

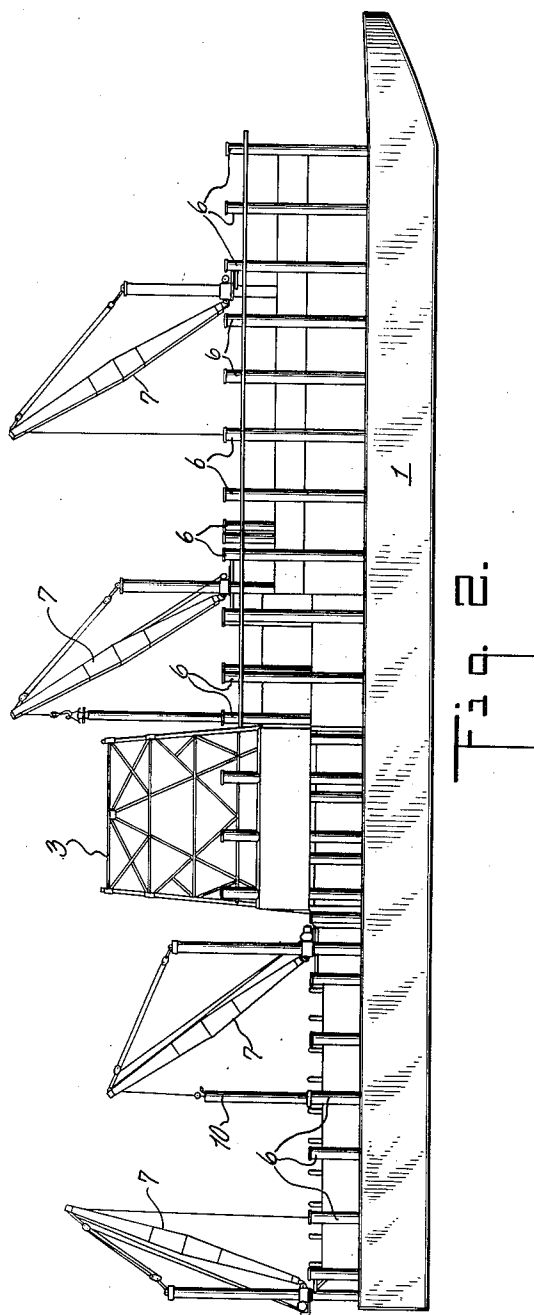
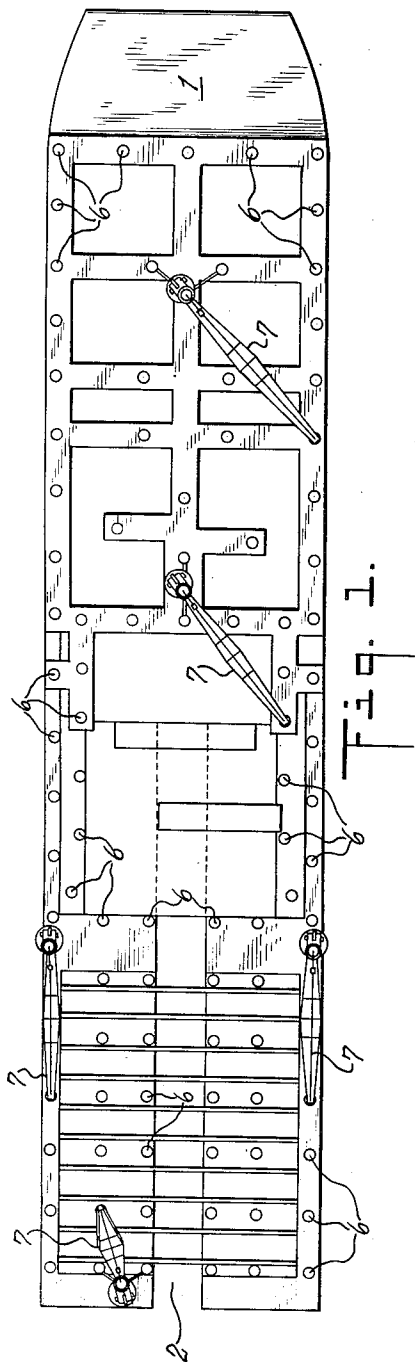
Nov. 28, 1950

