Feb. 11, 1958 G. E. SUDEROW 2,822,670

PERFORATED CAISSON JACK ASSEMBLY

Filed Sept. 2, 1953 3 Sheets-Sheet 1

Fig. 1.

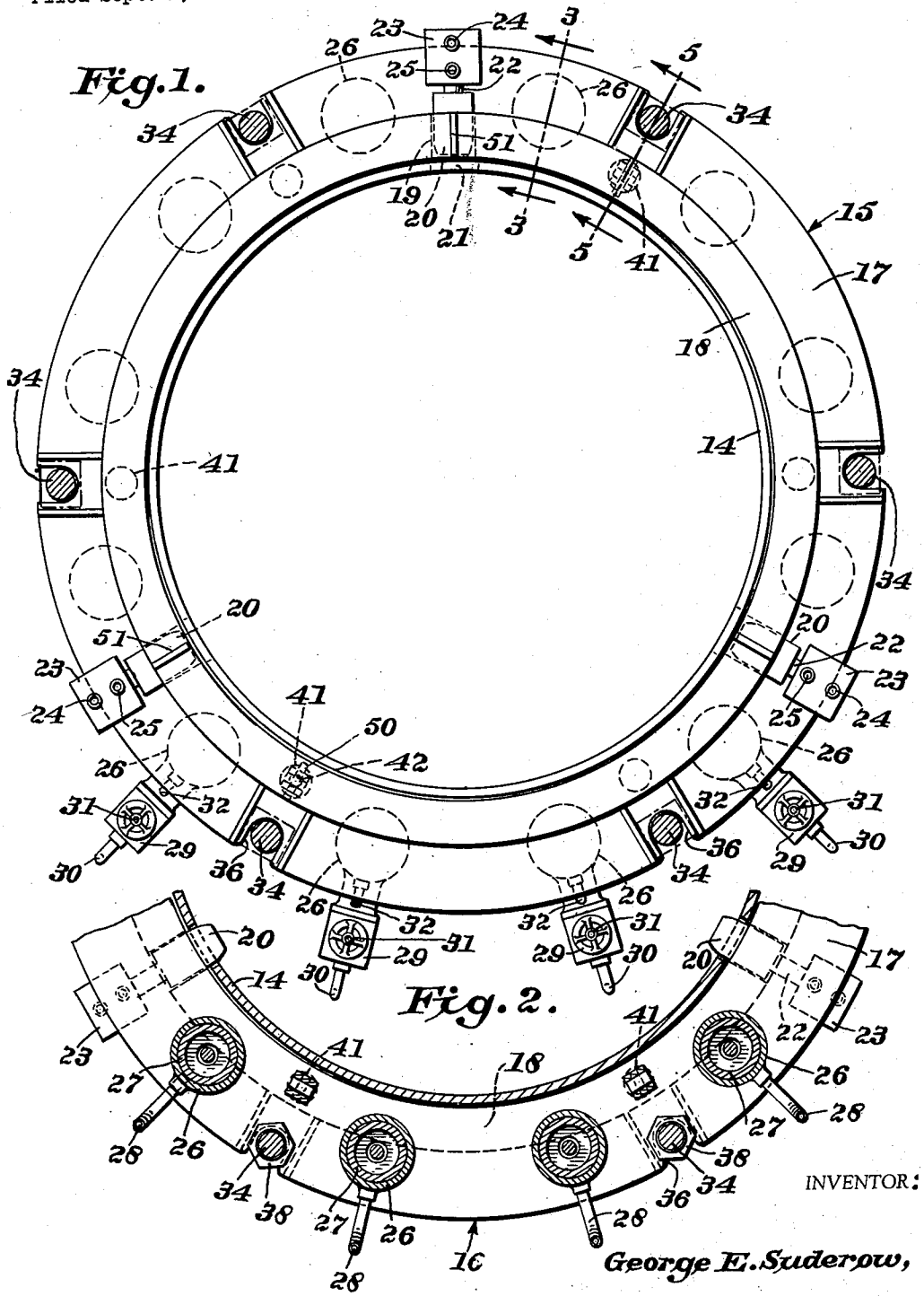

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Fig. 3.

