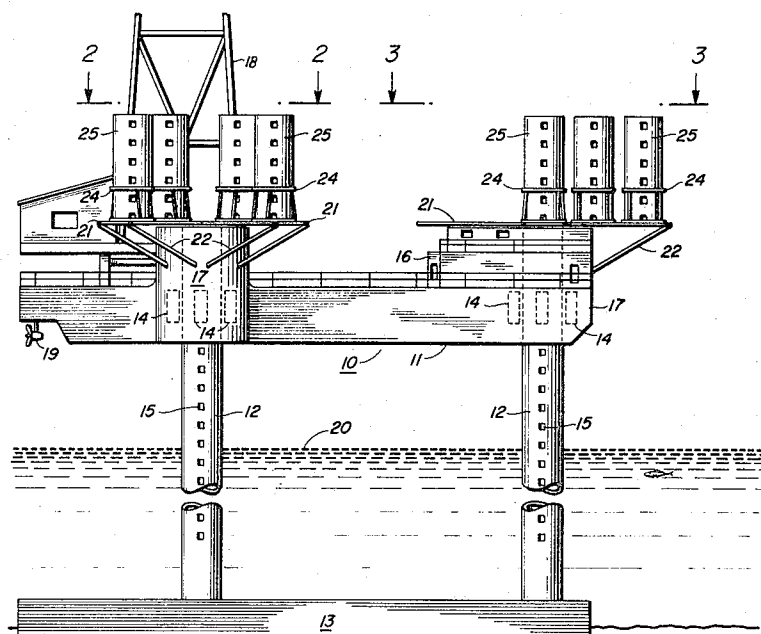
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[57] **ABSTRACT**

A method and apparatus for removing and/or adding column sections to a column of a marine structure, such as a mobile drilling platform, employs a carriage for supporting a column section slidably mounted on the marine structure platform and jacking means for moving the platform and column relative to each other. When a column section is to be added to the column, the carriage with a column section supported thereon is positioned above the column. The jacking means is then operated to bring the top of the column into contact with the bottom of the carriage supported column section. The column section is then welded to the column and detached from the carriage. When a column section is to be removed from the column, a carriage is positioned above the column. The jacking means is then operated to bring the column within the carriage, and the column is secured to the carriage. A portion of the column is then severed from the column.