C. J. McCOY
STABILIZABLE VESSEL FOR SUBMARINE OPERATIONS
AND METHOD OF OPERATING THE SAME

2,531,983

Filed Nov. 4, 1948

4 Sheets-Sheet 1



INVENTOR.
CLARENCE J. McCOY
BY
Kenyon & Kenyon
ATTORNEYS

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4 Sheets-Sheet 2

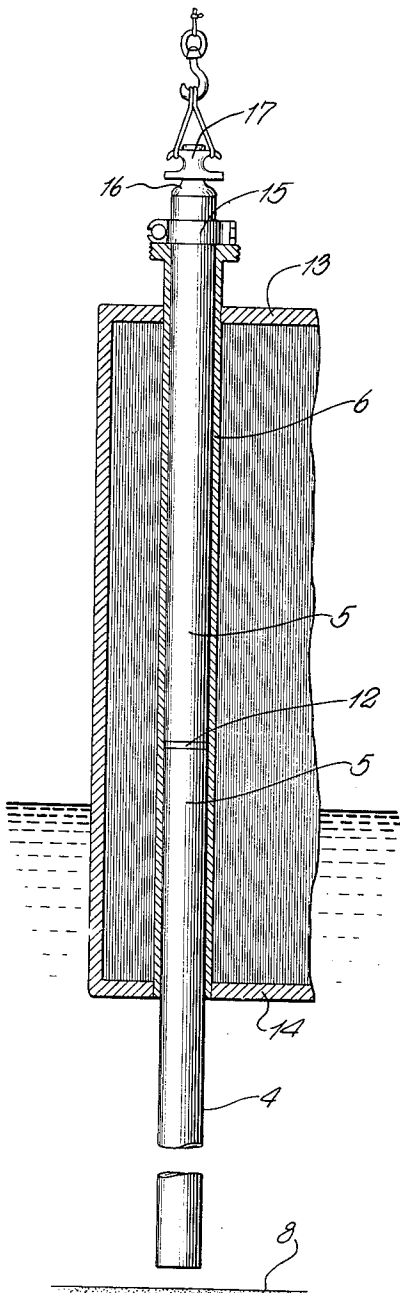


Fig. 3.

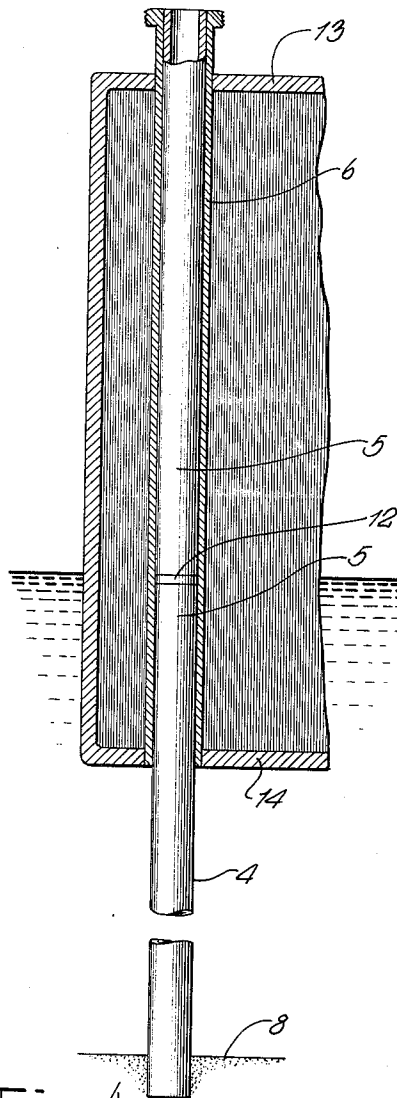


Fig. 4.