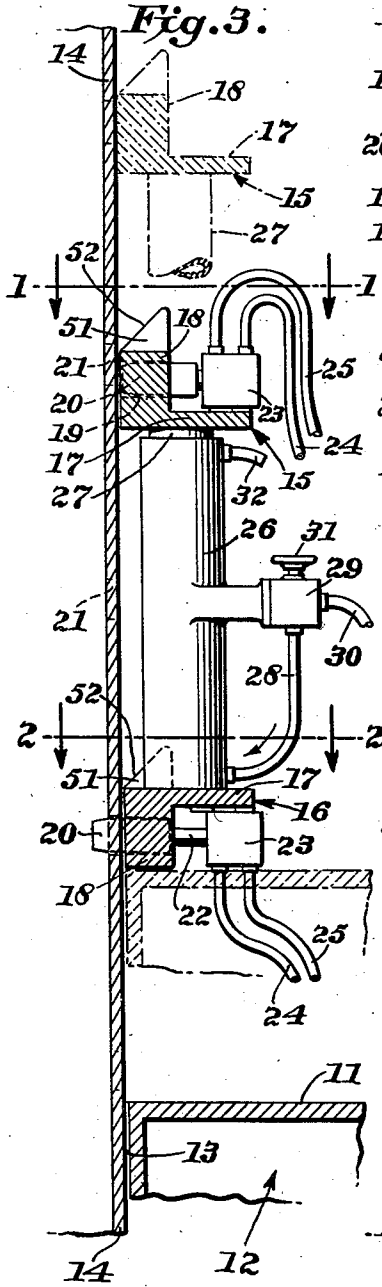

Fig. 4.

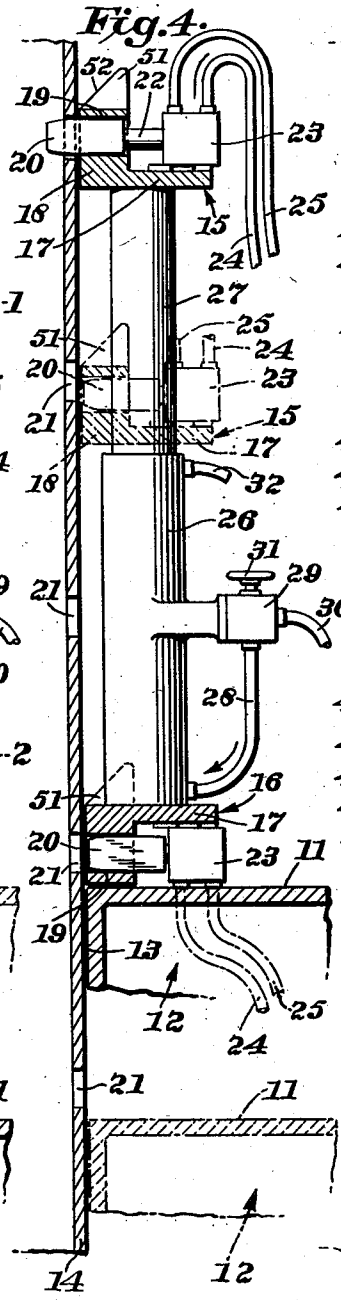

Fig. 5.