15 Claims, 10 Drawing Figures



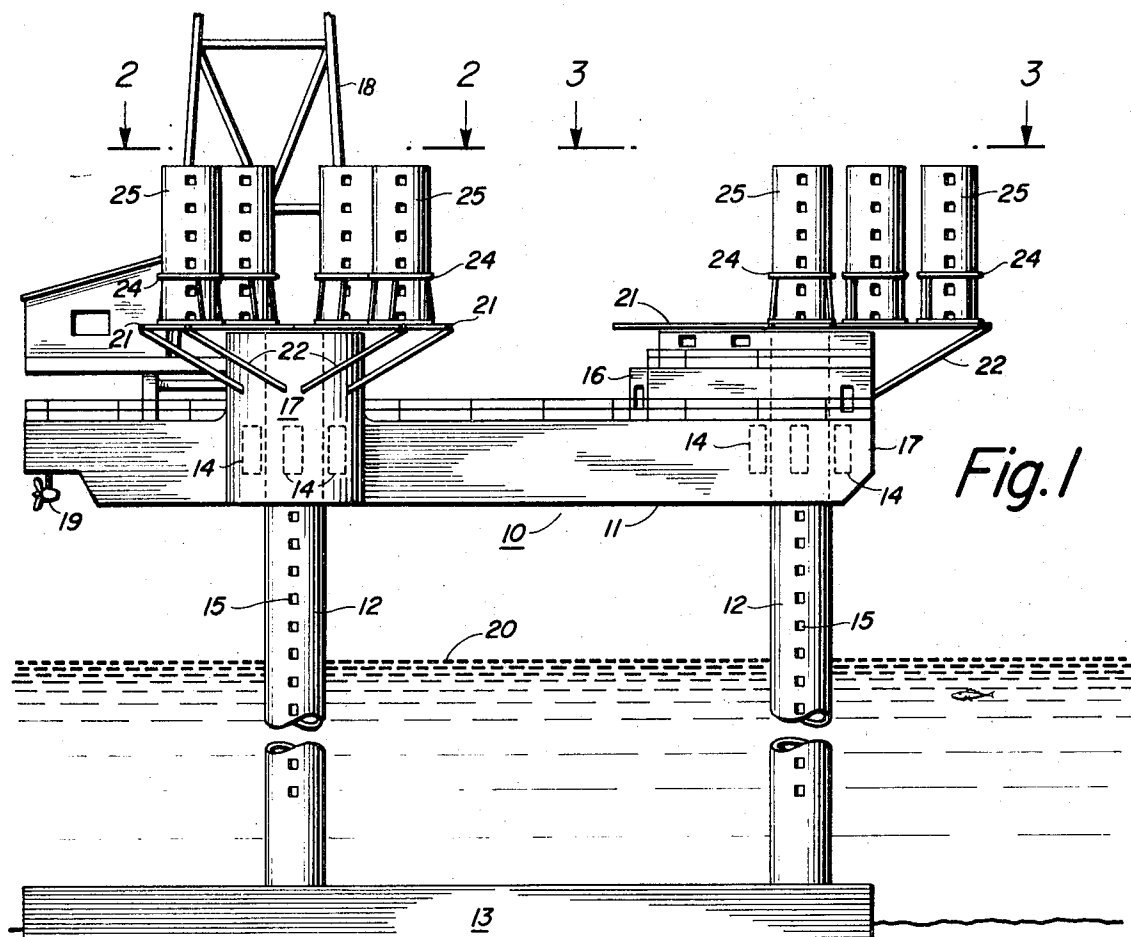


Fig. 1

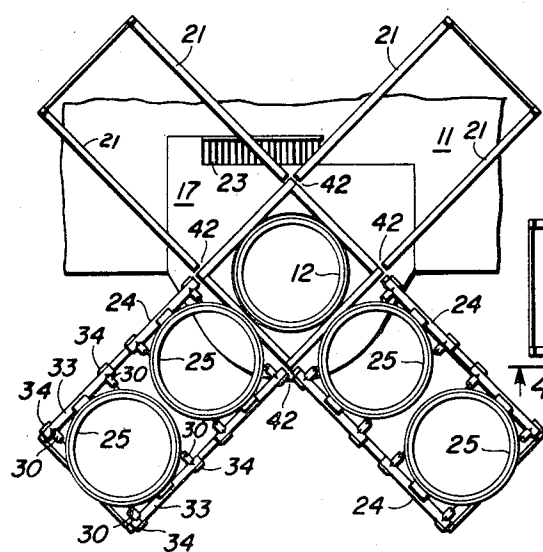


Fig. 2

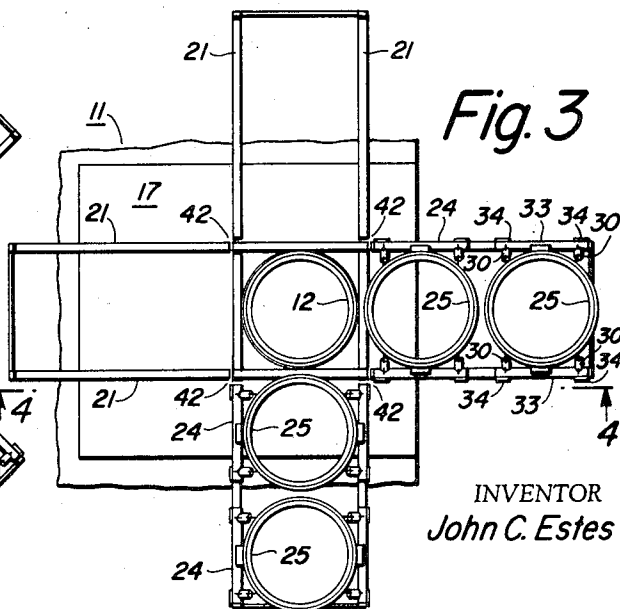