INVENTOR.
CLARENCE J. McCOY
BY
Kenyon + Kenyon
ATTORNEYS

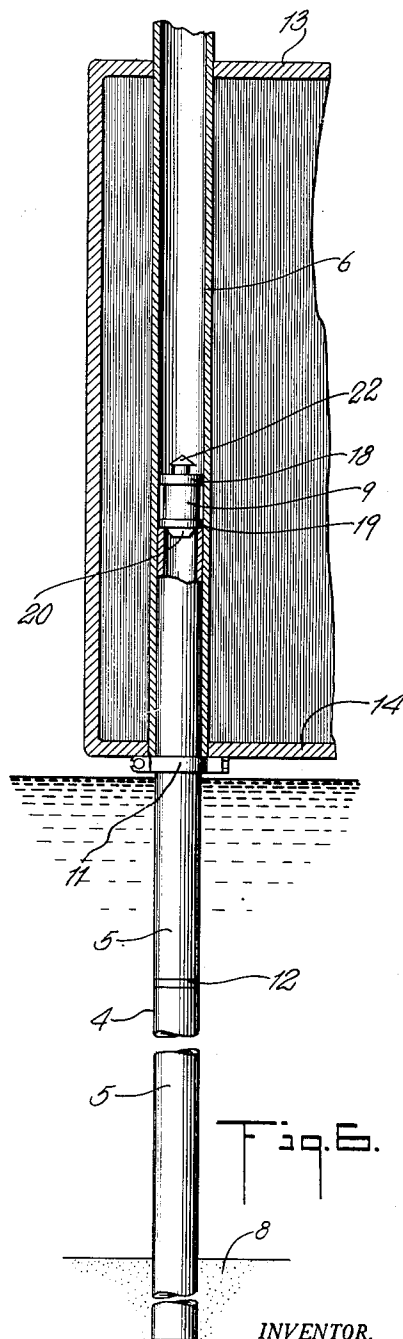
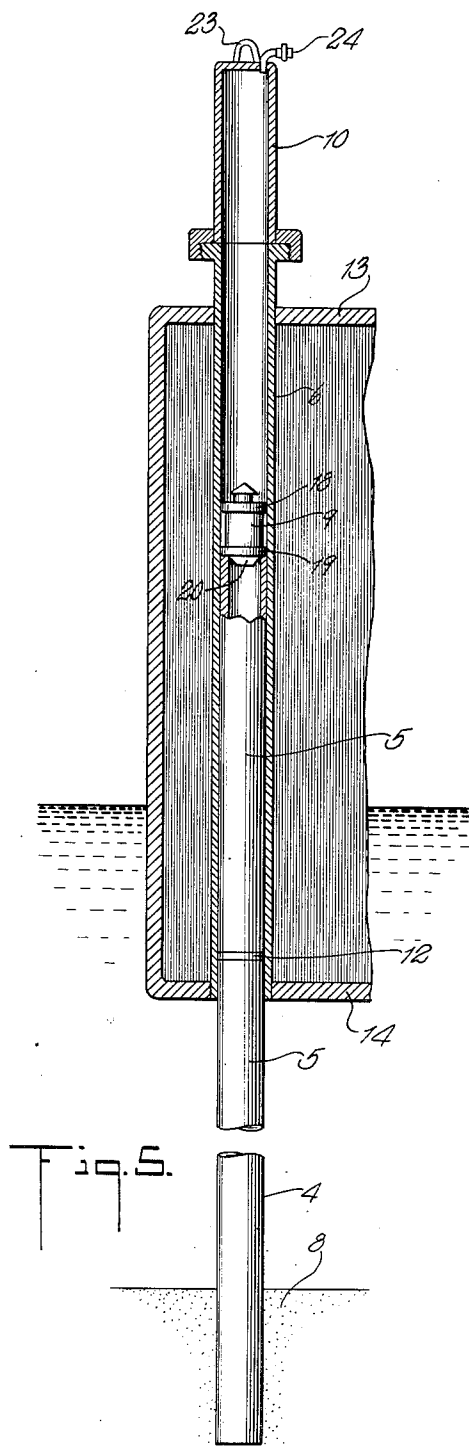
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CLARENCE J. MCCOY
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ATTORNEYS

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4 Sheets-Sheet 4

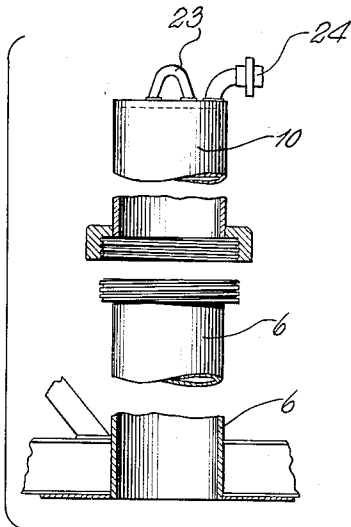


Fig. 7.