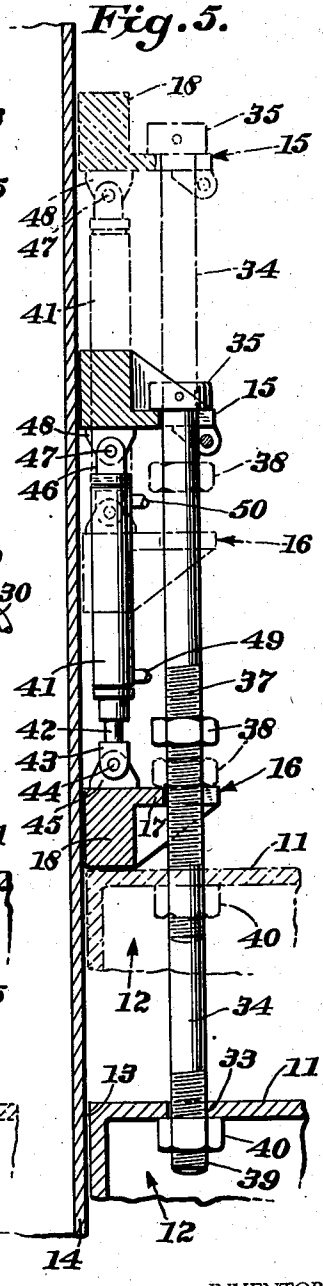

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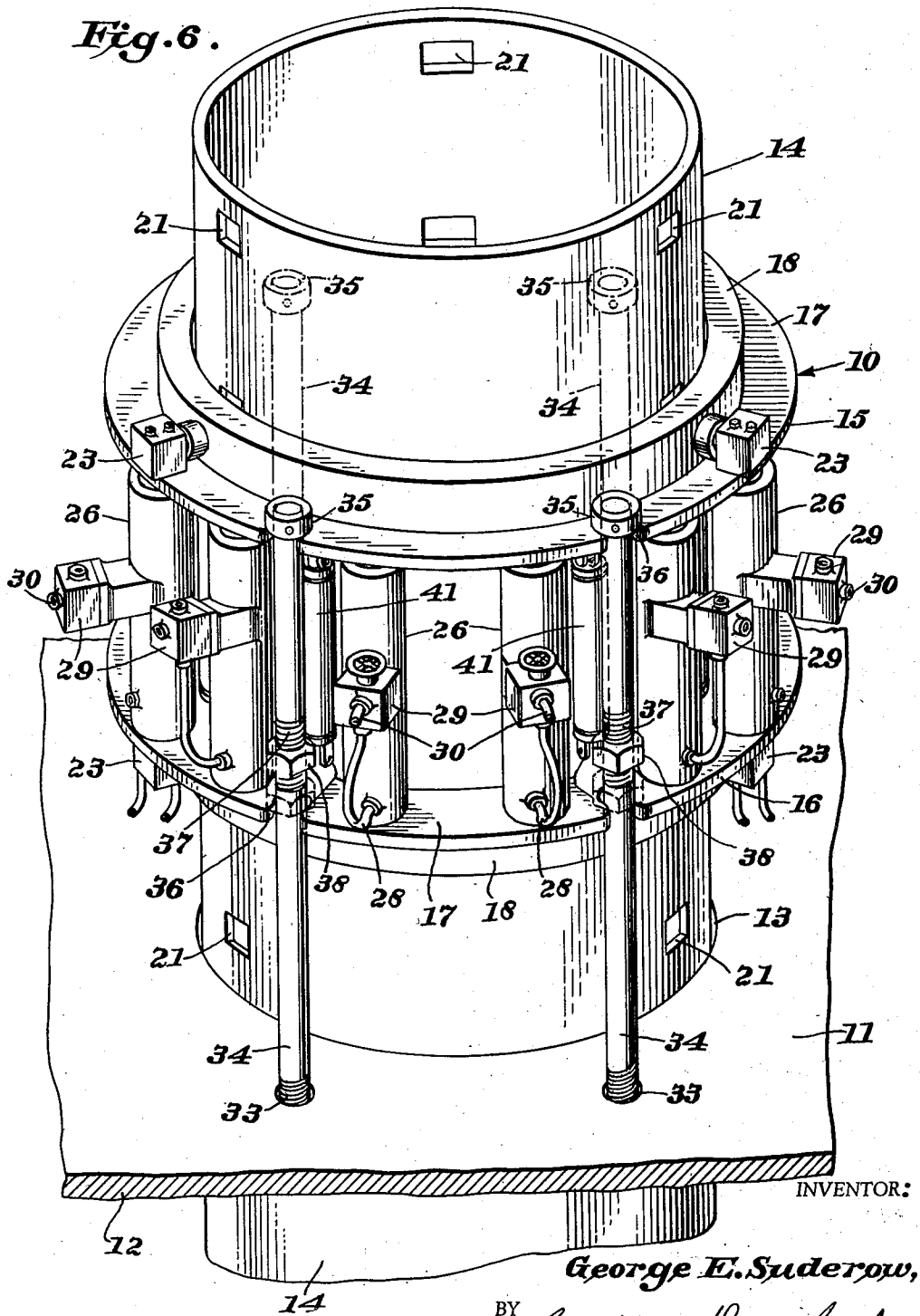
Fig. 6.



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United States Patent Office 2,822,670
Patented Feb. 11, 1958

2,822,670

PERFORATED CAISSON JACK ASSEMBLY

George E. Suderow, New York, N. Y., assignor to DeLong Corporation, a corporation of Delaware

Application September 2, 1953, Serial No. 378,103

11 Claims. (Cl. 61—46.5)

The present invention relates to an improved jack assembly for raising or lowering a supporting leg relative to a base or platform structure. More particularly, this invention relates to improvements in a jack assembly of the type disclosed in the patent to Pointer 2,775,869.

An important object consists in associating with a base such as the deck of a barge or the like, and a tubular member such as a caisson, an improved jack assembly including vertically spaced upper and lower concentric axially disposed gripper rings of such size and diameter as to loosely embrace the tubular member. Positioned between the rings are circumferentially disposed raising and lowering means for axially displacing the rings relative to each other. Associated with the rings are locking means for releasably connecting the tubular member to the base.

A further object consists in mounting a jack assembly on the deck of a barge or the like, by circumferentially spaced tie rods, which extend through the upper and lower gripper rings so as to allow the rings to be movable relative thereto and which also operatively connect the upper ring to the barge. Each of the tie rods has connected thereto an axially adjustable locking or retaining member which when the barge is elevated to the desired height on the caisson, is arranged to engage the lower gripper ring so as to relieve the lifting jacks of the load.

Other objects and advantages of the invention will become apparent from the following description when taken in conjunction with the accompanying claims and drawings.