Fig. 3

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Fig. 4

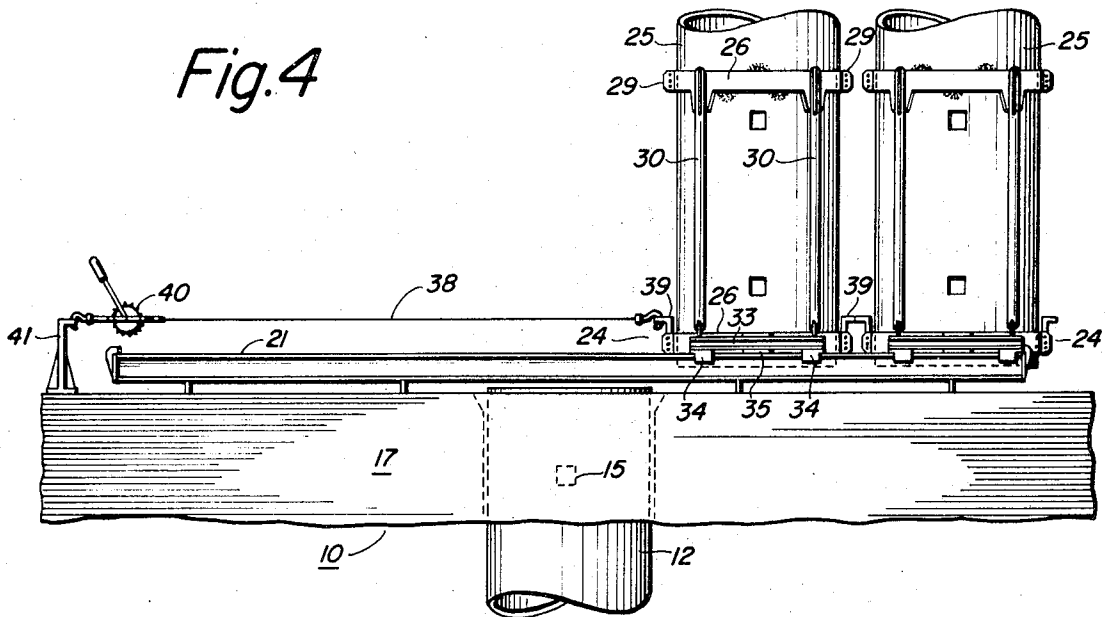
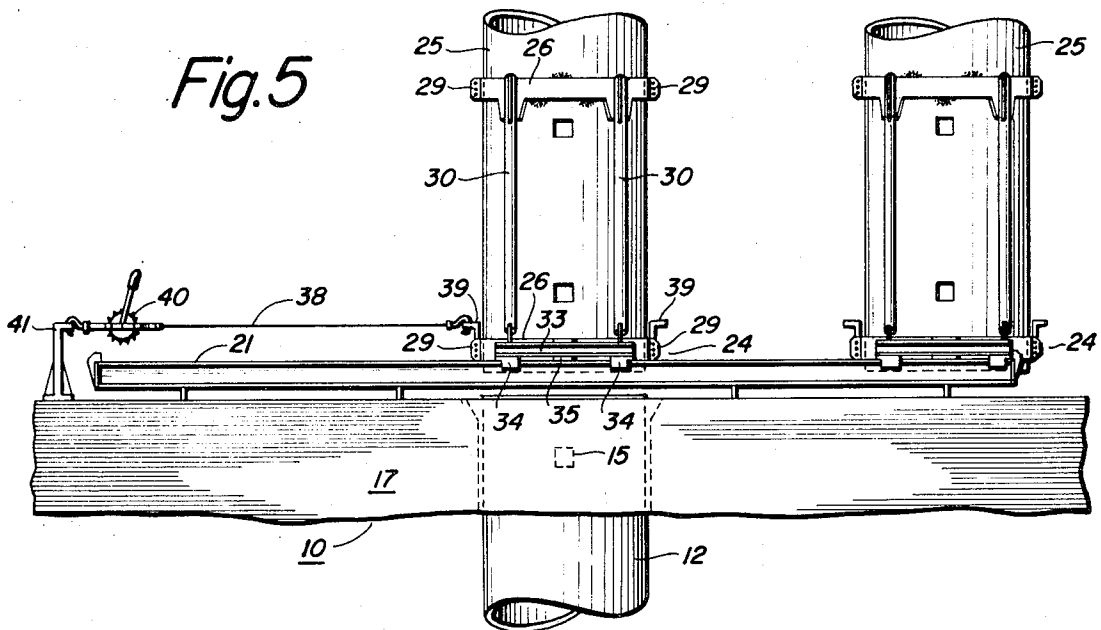