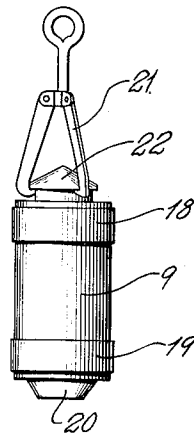


Fig. 8.

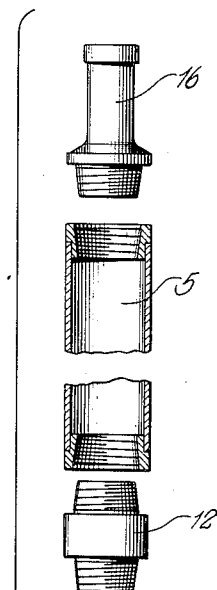


Fig. 9.

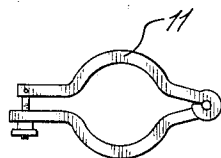


Fig. 10.

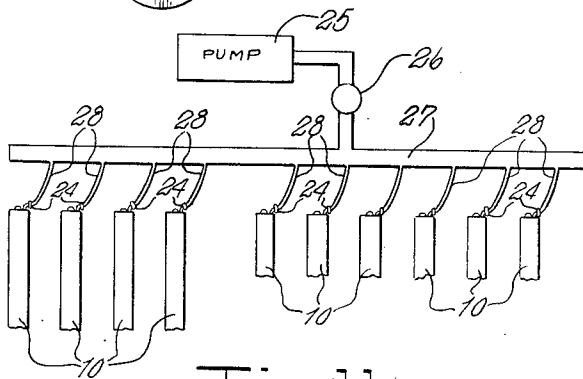


Fig. 11.

INVENTOR.
CLARENCE J. MCCOY
BY
Kenyon & Kenyon
ATTORNEYS

UNITED STATES PATENT OFFICE

2,531,983

STABILIZABLE VESSEL FOR SUBMARINE
OPERATIONS AND METHOD OF OPERAT-
ING THE SAMEClarence J. McCoy, Tulsa, Okla., assignor to
Noble Drilling Corp., Tulsa, Okla., a corpora-
tion of Delaware

Application November 4, 1948, Serial No. 58,206

13 Claims. (Cl. 61—46)

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This invention has for its general object the provision of a vessel construction and method of operating the same which permits a navigable or towable vessel or barge to be converted into a stabilized structure over a submarine surface for the purpose of conducting numerous desirable operations on or beneath such surface, such as the exploration for or exploitation of subterranean oil deposits.

One of the major problems in the art of submarine prospecting has been the provision of suitable equipment which would permit the relatively rapid and economic exploration and exploitation of relatively large areas over the surface of the sea. It will be understood that any such equipment would include among its desiderata the ability to be readily towed or navigated over considerable marine distances, the ability to be anchored or otherwise rigidly stabilized over some particular location on the ocean bottom which it is desired to explore or exploit, together with a maximum simplicity of construction such that it may be converted from its moving to its stabilized condition by methods requiring a minimum effort, time and auxiliary equipment. The present invention meets all of these objectives by the combination of a plurality of structural features and methods illustrated below.

The features of the invention upon which patent protection is sought are set forth in the appended claims. The invention itself, together with its further objects and the advantages thereof, may best be understood by reference to the following specification when taken in conjunction with the accompanying drawings in which:

The Figs. 1 and 2 illustrate, in top and side elevations, respectively, a seagoing barge embodying the invention;

The Figs. 3 through 6, inclusive, illustrate in partial lateral section through the barge the structure and methods of operation of the essential lifting mechanisms for converting the barge from a floating movable vessel into a stabilized platform resting on the submarine surface to be examined or exploited, or vice versa;

The Fig. 7 illustrates a detail of the structure of the Figs. 3 through 6 employed in the method of hydraulically operating the lifting mechanisms referred to;

The Fig. 8 illustrates the structure employed in the step of inserting hydraulic piston heads within the structures of the Figs. 3 through 6;

The Fig. 9 illustrates the structure involved in handling and interjoining the articulated sec-

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tions of the supporting legs of the Figs. 3 through 6;

The Fig. 10 illustrates a clamp mechanism utilized in the step shown by the Fig. 6;

While the Fig. 11 illustrates schematically a system for supplying hydraulic pressure to all lifting mechanism in common.