Referring to the drawings in which is shown a preferred embodiment of the invention:

Fig. 1 is a sectional view taken substantially along the line 1—1 of Figure 3.

Fig. 2 is a detailed sectional plan view taken substantially along the line 2—2 of Figure 3.

Fig. 3 is a sectional view taken substantially along the line 3—3 of Figure 1.

Fig. 4 is a view similar to Figure 3 but showing the parts in different operating positions, and

Fig. 5 is a sectional view taken substantially along the line 5—5 of Fig. 1.

Fig. 6 is a perspective view of the casing assembly.

Referring to the drawings, the improved jack assembly, which is generally indicated by the numeral 10 (Fig. 6), is shown for the purpose of illustration, associated with a base or platform structure in the form of the deck 11 of the floating drilling barge 12. The deck may be provided with one or more vertical openings 13, through each of which extends a tubular supporting column, such as the caisson 14 which has a plurality of circumferentially symmetrically disposed longitudinal rows of uniformly spaced slots or bolt-receiving apertures 21. The jack assembly 10 comprises an upper gripper ring or annular member 15 and a lower concentric ring 16 which are of such diameters as to loosely receive and embrace the caissons 14. Each of the rings 15 and 16 is preferably formed with a horizontal portion or flange 17 and an

angularly disposed collar or vertical flange 18, that extend in opposite directions from the rings.

Each of the collars 18 has circumferentially spaced holes 19 (Figure 4), in which are mounted reciprocating locking pins or bolts 20, which are arranged to register and extend into the slots or apertures 21 formed in the wall of the caisson 14. It will be seen that when the pins 20 of the rings 15 or 16 extend into such slots 21, the corresponding ring is firmly locked to the caisson 14 against relative movement therebetween longitudinally of the caisson. In this connection, it is pointed out that although the caisson or supporting column 14 has been shown as being provided with bolt-receiving apertures which extend completely through the wall of the supporting column, it will be realized that other means which are the full equivalent of such apertures may be provided on the column for cooperation with the pins 20 to prevent movement of either of the rings of the jack assembly longitudinally of the column. It is only essential that the interengaging surfaces between the pins and the supporting column extend substantially transversely of the latter so that on the imposition of loads on the pins longitudinally of the column, there will be no camming action between such surfaces that will be effective to urge displacement of the pins transversely of the supporting column. As shown, each of the reciprocating pins 20 is connected to a piston rod 22 of a double-action fluid pressure motor 23 so as to be operated by any suitable hydraulic or air pressure means from a main source of supply through the flexible inlet and exhaust tubes 24 and 25. While each of the rings is shown provided with three of the locking pins 20, circumferentially spaced thereon, it will be manifest that any number may be employed, so as to insure the uniform locking of the caisson 14 to the jack assembly during the operation of the device.

Positioned between upper ring 15 and the lower ring 16 and circumferentially disposed relative thereto, are spaced lifting cylinders 26 in each of which is mounted a reciprocating piston 27 (Figure 4) that is secured to the underside of the flange 17 of the upper ring 15 so as to raise or elevate the same. Fluid such as oil, air or steam is introduced under pressure, into each of the cylinders 26 beneath the pistons 27 through an inlet 28 from a valve housing 29 that communicates with the source of fluid through a pipe 30. As shown, a valve 31 is associated with each of the housings 29 so as to provide auxiliary manually operable means for controlling the flow of the fluid under pressure to the cylinder 26. The upper ends of each of the cylinders 26 is connected to atmosphere through the outlet 32.

The deck 11 adjacent each of the openings 13 is formed with circumferentially spaced apertures or holes 33 (Figure 6) through which extend the tie rods or tension bolts 34. Each of the rods 34 has an enlarged head 35 at the upper end thereof and extends through vertical aligned recesses 36 in the flanges 17 of the upper and lower ring, and is of such a length as to project a substantial distance above the upper ring 15. Each of the rods 34 intermediate its ends has a threaded portion 37 positioned above the lower ring 16 and arranged to receive a polygonal shaped tool receiving nut 38, for a purpose subsequently described. The lower end of each of the rods 34 is also threaded as at 39 and has detachably connected thereto a retaining nut 40 that engages the underside of the deck 11 so as to limit the upward movement of the bolt (Figure 5).

Between the upper ring 15 and the lower ring 16 are positioned spaced single-acting retracting cylinders 41, each having a reciprocating piston 42 (Fig. 5) terminating in a bifurcated lug 43 pivotally connected at 44 to a lug 45 that extends upwardly from the lower ring 16. The upper end of each cylinder 41 is pivotally connected

by a link 46 and a pin 47 to a depending lug 48 on the ring 15. Fluid from the main source of supply is conducted into one end of each of the retracting cylinders 41 through a pipe 49 (Fig. 5) in order to retract the pistons 42 into the cylinders. The other end of each cylinder is connected to atmosphere through a pipe 50. The rings 15 and 16 may be provided with the circumferentially spaced guide members 51, each of which has an inclined face 52 positioned so as to guide the caisson 14 into proper position relative to the opening 13 when the parts are being assembled or installed.