Fig. 5



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Fig. 6

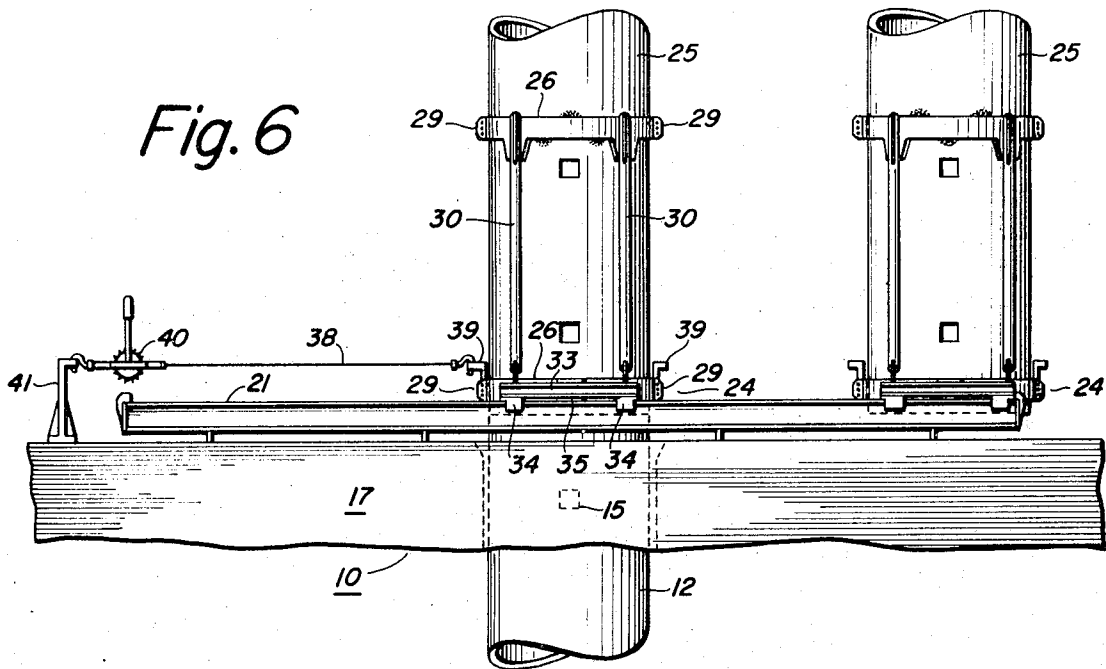


Fig. 7

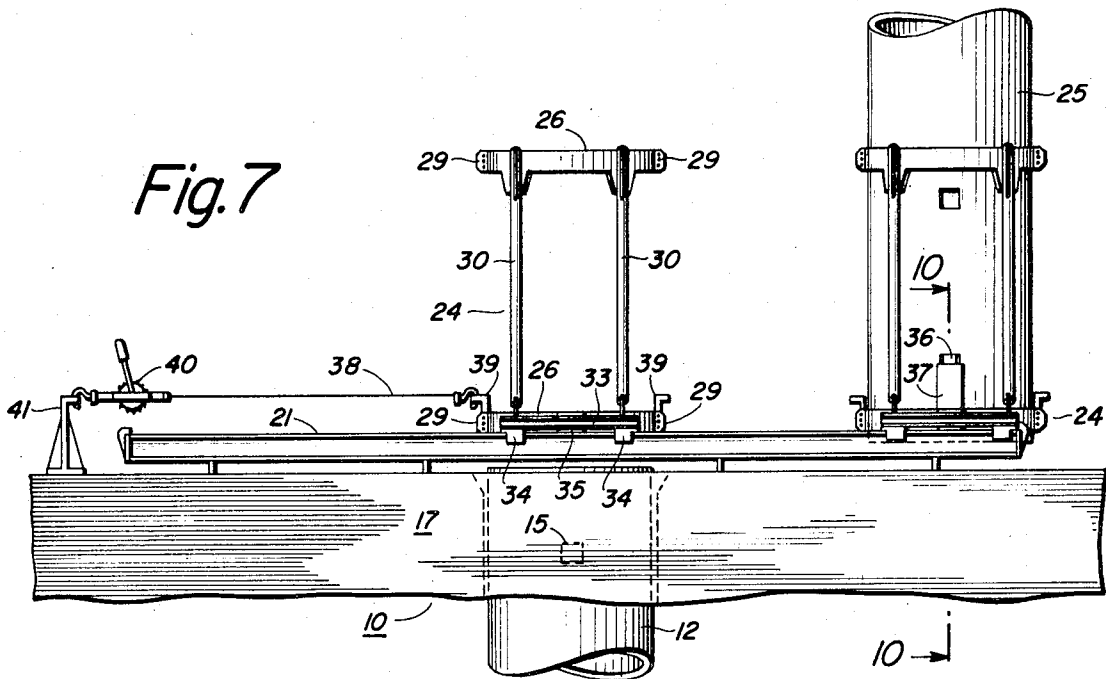
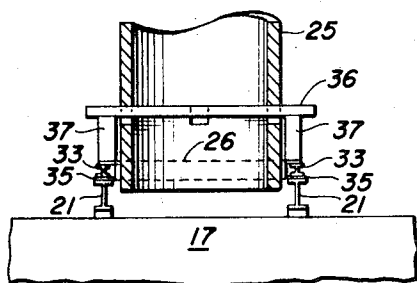
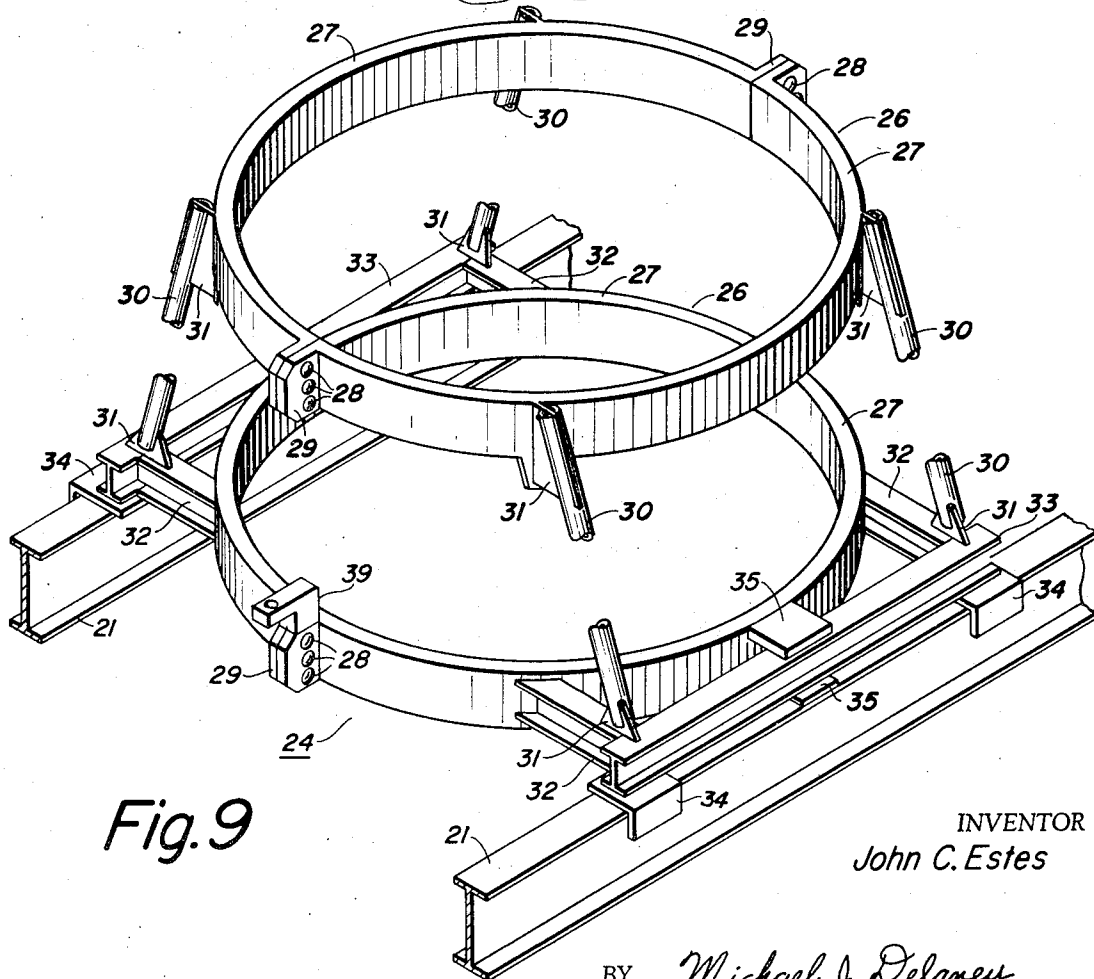
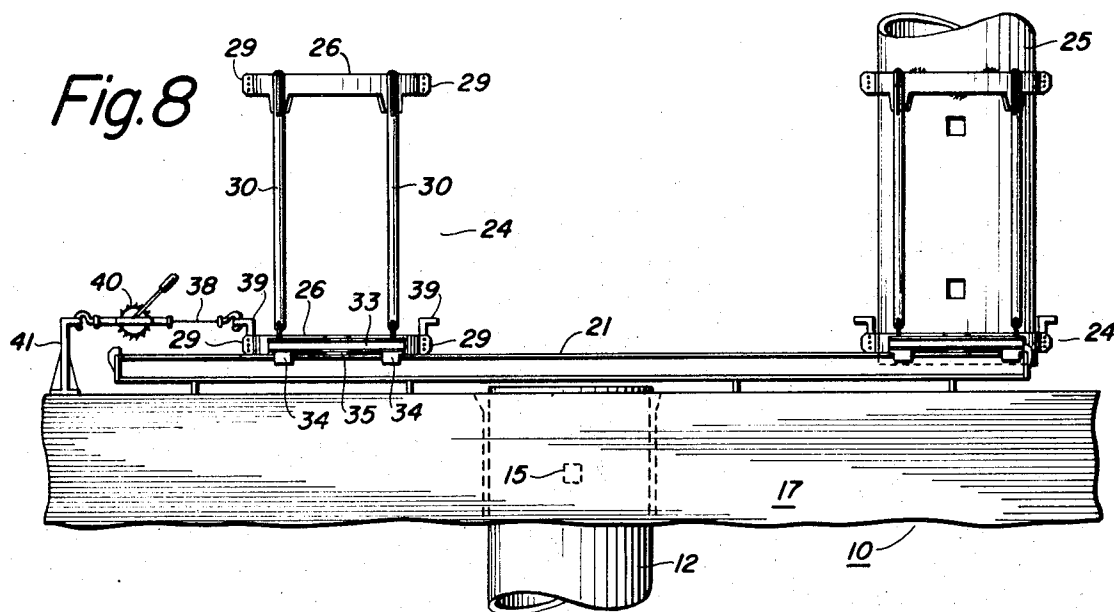


Fig. 10



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APPARATUS AND METHOD FOR REMOVING AND/OR ADDING COLUMN SECTIONS TO A COLUMN OF A MARINE STRUCTURE

BACKGROUND OF THE INVENTION

Some present day mobile marine structures include a plurality of columns which extend through openings in a platform. These columns are designed to contact the bottom of a body of water and support the platform during a drilling or similar operation. Jacks are used to produce the necessary relative movement between the column and the platform. When the depth of water is great, columns of considerable length are necessary. Columns of 300 feet or more are not unusual. These columns are made by joining together a plurality of column sections.