Referring now especially to the Figs. 1 and 2, there is illustrated a suitable floating vessel such as a barge 1 which, for convenience in moving it into position over any suitable working apparatus such as an oil pipe or like object protruding through the surface of the water, is provided with a bottomless inlet 2 over which a derrick 3 may be placed for the handling of oil pipes or other pieces of equipment. So much of the barge construction is quite conventional in form. However, for the purpose of converting it from a floating, movable object into a stabilized operating platform in accordance with the invention, there are provided means for extending or dropping down to and preferably driving into the sea bottom a plurality of stabilizing legs 4 (Figs. 3 to 6) which may be sent down in successive hollow or solid articulated sections 5 such that the over-all length of leg may be varied to accommodate different depths of water or muddy bottom. Such means comprise broadly a plurality of hollow tubes 6 having lower ends providing access to the sea bottom and through which the legs may be pushed or dropped downwardly, section after section, together with suitable hoisting means for lifting the leg sections into position, such as the derricks 7. The number of tubes 6 will depend upon the degree of stability or the amount of support required.

After a line of leg sections of suitable length has reached the bottom 8 of the sea through each tube 6, each leg is preferably driven into the mud by suitable means such as a pile driver or by hydraulic compression until they are securely in position. Preferably they will be driven into the mud to an extent sufficient to permit the legs to support the weight of the barge without further sinking of the legs within the mud. That is to say, the legs are driven down to a predetermined "refusal point" at which the mud "refuses" to receive any further insertion of the legs. The "refusal point" may be defined as the point at which a predetermined amount of force exerted downwardly on the legs will cease to drive the leg farther into the mud; and that predetermined force may be selected to have some value sufficiently high that the weight of

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the barge cannot effect any further sinking of the legs.

At this stage, the uppermost leg section of each leg is preferably cut off (Fig. 4) flush with the top of the tubes 6 to make room for the apparatus to be described presently. A compression chamber is next formed as by adding a piston head 9 (Figs. 5, 6 and 8) which is placed over the end of each last inserted section, and a cap 10 (Figs. 2, 5 and 7) which is screwed over the open end of each tube 6.

When all legs have been inserted in this manner in all of the tubes, and driven down into the mud, then all of the caps 10 may be connected to a common hydraulic supply (Fig. 11) and uniform pressure introduced with the effect that the barge will lift itself on the legs sufficiently far out of the water to make wave and tide action ineffective to disturb stability. It does not necessarily have to go completely out of the water in order to obtain this effect. Thereafter a series of clamps 11 (Figs. 6 and 10) are clamped around the lower end of the legs so that the barge may rest on the clamps 11 and hold itself up without the further maintenance of hydraulic pressure.

The details of structure and the method steps are better illustrated by the Figs. 3 through 6. In the Fig. 3 the first step of lowering the plurality of pipe-like leg sections is shown as having been advanced to the point where two sections 5 and the interjoining unions 12 (cf. Fig. 9) have already been lowered into one tube 6 which, as indicated, extends entirely through the upper and lower walls 13 and 14 of the barge. At this stage, a clamp 15 (may be the same as that of Fig. 10) is temporarily affixed to the upper section 5 to hold it and those preceding it in position within the tube 6 while a new section is added. The addition of a new section is accomplished simply by the mechanism illustrated in the Fig. 9. The lifting cap 16 is removed from the end of the last inserted section 5 simply by unscrewing it whereupon a new union 12 is inserted in its place. The lifting cap 16 is then inserted in a new section 5, as indicated in the Fig. 9 and the entire unit then lifted by a suitable grasping tool 17 and a derrick 7 onto the top of the last inserted section 5 and screwed tightly thereto, or, rather, to the union 12 as illustrated by the Fig. 9. The threads of lifting cap 16, sections 5 and unions 12 are shown as tapered to facilitate connection and disconnection. This process is performed repeatedly for each tube 6 of the Figs. 1 and 2, until each tube is provided with a leg resting on or in the sea bottom. At that stage each leg is either hammered or driven by hydraulic pressure to the predetermined "refusal point" already referred to. If the driving be accomplished by hydraulic means the device illustrated in the Fig. 5 for the lifting operation to be described will serve the purpose.

The Fig. 4 illustrates the condition after which all of the legs have been driven down to their predetermined "refusal points" and the tops of the uppermost sections 5 cut off flush with the tops of tubes 6. As a next step, there is placed on the top of the uppermost section of each leg a piston head 9 having sealing rings 18 and 19 capable of firmly engaging the side walls of the tubes 6 as well as those of caps 10 which preferably have the same diameter as tubes 6 so that legs 4 and pistons 9 may extend into them if necessary. Pistons 9 may be provided with protrusions 20 which facilitate the fitting with the upper end of the last inserted section 5. The

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piston 9 may be inserted into the tubes in the positions shown, or, rather, on top of the last section illustrated in Fig. 4, simply by lifting with a derrick 7 and a tong mechanism 21 (Fig. 8) which may engage releaseably a stud 22 on the pistons 9.

After the piston 9 has been thus inserted, there is lifted on to the end of each tube 6 a suitable sealing cap 10 (Fig. 7) which is screwed to the end of the tube as shown in Fig. 5. (As indicated by Fig. 2, those caps 10 on the lower portions of the vessel, such as the stern, may be made longer for the convenience of making all units, tube 6 and caps 10, of common heights.) Each cap 10 is provided with a lifting lug 23 and an inlet coupling mechanism 24 for attachment to a source of hydraulic pressure (Fig. 11).

As a next step in the process or method, hydraulic pressure such as air or liquid, is supplied from a common source and simultaneously to the internal portions of the caps 10 associated with all legs 4 and tubes 6 and, by virtue of the uniform hydraulic pressure on all legs, the barge is caused to lift itself on the legs to some convenient position at which the unstabilizing effect of wind, tide and water is minimized. This is illustrated by the position of the barge in Fig. 6 just above the water. It will be understood that it is preferable that the hydraulic systems supply a common hydraulic pressure within the caps 10 for all tubes and legs in order that there be a uniformity of lifting force so that all portions of the barge tend to be lifted at the same time. Such common hydraulic supply is illustrated in the sketch of the Fig. 11. It will be understood that any suitable means for supplying and controlling the hydraulic pressure may be utilized such as the schematically indicated pump 25 and valve 26 which control the supply of fluid pressure to a duct 27 to which all coupling mechanisms 24 are attached by suitable means such as flexible conduits 28.

After the barge has been lifted to the position desired above the water, the legs 4 may be provided with the clamps 11 upon which the barge may rest and, in which case, the hydraulic pressure may be removed. It will be understood that this expedient may be desirable where the barge is to remain in a stabilized position for a substantial length of time during which it might not be desirable to maintain a constant hydraulic pressure for supporting the weight of the barge.

After the barge has served its purpose in any given location and it is desirable to move on to a new one, the aforescribed method may be performed in reverse to reconvert the barge into a floating, navigable vessel. The hydraulic pressure may be momentarily reapplied to raise the vessel slightly off the clamps 11, the clamps may then be removed, the hydraulic pressure gradually reduced to lower the barge to its normal floating position, and, thereafter, the caps 10 may be removed. The pistons 9 may be simply removed by hoisting with the tong mechanism 21 of the Fig. 8, the lifting cap 16 may be reinserted in the last inserted leg section (rethreading the same if necessary) so that the whole leg may be withdrawn in successive decoupling steps with the use of the clamp 15 substantially in the manner already described in connection with the construction of the leg.

While I have shown and described one illustrative embodiment of the invention, it will be understood that numerous modifications thereof will occur to those skilled in the art without de-

parting from the true spirit and scope of the invention. All such modifications I aim to include within the scope of the appended claims.

What I claim is:

1. A method of operating a vessel convertible into a stabilized structure over a submarine surface and having a plurality of open ended tubes one end of each of which provides access to said surface through the bottom of said vessel and each of which is adapted to receive within itself sections of an articulated downwardly extensible supporting leg and to direct the same into engagement with said surface, comprising the steps of forming a leg extending downwardly through each of said tubes by successively inserting and interconnecting a plurality of such sections until said surface is reached, forming a compression chamber about the upper end of each said leg, and supplying fluid under hydraulic pressure to all of said chambers whereby said vessel may be lifted upon said legs.

2. A method as in claim 1 including, after the first step of forming said leg, the step of driving the leg thus formed into said surface to a predetermined "refusal point."

3. A method as in claim 1 in which the step of forming a leg includes the step of temporarily clamping the previously inserted sections of leg to said tube for holding the same to said tube while a new section is added.

4. A method as in claim 1 including, immediately before the step of forming said compression chamber, the step of cutting off an upper portion of the last inserted section to provide room for the formation of said chamber.

5. A method as in claim 1 including the method of reconverting said vessel from a stabilized structure to a floating condition comprising the steps of lowering said vessel to floating condition by reducing said fluid pressure, disassembling said compression chamber, and disassembling said legs by successively withdrawing and disconnecting said sections.

6. A method as in claim 1 including as a last step the step of clamping said vessel to said legs whereby further maintenance of said fluid pressure may be obviated.

7. A method as in claim 6 including the method of reconverting said vessel from a stabilized structure to a floating condition comprising the steps of unclamping said vessel from said legs, lowering said vessel to floating condition by reducing said fluid pressure, disassembling said compression chamber, and disassembling said legs by successively withdrawing and disconnecting said sections.

8. A method of operating a vessel convertible into a stabilized structure over a submarine surface and having a plurality of open ended tubes one end of each of which provides access to said surface through the bottom of said vessel and each of which is adapted to receive within itself sections of an articulated downwardly extensible supporting leg and to direct the same into engagement with said surface, comprising the steps of forming a leg extending downwardly through each of said tubes by successively inserting and interconnecting a plurality of such sections until said surface is reached, including the step of temporarily clamping previously inserted sections to said tube while interconnecting them with a newly added section, driving the leg thus formed into such surface to a predetermined "refusal point," cutting off an upper portion of the last inserted section to provide room for the forma-

tion of a compression chamber, adding a piston head to the upper end of each last inserted section and a sealing cap to the upper end of each said tube to form a compression chamber about the upper end of each said leg, supplying fluid under hydraulic pressure to all of said chambers whereby said vessel may be lifted upon said legs, and clamping said vessel to said legs whereby further maintenance of said fluid pressure may be obviated.

9. A method as in claim 8 including the method of reconverting said vessel from a stabilized structure to a floating condition comprising the steps of unclamping said vessel from said legs, lowering said vessel to floating condition by reducing said fluid pressure, removing said cap and said piston head, disassembling said legs by successively withdrawing and disconnecting said sections including the step of temporarily clamping remaining sections to said tube while disconnecting previously withdrawn sections.

10. A structure convertible from a floating vessel into a stabilized structure over a submarine surface, and vice versa, comprising a vessel including a plurality of open ended tubes one end of each of which provides access to said surface through the bottom of said vessel for an extensible and retractible supporting leg, interconnected leg sections within each said tube constituting an articulated downwardly extensible and upwardly retractible supporting leg for engagement with said surface, said sections being disconnectible from each other whereby said leg may be assembled and extended downwardly by the progressive addition of such sections to the top of the leg and disassembled by the progressive raising thereof and successive disconnection of the uppermost of said sections, piston heads each removably positioned on the uppermost of such sections in each said tube and each engaging the associated tube, removable means closing the upper end of each tube to define in each tube a compression chamber with such tube and the piston head therein, and means for supplying fluid under pressure to all of said chambers whereby said vessel may be lifted and lowered on said legs.

11. A structure as in claim 10 including a clamping device engaging each leg below said vessel for affixing said vessel to said legs after the vessel has been lifted to a desired height.

12. A structure convertible from a floating vessel into a stabilized structure over a submarine surface, and vice versa, comprising a vessel including a plurality of open ended tubes extending through the top and bottom of said vessel such that one end of each tube provides access to said surface through the bottom of said vessel for an extensible and retractible supporting leg, interconnected leg sections within each said tube constituting an articulated downwardly extensible and upwardly retractible supporting leg for engagement with said surface, said sections being disconnectible from each other whereby said leg may be assembled and extended downwardly by the progressive addition of such sections to the top of the leg and disassembled by the progressive raising thereof and successive disconnection of the uppermost of said sections, piston heads each removably positioned on the uppermost of such sections in each said tube and each engaging the associated tube, removable means closing the upper end of each tube to define in each tube a compression chamber with such tube and the piston head therein, and means for supplying

fluid under pressure to all of said chambers simultaneously and at common pressure whereby said vessel may be lifted and lowered uniformly on said legs.

13. A structure as in claim 12 including a clamping device engaging said leg below said vessel and upon which said vessel may rest for affixing said vessel to said legs after the vessel has been lifted to a desired height.

CLARENCE J. McCOY. 10

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