In operation of the mechanism embodying this invention, the jack assemblies 10 and their associated parts are initially mounted on the deck 11 about the openings 13 and secured to the barge 12 by the tie rods 34. It will be seen that the lower ring 16 of each assembly will then rest on the deck about the openings 13. With a jack assembly 10 in this position, a caisson 14 is inserted, as by a crane, through the assembly, with such insertion being facilitated by the inclined faces 52 of the guide members 51, and through the opening or well 13 in the barge 12. During such insertion, care is taken to align the several vertical rows of openings 21 in the caisson with the corresponding pins or bolts 20 in the jack assembly 10. With the caisson being held in such inserted position as by a crane (not shown) or the like, the cylinders 26 may be operated to lift the upper ring 15 until the upper pins 20 become aligned horizontally with a corresponding series of apertures 21 in the caisson. At this time the fluid motors 23 of the upper ring 15 are operated to extend its pins 20 into the caisson apertures, to thereby lock the ring 15 to the caisson. The caisson will thereby be supported by the jack assembly 10 and, if desired, pressure can be relieved slowly from the lifting cylinders 26 so that the upper ring 15 will slowly descend, carrying the caisson 10 with it, until the pistons 27 are completely retracted. Thereupon, pressure fluid to the cylinders 26 can be shut off and the entire weight of the caisson will be borne by the upper ring 15 and transmitted through the cylinders 26 and the lower ring 16 to the deck 11 of the barge.

Desirably, in this final barge-supported position of the caisson, the lower end thereof does not project appreciably below the bottom of the barge 12 so that the latter can be floated to an erection site, as by being towed by a tug (not shown), with a minimum of towing resistance.

At an erection site, all of the caissons of the barge are moved downwardly into engagement with the marine bottom by the following sequence of operations of each jack assembly 10. In the event that the pins 20 of the lower rings 16 are not aligned with a series of apertures 21 in the caisson, the lifting cylinders 26 are operated to lift the caisson, by the pins 20 of the upper ring 15, until a series of apertures 21 in the caisson become so aligned with the pins 20 in the lower ring 16. At such time, the motors 23 of the lower ring 16 are operated to extend their pins 20 through the aligned apertures 21 in the caisson 14. Thereupon, the lifting cylinders 26 are operated to lower the upper ring 15 slightly to transfer the load of the caisson 14 from the upper pins 20 to the lower pins 20, so that the upper pins 20 can be withdrawn from engagement with their corresponding apertures in the caisson.

After such withdrawal of the upper pins, the cylinders 26 are operated to extend their piston rods 27 and lift the upper ring 15 substantially the full stroke of the lifting cylinders until the upper pins 20 become aligned with a higher series of apertures 21 in the caisson 14, whereupon the motors 23 of the upper ring 15 are operated to extend their pins 20 through such apertures. The cylinders 26 are continued to be operated to raise the upper ring 15 slightly to transfer the load of the caisson 14 from the lower pins 20 to the upper, so that such lower pins can be withdrawn from the caisson. Fluid pressure is then slowly relieved from the lifting cylinders 26 to slowly lower the upper ring 15, and thereby slowly lower the caisson 14 a distance equal to substantially the full retracting stroke of the cylinders. Thereupon, the pins 20 of the lower ring 16 will become realigned with a higher series of apertures 21 in the caisson 14 and are inserted thereinto. The lifting cylinders then continue to lower the caisson 14 slightly until the load of the latter is transferred from the upper pins 20 to the lower pins 20 so that the upper pins 20 can be retracted or withdrawn from the caisson.

The foregoing cycle of operations of the jack assembly 10 is repeated until the caisson is in engagement with the marine bottom. At that time the jack assembly 10 is operated in the following sequence of operations in order to raise the barge 12 on the caisson 14. With all the pins 20 retracted, the lifting cylinders 26 are operated to lift the upper ring 15 a distance substantially equal to the full extension stroke of the cylinders 26 until the upper pins 20 become aligned with a series of apertures 21 in the caisson. The motors 23 of the upper ring 15 are then operated to insert their pins 20 into such apertures in the caisson 14. With the lower pins 20 being withdrawn from the caisson, the retracting cylinders 41 are operated to pull the lower ring 16 upward while fluid pressure is relieved from the lifting cylinders 26, until the latter cylinders are substantially completely retracted and the lower pins 20 become realigned with a higher series of apertures 21 in the caisson 14. Thereupon, the pins of the lower rings 16 are inserted into such apertures to thereby support the lower ring 16 on the caisson.