Generally, when such a structure is being moved a considerable distance, it is desirable to remove as much of the column as possible from the water due to the resistance to movement created by the portion of the column which is under water. However, when a considerable length of column extends above the platform, the stability of the structure may be adversely affected, especially in rough waters.

In addition, due to a limited vertical clearance which may be present in some waterways, e.g., access waterways to shipyards, it may not be possible to remove an appreciable portion of the column from the water. Furthermore, the sum of the water depth and the vertical clearance of some waterways may be less than the required column length. It may also be desirable to remove and/or add column sections due to a damaged column or a change in the water depth at which the structure is to operate.

The above problems are presently overcome by the use of a derrick barge which is capable of handling column sections which must be removed or added to a column. However, the services of such a barge are expensive and not always available when needed.

SUMMARY OF THE INVENTION

An object of this invention is to provide an arrangement wherein the services of a derrick barge are not required to remove or add a column section to the column of a marine structure.

Another object of this invention is to provide an arrangement wherein column sections are stowed on a marine structure and are added to the columns of the structure as required.

A still further object of this invention is to provide an arrangement whereby column sections may be removed from the columns of a marine structure and stowed on the structure ready to be added to the column when necessary.

The above objects can be accomplished by providing a marine structure having a carriage for supporting a column section adjacent the top of an existing column, means to move the column section into vertical alignment with the column and means to move the top of the column relative to the bottom of the column section and means to sever or join the column section from or to the column.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevation view of the apparatus of this invention.

FIG. 2 is a view taken substantially along the line 2—2 of FIG. 1.

FIG. 3 is a view taken substantially along the line 3—3 of FIG. 1.

FIGS 4, 5, 6, 7 and 8 are elevational views showing steps during the operation of the apparatus of this invention.

FIG. 9 is an enlarged perspective view of a carriage.

FIG. 10 is a view taken on the line 10—10 of FIG. 7.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to FIG. 1, a marine structure 10 includes a buoyant platform 11 having a plurality of vertically extending, circular openings therethrough and a cylindrical column 12 extending through each of the openings. Each column 12 may be rigidly attached to a mat 13. Jacking means 14 are attached to platform 11 adjacent each opening in the platform 11 and may be of the type which engages openings 15 in the column 12 to produce relative movement between the platform 11 and column 12. When as shown, the columns 12 are attached to a mat 13, the jacking means 14 for the columns 12 operate substantially in unison to produce the required relative movement. Mounted on the platform are the usual deck house 16, jack housing 17 and derrick 18. A motor driven propeller 19 may be suitably secured to the platform if it is desired to provide self propelling means for the structure 10.

As shown in FIG. 1, mat 13 is in contact with the bottom of a body of water 20 and the platform 11 has been elevated above the surface of the water 20. When the structure is to be towed, the platform 11 is lowered to the surface of the water 20 and the columns 12 and mat 13 raised from the bottom of the water 20. These movements of the platform 11, columns 12 and mat 13 are accomplished by the operation of jacking means 14. While a mat 13 has been shown connected to the lower ends of columns 12, a marine structure 10 could be provided wherein the columns 12 are not attached to a mat 13. In such a case, the columns 12 would directly engage the bottom of the body of water 20 and support the platform 11.

The marine structure 10 including jacking means 14, as described above, are well known in the art and no further detailed description is necessary for an understanding of this invention.

While cylindrical columns 12 are shown and described, columns having other shapes may be used in the practice of this invention. Columns could be fabricated from a plurality of members such as beams, bars, rods, etc., including a truss shaped column.

Referring to FIGS. 1, 2 and 3, two pair of spaced horizontally extending rails 21 are attached to the top of each jack housing 17 of platform 11. Each pair of rails 21 is spaced a distance greater than the exterior dimensions of a column 12. In addition, each pair of rails 21 extends perpendicular to each other and to the vertical axis of the column 12. Rails 21 extend on opposite sides of the jack housing 17 and are supported by diagonal braces 22. Steps 23 may be provided between the top of jack housing 17 and the deck of platform 11, as shown in FIG. 2.

As best shown in FIGS. 1, 2 and 3, a plurality of carriages 24 are slidably mounted on each pair of rails 21. Each carriage 24 is adapted to support a column section 25 which has been removed from column 12 or may be added to column 12.

Referring to FIG. 9, a carriage 24 comprises vertically spaced upper and lower members 26. Each member 26 includes a pair of semicircular portions 27 detachably secured to each other by fasteners 28 which extend through integral ears 29. The opening within the upper and lower members 26 is shaped to conform to the exterior shape of a column section 25. Diagonal braces 30 extend between and are rigidly connected to plates 31 attached to upper member 26 and to horizontal braces 32 attached to lower member 26. A pair of I-beams 33 extend on opposite sides of and adjacent to the lower member 26. Horizontal braces 32 are also attached to the I-beams 33. Upper and lower plates 35 extend between and are attached to lower member 26 and the upper and lower surfaces of I-beams 33. Plates 35, I-beams 33 and horizontal braces 32 form the base of carriage 24 and along with diagonal braces 30 and plates 31 rigidly position the upper and lower members 26.

In order to slide the carriage 24 along rails 21, each I-beam 33 includes a number of L-shaped plates 34, attached to its lower surface. Each plate 34 has one of its legs in contact with rail 21 and its other leg extending downwardly and on the outside of rail 21 to guide the carriage 24 along the rails 21. Lower plates 35 also contact rails 21 and slidably support I-beams 33 on rails 21.

Any well known fastening arrangement can be used to detachably secure a column section 25 to upper and lower members 26. For example, the column section 25 can be spot welded to the members 26. In the case of a column section 25 having openings therein and as best shown in FIG. 10, a bar 36 may extend through the openings and rest on blocks 37 supported by rails 33. In addition, upper and lower members 26 could be made to releasably clamp a column section 25 to carriage 24.

Any suitable means may be provided to move the carriage 24 along the rails 21. One such means, shown in FIG. 8, is a hand or motor operated pulling device. The device includes a cable 38 attached at one end to a bracket 39 fixed to carriage 24 and at the other end to a ratchet type device 40 which is attached to a bracket 41 mounted on the jack housing 17. The pulling device may be detached from the brackets 39 and 41 and moved to the opposite side of the jack housing 17 to move the carriage 24 in the opposite direction.

As shown in FIGS. 2 and 3, slits 42 are provided in rails 21 where the rails 21 intersect each other in order to allow clearance for the vertical legs of the L-shaped plates 34 when the carriage 24 moves from one end of a pair of rails 21 to the other end.

In operation, a sufficient number of column sections 25 are lifted by any suitable lifting means (not shown) and positioned within the carriages 24. Thereafter, the sections 25 are detachably secured to the carriages 24. When a column section 25 is to be added to a column 12, a carriage 24 with a column section 25 thereon is located at a first position as shown in FIG. 4, i.e., horizontally spaced from the column 12. Next, the jacking means 14 is operated to position the column 12 so that it is spaced vertically below the bottom of the column section 25, as shown in FIG. 4. The carriage 24 is then moved by the pulling device to a second position as shown in FIG. 5, i.e., the column section 25 is in vertical alignment with the column 12 but spaced therefrom. The jacking means 14 is then operated to

move the top of the column 12 into contact with the bottom of the column section 25, as shown in FIG. 6. The column section 25 may then be joined to the column 12 by any suitable method such as welding. The column section 25 is detached from the carriage 24. Thereafter the jacking means 14 is operated so that the top of the newly added section of the column 12 is located at a lower elevation than the carriage 24, as shown in FIG. 7. The carriage 24 is then moved by the pulling device to the position shown in FIG. 8.

The above described method discloses detaching the column section 25 from the carriage 24 after they are joined together. Such detachment may take place after the column 12 and column section 25 are brought into contact and prior to joining them together. In which case, jacking means 14 may then be operated to raise or lower the column and column section so that the joint therebetween may be positioned at a more favorable place for welding or other type fastening arrangement. When so raised or lowered, carriage 24 acts as a guide for column section 25.

In removing a portion of the column 12, an empty carriage 24 is positioned above the top of the column 12, as shown in FIG. 7. The jacking means 14 is operated to position a top portion of the column 12 within the carriage 24, as shown in FIG. 6. Next the top portion of the column 12 is secured to the carriage 24 in any suitable manner. Thereafter, the top portion is severed from the column 12 along a line just below the lower member 26 of carriage 24. The jacking means 14 is then operated to further separate the column 12 from the severed top portion, as shown in FIG. 5. The carriage 24 is then moved to a position horizontally spaced from the column, as shown in FIG. 4.

It should be obvious that the above procedure for adding and removing column sections can be repeated as often as needed in order to lengthen or shorten the column the desired amount. Also the procedure may be performed when the platform is afloat or when the platform is supported by the columns, i.e., the column or platform can be moved to vertically position the column and column section relative to each other. Furthermore, the above procedure may be performed on a number of columns simultaneously. When the above procedure is performed on columns attached to a mat it is desirable to have the jacking means on all columns operate substantially in unison to maintain the platform in a horizontal attitude.

I claim:

1. In a marine structure including a platform having a plurality of vertically extending openings therethrough and a column extending through each of said openings, apparatus for removing and adding a column section to a column comprising:

- a. a carriage adapted to support a vertically extending column section and including vertically spaced upper and lower members, each detachably secured to said column section and rigidly connected to each other, and a base rigidly connected to each of said members,
- b. means mounting said carriage to said platform for horizontal movement between a first position wherein said column section is horizontally spaced from said column and a second position wherein said column section is in vertical alignment with

said column and including a pair of spaced rails with said base slidably mounted on said rails, and

- c. means mounted on said platform and adapted to independently move said platform and said column vertically relative to each other and between a third position wherein the top of said column is vertically spaced from the bottom of said column section when said carriage is in said first position and a fourth position wherein the top of said column is in contact with the bottom of said column section when said carriage is in said second position.

2. The apparatus of claim 1 wherein said column and said column section have a circular horizontal cross section.

3. The apparatus of claim 1 wherein said upper and lower members each comprise a pair of semicircular portions detachably secured to each other.

4. In a marine structure including a platform having a plurality of vertically extending openings therethrough and a column extending through each of said openings, apparatus for removing and adding column sections to a column comprising:

- a. a plurality of carriages each adapted to support a vertically extending column section, each carriage includes vertically spaced upper and lower members each detachably secured to said column section and rigidly connected to each other and a base rigidly connected to each of said members,
- b. means mounting said carriages to said platform for horizontal movement between a first position wherein said column section is horizontally spaced from said column and a second position wherein said column section is in vertical alignment with said column and including two pairs of spaced rails, each pair extending substantially perpendicular to the longitudinal axis of said column and to each other, and a portion of the carriages have their bases slidably mounted on one pair of rails and the remainder of the carriages have their bases mounted on the other pair of rails, and
- c. means mounted on said platform and adapted to independently move said platform and said column vertically relative to each other and between a third position wherein the top of said column is vertically spaced from the bottom of said column section when said carriages are in said first position and a fourth position wherein the top of said column is in contact with the bottom of said column section when said carriages are in said second position.

5. The apparatus of claim 4 wherein said column and said column section have a circular horizontal cross section.

6. The apparatus of claim 5 wherein said upper and lower members each comprise a pair of semicircular portions detachably secured to each other.

7. In a marine structure including a platform having a plurality of vertically extending openings therethrough and a column extending through each of said openings, a mat rigidly connected to the lower end of each column, apparatus for removing and adding column sections to each column comprising:

- a. a plurality of carriages each adapted to support a vertically extending column section adjacent each

column, and including vertically spaced upper and lower members, each detachably secured to a column section and rigidly connected to each other, and a base rigidly connected to said members,

- b. means mounting said carriages to said platform for horizontal movement between a first position wherein its column section is horizontally spaced from its adjacent column and a second position wherein its column section is in vertical alignment with the column and including a pair of spaced rails with said base slidably mounted on said rails, and

c. means mounted on said platform and adapted to independently move said platform and each column substantially in unison vertically relative to each other and between a third position wherein the top of the columns are vertically spaced from the bottom of the column sections when said carriages are in said first position and a fourth position wherein the top of the columns are in contact with the bottom of the column sections when said carriages are in said second position.

8. The apparatus of claim 7 wherein each column and each column section has a circular horizontal cross section.

9. The apparatus of claim 8 wherein said upper and lower members each comprise a pair of semicircular portions detachably secured to each other.

10. In a marine structure including a platform having a plurality of vertically extending openings therethrough and a column extending through each of said openings, a method for adding a column section to a column comprising:

- a. providing a carriage and jacking means on said platform,
- b. detachably supporting a vertically extending column section on said carriage at a first position wherein said column section is horizontally spaced from said column,
- c. operating said jacking means to position the top of said column at a lower elevation than the bottom of said column section when said carriage is in said first position,
- d. moving said carriage from said first position to a second position wherein said column section is in vertical alignment with said column,
- d. operating said jacking means to bring the top of said column into contact with the bottom of said column section when said carriage is in said second position, and
- f. joining said column section to said column.

11. The method of claim 10 further comprising:

- g. detaching said column section from said carriage.

12. The method of claim 11 further comprising:

- h. operating said jacking means to position the top of said column section at a lower elevation than the bottom of said carriage, and
- i. moving said carriage from said second position to said first position.

13. In a marine structure including a platform having a plurality of vertically extending openings therethrough and a column extending through each of said openings, a method for removing a column section from said column comprising:

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- a. providing a carriage and jacking means on said platform,
 - b. positioning said carriage at a first position wherein said carriage is in vertical alignment with said column,
 - c. operating said jacking means to bring said column within said carriage,
 - d. securing an upper portion of said column to said carriage, and
 - e. severing the upper portion from said column.
14. The method of claim 13 further comprising:
- f. moving said carriage from said first position to a second position wherein said carriage is horizontally spaced from said column.

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15. In a marine structure including a platform having a plurality of vertically extending openings therethrough and a column extending through each of said openings, apparatus for removing and adding a vertically extending column section to a column comprising:
- a. a carriage including vertically spaced upper and lower members, each detachably secured to said column section and rigidly connected to each other, and a base rigidly connected to each of said members, and
 - b. means mounting said carriage to said platform for horizontal movement thereon.

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