The upper pins 20 are then withdrawn from the caisson and the lifting cylinders 26 operated to raise the upper ring 15. Such raising of the upper ring 15 will move the latter into engagement with the heads 35 on the tie rods or bolts 34 so that the latter will pull the entire barge 12 upwardly with the upper ring 15. Near the end of such lifting stroke of the cylinders 26 the upper pins 20 will become realigned with a higher series of apertures 21 in the caisson 14, and at such time are inserted into such apertures. Fluid pressure is then relieved in the lifting cylinders 26 so that the load of the barge is transferred from the lower pins 20 to the upper pins 20. Thereupon, the lower pins 20 can be withdrawn from the caisson 14 and the retracting cylinders 41 operated to lift the lower ring 16 in order to re-cycle the jack assembly for another lifting stroke in accordance with the foregoing sequence of operations.

After the barge has been raised a predetermined or desired distance on the caissons, it will be seen that the upper pins 20 may not necessarily become aligned with a series of apertures 21 in the caisson 14, because the last step through which the barge is lifted may not be equal to the full stroke of the cylinders 26, so that the barge cannot be supported on the upper pins. Furthermore, it may be desirable to shut off the source of fluid pressure to the cylinders 26 while the barge is in such elevated position. Accordingly, while the load of the barge is on the lower pins 20 of the jack assembly, the nuts 38 on the tie rods 34 can be screwed downwardly until they engage with the upper surface of the lower ring 16. Thereupon, relief of the fluid pressure in the cylinders 26 will allow the barge to settle slightly until the load of the barge is taken by such nuts, instead of by the headed ends 35 of the rods 34.

Of course, in the event that the pins 20 of the upper ring 15 are aligned with a series of apertures 21 in the caisson 14 when the barge is raised to its desired height on the caisson, the upper pins 20 can be inserted into such apertures so that the load of the barge can be borne by the upper pins 20 and through the heads 35 on the bolts rather than by the nuts 38.

When drilling operations, or the like, have been completed at such a marine site and it is desired to move the barge to another marine site, the following sequence of operations is performed to lower the barge back down into the water and to pull up the caissons 14 out of en-

gagement with the marine bottom so that the barge can be towed to another marine site.

Assuming first that the load of the barge is being borne by the lower pins **20** and the nuts **38**, the lifting cylinders **26** are first operated to lift the upper ring **15** until the load of the barge is taken by the heads **35** of the tie rods **34**. Thereupon, the nuts **38** are screwed upwardly on the tie rods **34** so as not to interfere with normal operation of the jack assembly **10**. Fluid pressure is then slowly bled from the lifting cylinders **26** to thereby lower the upper ring **15**, and consequently the barge, until the pistons **27** of the cylinders **26** are substantially completely retracted and the upper pins are aligned with a lower series of apertures **21** in the caisson and are inserted thereinto.

Making the alternative assumption, namely, that the weight of the barge in its erected position is being borne by the upper pins **20**, the lower pins are retracted, and that the fluid pressure in the cylinders **26** is relieved, it will be seen that the cylinders **26** by their own weight drop downwardly to the extent permitted by the full extension of the retracting cylinders **41**. Consequently, the first step in the lowering of the barge from this assumed position will be to operate the retracting cylinders **41** until the lower pins **20** become aligned with a series of apertures in the caisson and are thereupon inserted thereinto. The lifting cylinders **26** are thereupon operated to lift the upper ring **15** slightly and also the barge, to transfer the load of the latter from the upper to the lower pins. After such transfer has been accomplished, the upper pins **20** are withdrawn from their engagement with the caisson, and fluid pressure is slowly bled from the lifting cylinders **26**, to thereby lower the upper ring **15** together with the barge a distance substantially equal to the full retraction stroke of the cylinders **26**. At or near the end of such stroke, the upper pins **20** will become aligned with a lower series of apertures **21** in the caisson **14** and are inserted thereinto. This position of the parts now corresponds to that of the parts at the end of the cycle described above with reference to the first assumption.

Thereafter, continued bleeding of fluid from the cylinders **26** transfers the load of the barge from the lower pins **20** to the upper pins **20**. The lower pins are thereupon withdrawn from the caisson **14**, and the cylinders **26** will again descend by their own weight, as governed by bleeding fluid from the retracting cylinders **41**, until the lower pins become realigned with a lower series of apertures in the caisson and are inserted thereinto. Fluid pressure is then again applied to the cylinders **26** to transfer the load of the barge from the upper pins **20** to the lower pins **20**. The upper pins are thereupon withdrawn and the fluid pressure slowly relieved from the cylinders **26** to lower the barge another step.

The foregoing sequence of operations is repeated until the barge becomes afloat. The following sequence of operations is then performed in order to raise the caissons off the marine bottom for towing of the entire structure to another site of operations.

Assuming that the lower pins **20** are in engagement with the caisson **14** when the barge becomes afloat, the first step will be to continue to bleed fluid from the lifting cylinders **26** until the upper pins **20** become aligned with a lower series of apertures in the caisson **14** and are inserted thereinto. The retracting cylinders **41** are then operated to lift the lower ring slightly to transfer its weight off of the lower pins **20**, so that they can be withdrawn from the caisson **14**. Thereupon, fluid pressure is slowly relieved from the retracting cylinders **41** to lower the lower ring **16** until it rests on the deck **11** of the barge. The upper pins **20** are then withdrawn from the caisson **14**, if need be first taking the weight of the upper ring off the upper pins by operation of the lifting cylinders, and fluid pressure slowly relieved from the cylinders **26** to lower the upper ring **15** until the upper pins **20** become realigned with a lower series of apertures **21** in the caisson **14**. The upper pins **20** are then inserted into such apertures, and the cylinders **26** operated to lift the upper ring **15** and consequently the caisson **14**. Near the end of the lifting stroke of the cylinders **26**, a lower series of apertures **21** in the caisson **14** will become aligned with the lower pins **20**, and such pins are inserted into such apertures. The upper pins **20** are then withdrawn from the caisson, while the load thereon is borne by the pins of the lower ring **16**, and fluid pressure bled from the cylinders **26** to lower the upper ring **15** in preparation for another lifting stroke, on which the upper pins will be reinserted into the caisson and the lower pins withdrawn. The foregoing sequence of operations is continued in order to lift the caissons **14** until their lower ends are substantially flush with the bottom of the barge. The weight of the caissons then can be borne by the lower pins and the supply of fluid pressure to the jack assembly **10** shut off during towage of the assembly to another marine site.

It will be manifest that the size and number of gripping pins and bolts, lifting cylinders, tie rods, as well as the overall arrangement of the jack assembly may be varied to suit the particular use to which the device is applied. Moreover, the jack may be with equal facility used to elevate or lower various types of both land and marine supports, members or columns as particular operating conditions may require. It is to be understood that the form of the invention shown is merely illustrative and that such changes may be made as come within the purview of the following claims.

I claim:

1. In combination with a floating barge having spaced openings in the deck thereof, caissons extending into said openings and provided with vertically spaced apertures, a jack assembly for releasably connecting the barge to each of the caissons and providing means for moving the caisson relative to the barge and for moving the barge relative to the caisson, said jack assembly including axially displaceable upper and lower rings through which the caissons extend, said rings being independently movable relative to each other, means connecting the upper ring to said barge, means for moving the upper ring and barge relative to the lower ring, means for moving the lower ring relative to the upper ring, circumferentially spaced bolts extending upwardly from the deck and loosely through said rings, means on the lower end of each bolt engaging the underside of the deck for limiting the upward movement of the bolt, means on the upper ends of the bolts for limiting the upward movement of the upper ring, reciprocating locking pins on each of the rings and arranged to engage apertures in the caissons when moved into registration therewith, and means for actuating said pins, each of said caissons arranged to be moved by the jack assembly into fixed engagement with the marine ground, and said barge when the caissons are in engagement with the ground being operable by the jack assembly to be raised above the water.

2. In combination with a floating barge having spaced openings in the deck thereof, caissons extending into said openings and provided with vertically spaced apertures, a jack assembly for releasably connecting the barge to each of the caissons and providing means for moving the caisson relative to the barge and for moving the barge relative to the caisson, said jack assembly including axially displaceable upper and lower rings through which the caisson extends, said rings being independently movable relative to each other, circumferentially spaced lifting cylinders between said rings, pistons movable in said cylinders, each of said lifting cylinders being mounted on the lower ring and having its piston connected to the upper ring, retracting cylinders between said rings and having pistons reciprocally mounted therein, means connecting each retracting cylinder to one of the rings, means connecting each retracting piston to the other of said rings,

circumferentially spaced bolts extending upwardly from the deck in the barge and loosely through said rings, means on the lower end of each bolt engaging the underside of the deck for limiting the upward movement of the bolt, reciprocating locking pins mounted on each of the rings and arranged to engage apertures in the caissons when moved into registration therewith, means for supplying fluid pressure to said cylinders to selectively actuate the same, means for selectively actuating said pins, each of said caissons arranged to be moved by the jack assembly into fixed engagement with the marine ground, and said barge when the caissons are in engagement with the ground being operable by the jack assembly to be raised above the water.

3. In combination with a floating barge as called for in claim 2 in which each of the bolts is provided with means arranged to engage the lower ring for transferring the load on the bolts from the lifting cylinders directly to the lower ring.

4. In combination with a floating barge as called for in claim 2 in which each bolt is provided with an intermediate threaded portion, a nut threaded on said portion above the lower ring and arranged to engage the same to transfer the weight of the load on the bolts from the lifting cylinders directly to the lower ring.

5. In apparatus for erecting an over-water platform, the combination comprising: an elongated leg for supporting a platform-like body, said leg having at least two longitudinal rows of pairs of oppositely-facing abutment surfaces spaced apart longitudinally of said leg and extending generally transversely thereof, said rows being arranged symmetrically about said leg; jacking mechanism operable on said leg for effecting relative movement between said leg and the body in either direction longitudinally of said leg, said mechanism including a pair of rigid members surrounding said leg and movable relative thereto and to each other longitudinally of said leg, a pair of locking elements spaced along the length of said supporting member in alignment with each of said rows, each of said elements having a pair of oppositely-facing abutment surfaces complementary to each pair of surfaces of the corresponding row, one of said elements of each pair being mounted on one of said rigid members and the other of said elements of each pair on the other of said rigid members and both of said elements of each pair being mounted for independent linear reciprocating movement generally transversely of said leg to project and withdraw the corresponding element pair of surfaces into and out of overlapping relation with a pair of row surfaces, when aligned therewith, in order to substantially lock the corresponding rigid member to said leg against said relative movement in either direction therebetween or permit said relative movement, respectively, all of said abutment surfaces being substantially planar, disposed substantially normal to the length of said leg, and free of camming action effective on the imposition of a load longitudinally of said leg through a complementary pair of overlapped and mutually engaged abutment surfaces to urge a said element to withdraw its surfaces from a pair of row surfaces when overlapped therewith, and a plurality of reciprocating fluid motor means operatively connected to said rigid members for selectively effecting or restraining said relative movement therebetween in either direction, said motor means being arranged symmetrically about said leg and with respect to each of said elements and the connection of at least certain of said motor means with one of said members being disposed closely adjacent said elements thereon with less than 90° spacing, circumferentially of said one member, between each said connection and the nearest element in order to minimize bending stresses in said one member; and means mounting said mechanism to a platform-like body in order to operate the mechanism to lower said leg down into engagement with a marine bottom, raise the body and support it at least partially on said leg, lower the body back down until it is no longer supported on said leg, and pull said leg up out of engagement with the marine bottom for movement of the body, together with said leg and mechanism to another erection site, said one member, when said mechanism is being operated to raise or lower the body on said leg, being locked to the leg and the other member being unlocked therefrom, and said mounting means being connected to said other member and arranged symmetrically thereabout and with respect to each element thereon, said mounting means connections being disposed closely adjacent said other member elements to minimize bending stresses in said other member when the latter is locked to the leg and supporting the weight of the platform.

6. The structure defined in claim 5 in which each pair of surfaces of a row is defined by portions of the edges of an aperture and each pair of surfaces of an element is defined by portions of a locking bolt receivable in a said aperture when aligned therewith.

7. The structure defined in claim 5 including power-operated means connected to each of the locking elements for selectively projecting or withdrawing the latter.

8. The structure defined in claim 5 in which the motor means are arranged to raise the said other member relative to the said one member by extension of said motor means when said one member is locked to and said other member is unlocked from the leg.

9. The structure defined in claim 5 in which the extent of the element abutment surfaces in the direction of their movement and engageable with the leg abutment surfaces is less than the transverse dimension of the leg in said directions, whereby the extent of locking and unlocking movements of the elements is less than said leg transverse dimension.

10. The structure defined in claim 5 in which the means mounting the mechanism includes a tension element secured to the other rigid member and securable to the body for lifting the latter when said other rigid member is unlocked from said leg, the one rigid member is locked thereto, and the motor means are operated to effect upward movement of said other rigid member relative to the other, and including relatively-vertically-adjustable, inter-engageable abutment means on said tension element and on said one rigid member to support the body on said one rigid member independently of said motor means when the latter are rendered ineffective.

11. The structure defined in claim 5 including an adjustable disengageable mechanical supporting connection extending between the said one member and the body for supporting the latter on the leg independently of said motor means, whereby after elevation of the body on the leg by operation of said motor means to an elevation whereat the element pair of surfaces on the other member are not in alignment with a pair of row surfaces on the leg so that said other member cannot be locked to said leg, said mechanical connection can be engaged and the pressure in said motor means can be released.

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U. S. DEPARTMENT OF COMMERCE

PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,822,670 February 11, 1958

George E. Suderow

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 8, list of references cited, after line 69, add the following:

FOREIGN PATENTS

1,014,974 France----------June 25, 1952

Signed and sealed this 29th day of April 1958.

(SEAL)
Attest:
KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents