July 12, 1960 E. A. SMITH 2,944,403

HYDRAULIC JACKING ASSEMBLY FOR MARINE PLATFORMS

Filed Sept. 4, 1953 5 Sheets-Sheet 1

Fig. 1.

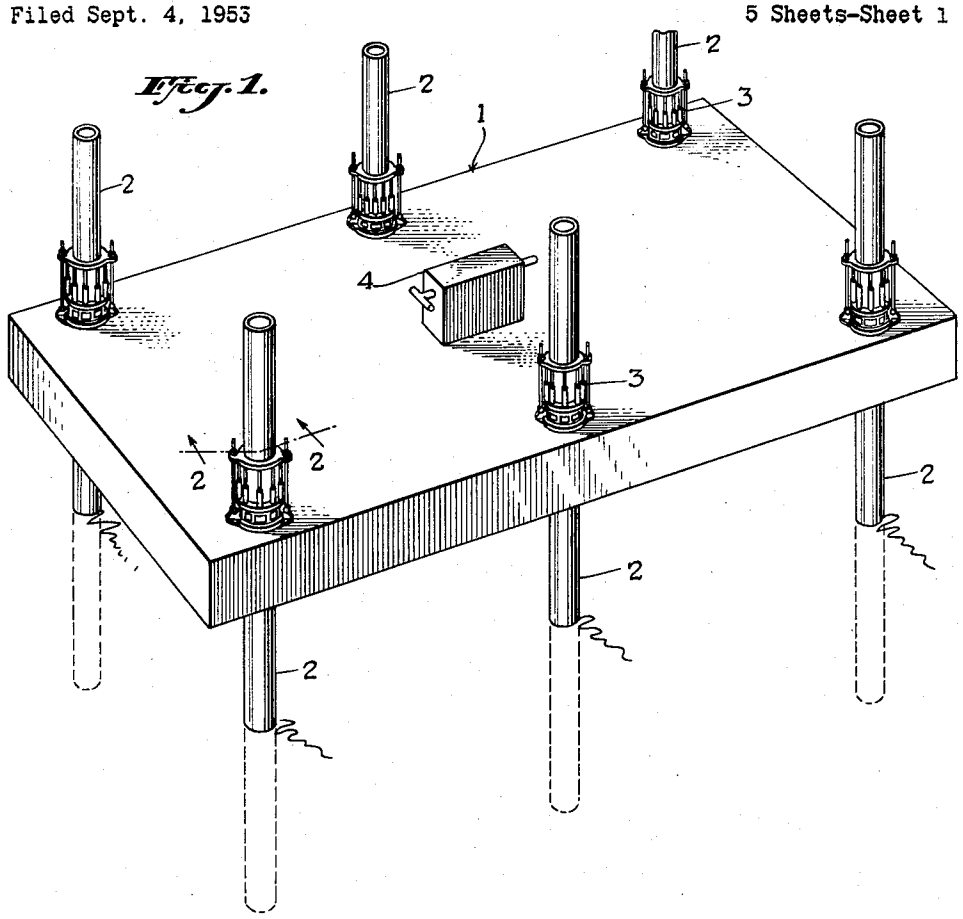


Fig. 8.

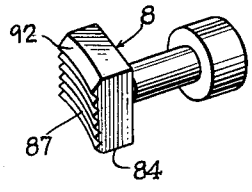
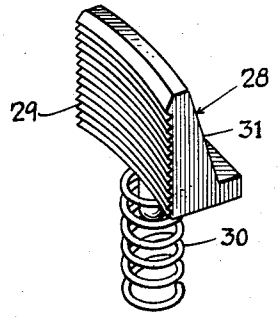


Fig. 7.



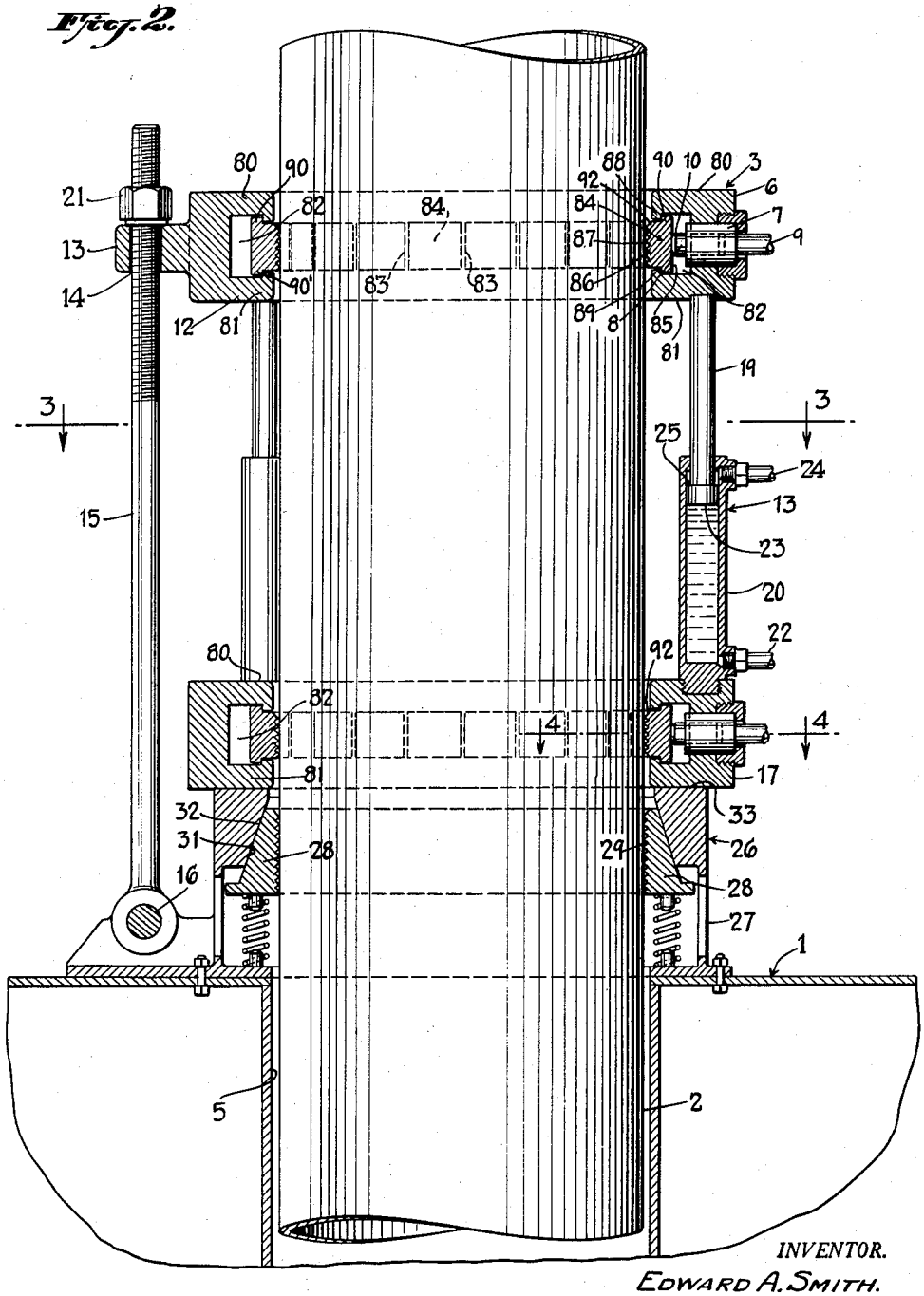
INVENTOR.
EDWARD A. SMITH.
BY
Ward Crosby & Neal.
ATTORNEYS.

July 12, 1960 E. A. SMITH 2,944,403

HYDRAULIC JACKING ASSEMBLY FOR MARINE PLATFORMS

Filed Sept. 4, 1953 5 Sheets-Sheet 2

Fig. 2.



INVENTOR.
EDWARD A. SMITH.
BY Ward Crosby & Neal.
ATTORNEYS.

July 12, 1960 E. A. SMITH 2,944,403

HYDRAULIC JACKING ASSEMBLY FOR MARINE PLATFORMS

Filed Sept. 4, 1953 5 Sheets-Sheet 3

Fig. 3.

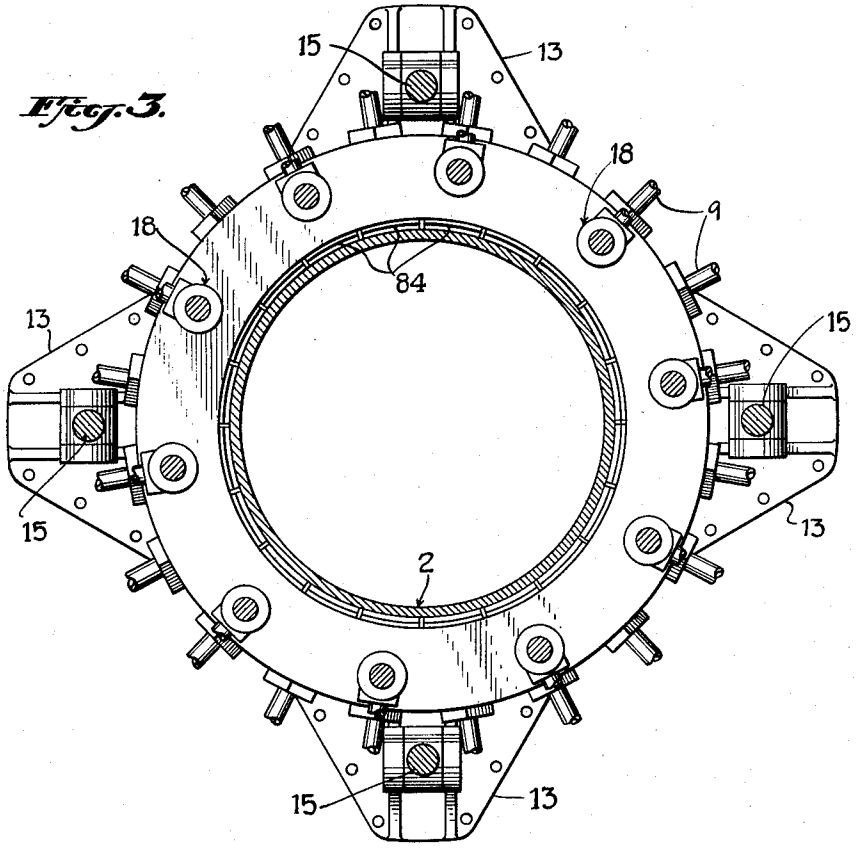
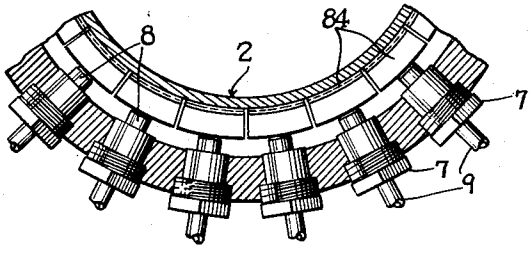


Fig. 4.



INVENTOR.
EDWARD A. SMITH.
BY Ward Crosby & Neal
ATTORNEYS.

July 12, 1960 E. A. SMITH 2,944,403

HYDRAULIC JACKING ASSEMBLY FOR MARINE PLATFORMS

Filed Sept. 4, 1953 5 Sheets-Sheet 4

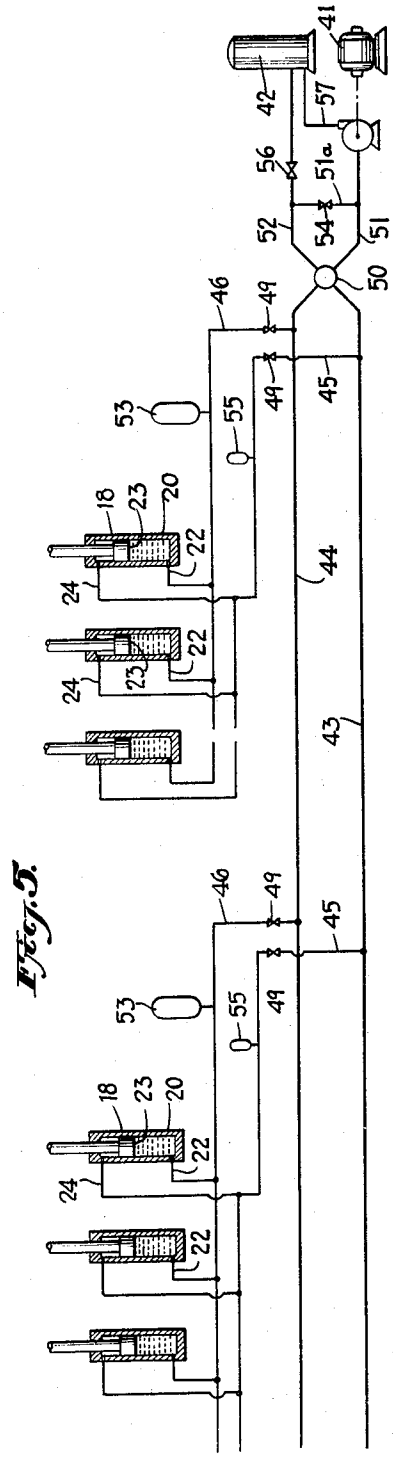


Fig. 5.

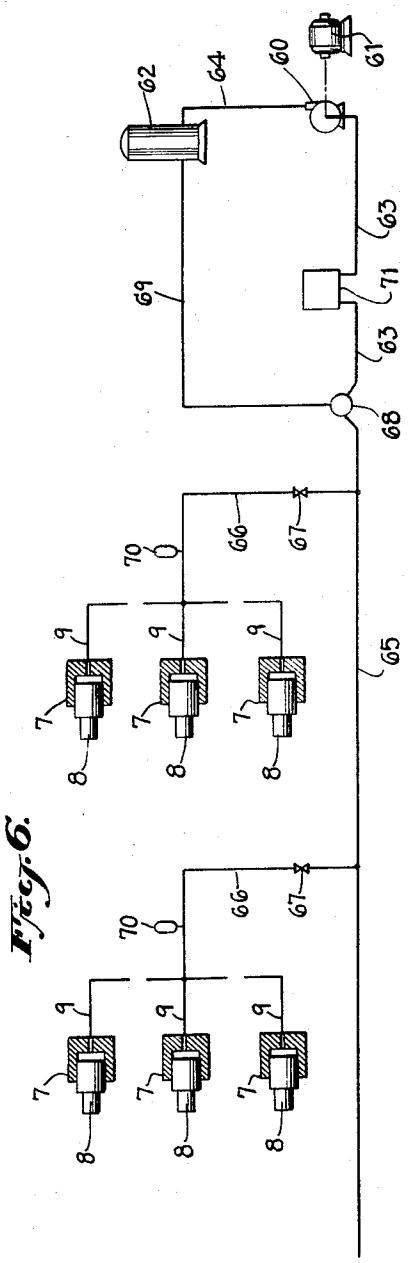


Fig. 6.

INVENTOR.
EDWARD A. SMITH.
BY
Ward Crosby & Neal.
ATTORNEYS.

July 12, 1960 E. A. SMITH 2,944,403

HYDRAULIC JACKING ASSEMBLY FOR MARINE PLATFORMS

Filed Sept. 4, 1953 5 Sheets-Sheet 5

Fig. 9.

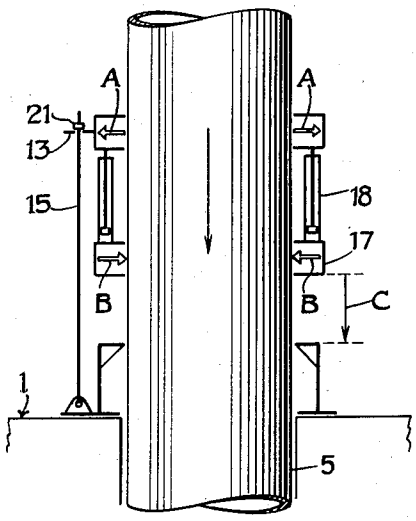


Fig. 12.

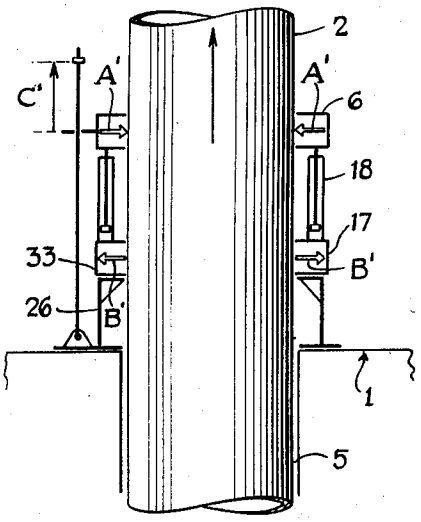


Fig. 11.

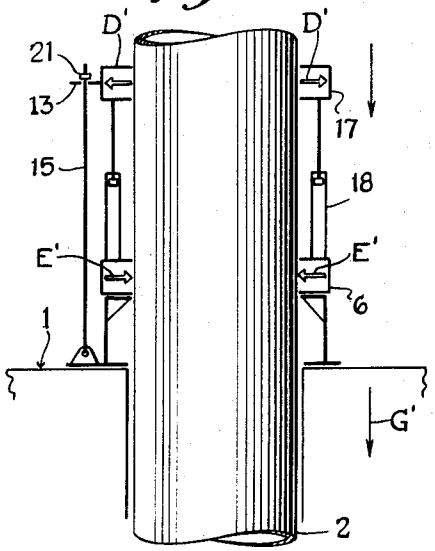
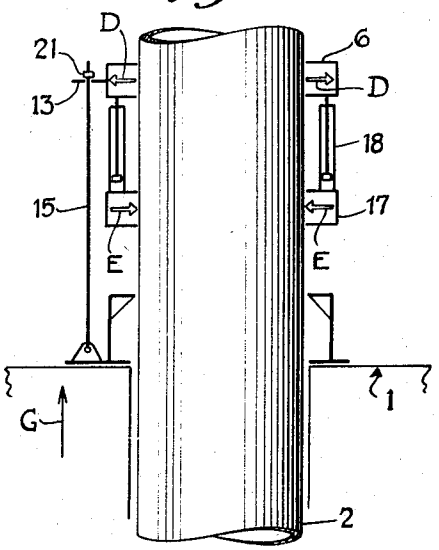


Fig. 10.



INVENTOR.
EDWARD A. SMITH.
BY
Ward Crosby & Neal.
ATTORNEYS.

United States Patent Office

2,944,403

Patented July 12, 1960

2,944,403

HYDRAULIC JACKING ASSEMBLY FOR MARINE PLATFORMS

Edward A. Smith, Chatham, N.J., assignor to Raymond International Inc., New York, N.Y., a corporation of New Jersey

Filed Sept. 4, 1953, Ser. No. 378,460

1 Claim. (Cl. 61—46.5)

This invention relates to a novel and improved hydraulic jacking assembly for use in a marine platform construction of the type supported above the water on spuds or cylindrical pilings.

Marine platforms which are buoyant and carry with them the necessary apparatus for forcing their supporting spuds into the sea bottom have utility in many fields of endeavor, especially, however, in the off-shore oil well drilling industry. There, it is most desirable to be able to float such a platform or dock out to the appointed location, anchor it in position by dropping the spuds into the sea bottom, then force the spuds down firmly into the sea bottom and finally raise the platform on its supporting spuds above the surface of the water so as to free its working deck space from the damaging effect of the sea's waves. When such operations can be accomplished without the necessity of employing expensive cumbersome auxiliary equipment, the advantages are self-evident. Therefore, jacking devices capable of forcing spuds into the sea bottom have been developed which can easily be carried by the marine platform itself. At present, one form of jacking assembly being employed is of the pneumatic type wherein the jacks consist of expansible rubber tubes or bellows. These tubes are purchased from the rubber companies which manufacture ordinary automobile tires. The marine platforms employed in this connection, however, are of large size, generally being in the order of 100′ by 250′. Obviously, their weight is of such magnitude as to require tremendously powerful lifting jacks. It has been observed that jacks of the pneumatic type will have to be able to stand pressures as high as 350 p.s.i. if they are to perform satisfactorily on such platforms. Since this pressure is far above the structural limits for the commercial rubber tire, custom built rubber tubes must be utilized. Needless to say, the expense of such items is an all important consideration in the overall cost of the jacking assembly.

Other disadvantages inherent in the use of this pneumatic type of jack have become apparent during actual commercial operation of the device. Barges of the type herein contemplated are provided with a plurality of wells or apertures through which supporting spuds can be inserted from the deck of the barge through to the ocean floor beneath. Each well is provided with a jacking assembly for laterally gripping and vertically forcing its respective spud into or up from the ocean bottom. When it is desired to erect an oil well drilling platform, the normal procedure is to place the spuds within their respective wells, and grip the spuds with the jacks so that the former are held extending vertically above the deck of the barge. With the spuds in this position, the barge is then towed to the drilling location and is brought to a substantially full stop by the use of anchors or tug boats. It is highly desirable that all of the jacks then be released

simultaneously, so as to permit all the spuds to drop through their wells and sink into the ocean floor at the same time. This simultaneous operation is especially desirous in any kind of rough seas, for if one spud is released before the others, it of course will anchor itself in the sea bottom while the others are still held above the barge. Then, if the sea is at all rough, waves striking the barge will cause it to roll and toss and, if only one or two such spuds are fixed in the sea bottom, the weight of the barge will twist and bend them beyond repair. When the pneumatic type of jack is used, simultaneous release of all spuds has proven impossible from a practical standpoint.

Another serious drawback inherent in this pneumatic type of jack is its relatively slow speed of operation. Basically, these jacking assemblies operate on the principle of expanding one jack laterally to grip the spud and then expanding another jack vertically to move said spud either up or down. At the end of each vertical expansion the jacking cycle must be repeated. Therefore, it is obvious that the stroke of the vertically expanding jack is determinative of the number of cycles necessary to force a spud any given distance. Of course, at the end of each cycle the vertical jacks must be collapsed to set them in position to start over, and in the pneumatic type this means evacuation of the air from the tubes. This air evacuation, practice has shown, is time consuming, taking sometimes as long as 60 seconds. If then the stroke of the vertical jack is relatively small, the number of cycles will be large and the time delay for evacuation of air considerable. Therefore, it would be advantageous to provide a vertically expanding jack having a stroke of several feet. However, pneumatic tires have a critical size beyond which production is impractical. Therefore, if, for example, a four-foot vertical jacking stroke is desired, it would be impossible to provide a single pneumatic tube to accomplish such a result. Rather a plurality of tubes with their resulting expense would be necessary. Thus if the pneumatic type jack is to be used, either extremely slow or costly operation is inevitable.

Other disadvantages of the aforementioned pneumatic type of jacking assembly will be apparent to those skilled in the art.

These and other disadvantages of the jacking systems above referred to can be eliminated with the present invention. The present invention contemplates a hydraulic jacking assembly which is composed of standard, commercially available, hydraulic jacks and which provides sufficient power to perform the most difficult of barge jacking operations. In such a hydraulic system, release of all jacks can be accomplished substantially instantaneously, and all of the spuds dropped simultaneously into the sea bottom, when it is desired to anchor the barge at the beginning of a drilling operation. Moreover, no time is lost at the end of each cycle since the hydraulic fluid evacuates from the jacks substantially instantaneously. Furthermore, the hydraulic jacking assembly of this invention contemplates the use of vertical jacks having a four-foot stroke. These are available commercially and will result in a speedier less expensive process.

Other and more specific objects, features and advantages of the invention will appear from the detailed description given below, taken in connection with the accompanying drawings which form a part of this specification and illustrate by way of example the present preferred embodiment of the invention.

In the drawings—

Fig. 1 is a perspective view showing the marine platform supported on spuds above the surface of the water;

Fig. 2 is an enlarged partial vertical sectional view taken on line 2—2 of Fig. 1, showing a hydraulic jacking assembly constructed according to the present invention in engagement with one of the spuds;

Fig. 3 is a horizontal sectional view taken on line 3—3 of Fig. 2;

Fig. 4 is a fragmentary horizontal sectional view taken on line 4—4 of Fig. 2;

Fig. 5 is a schematic view of the hydraulic system for operating the vertical jacks;

Fig. 6 is a schematic view of a hydraulic system for operating the horizontal jacks;

Fig. 7 is an enlarged perspective view of one of the oil well "slip" wedges which may be used in connection with the invention;

Fig. 8 is an enlarged perspective view of one of the horizontal jack pistons and its cooperating gripping shoe;

Fig. 9 is a schematic showing of the position of the various jacks of a jacking assembly at the start of the operation of forcing a spud down into the sea bottom;

Fig. 10 is a schematic showing of the position of the various jacks of a jacking assembly at the start of the operation of raising the platform on the spuds;

Fig. 11 is a schematic showing of the position of the various jacks of a jacking assembly at the start of the operation of lowering the platform on the spuds; and

Fig. 12 is a schematic showing of the position of the various jacks of a jacking assembly at the start of the operation of jacking a spud up from the sea bottom.

Referring to the drawings in more detail, Fig. 1 illustrates a marine platform supported on a plurality of cylindrical pilings or spuds 2. Hydraulic jacking assemblies 3 are shown in association with each of the spuds 2, and a central control station 4 for directing the operation of each of these jacking assemblies is seen located centrally of the platform.

As is seen in Fig. 2, the platform is provided with a plurality of apertures or wells 5 adapted to receive spuds 2, and surrounding each spud above the platform is a jacking assembly 3. Each such jacking assembly 3 comprises an upper ring 6 which has inwardly projecting, spaced, parallel upper and lower flanges 80 and 81, which form an inner circumferential groove 82 in the ring. This ring carries a plurality of horizontally and radially disposed hydraulic jacks 7, having hydraulic fluid inlet passages 9 and pistons 8 extending into the groove 82. Located in groove 82 are a plurality of gripping shoes 84, with one such shoe being provided for cooperative action with each of the pistons 8. The shoes are free to slide radially in the groove 82 but are restrained from circumferential movement by means of partitions 83, which extend vertically between the ring flanges 80 and 81 and are circumferentially disposed around the ring, one being located on either side of each shoe 84. These partitions 83 serve to center the shoes in relation to their cooperating pistons 8. The pistons 8 are provided with slightly bevelled ends 10 and each shoe is provided with a substantially flat rear surface 85 against which this bevelled end of the pistons forces. When hydraulic pressure fluid is introduced into cylinders 7 the pistons 8 are urged forward and engage the flat surfaces 85 of the shoes, thereby forcing said shoes outward of the groove 82 and into tight gripping relation with the spud which is positioned within the ring 6. The upper flange 80 is provided at its inner periphery with a downwardly extending circumferential lip 88, and the lower flange 81 is provided with a similar upwardly extending lip 89. These lips 88 and 89 cooperate with flanges 90 and 90' formed on shoes 84 to prevent said shoes from being forced completely out of the groove under the urging of pistons 8. Due to the bevelled end 10 of pistons 8, the shoes 84 are free to rock slightly relative to the pistons even when

force is applied to them by the pistons. This slight freedom of movement prevents undue stress in the pistons and shoes when the barge rocks relative to the spuds. The shoes 84 are normally provided with front surfaces 86 having gripping teeth 87 adapted to engage frictionally the spuds. These teeth insure proper contact with the spud, even in the presence of a water film which may develop between the spud and the shoe. The upper portion of each of these toothed gripping surfaces is provided with a downwardly extending bevel 92 which permits an entering spud to pass through the ring 6 without jamming. If, for example, one of the shoes 84 were extending slightly beyond the flanges 80 and 81, an entering spud would strike the bevelled surface 92 and as it travelled downwardly there along, forcing the shoe back into the groove 82. The front surfaces 86 of these shoes are formed of a material which will possess a high coefficient of friction with respect to the spud. The material chosen will of course vary with the type and makeup of the spud to be used. For example, when a cylindrical concrete spud is to be used, it has been ascertained that gripping surfaces of certain types of hard wood will result in a coefficient of friction in the order of 50 or more, which is satisfactory for the jacking operations to be performed. If wood is used the teeth 87 are omitted. In other situations steel or other metal may be desirable.

In order to develop the necessary lifting and driving force, it is contemplated that approximately twenty, 25-ton horizontal jacks having a two-inch piston stroke, will be employed in ring 6.

The ring 6 carries a plurality of horizontally extending flanges 13 having apertures 14 adapted to receive in sliding relation a plurality of upstanding tie rods 15, which are secured to the deck of the marine platform as shown at 16 in Fig. 2. Threaded to the upper extremity of each of the tie rods is a nut 21 which serves as a stop means to limit the upward travel of ring 6.

The jacking assembly 3 further comprises a lower gripping ring 17 which is identical in construction to upper gripping ring 6, except that this lower ring 17 is not provided with any horizontally extending flanges equivalent to those members 13 of ring 6. The upper ring 6 is interconnected with lower ring 17 by means of a plurality of generally vertically positioned, double acting hydraulic jacks 18, having their pistons 19 suitably secured to ring 6 and their cylinders 20 secured to ring 17. The cylinders 20 are provided with hydraulic fluid connections 22 through which operating fluid can be introduced under pressure into engagement with the lower or large area faces 23 of pistons 19, thereby forcing pistons 19 outwardly relative to cylinders 20. These cylinders 20 are likewise provided with hydraulic fluid connections 24 through which operating fluid can be introduced under pressure into engagement with the upper or small area faces 25 of pistons 19, thereby forcing the pistons into telescoping relation with their cylinders. It is contemplated that approximately ten, 25-ton double acting vertical jacks 18, having a four-foot piston stroke, will be circumferentially spaced around the spud as shown in Fig. 3. Of course, it should be understood that in place of such double acting vertical jacks, single acting jacks could be used to force the rings apart and auxiliary means provided to bring them back together.

Secured to the marine platform 1 in concentric relation with apertures 5 are so-called "slip" rings 26 similar to those used in oil well drilling apparatus. The upper surface 33 of these rings serves as a stop means to limit the downward travel of lower gripping ring 17 with respect to the deck of the barge. These "slip" rings are each provided with a plurality of circumferentially spaced hand holes 27 designed so as to permit insertion therethrough of a plurality of slip wedges 28 having gripping teeth 29. These wedges are supported from the deck of the platform 1 by springs 30. When it is desired to permanently or semi-permanently secure the platform in

raised position above the water on spuds **2**, the wedges **28** are inserted through hand holes **27** into position so that their wedging surface **31** engages surface **32** of the slip ring **26**. If the jacking assembly is free with respect to the spud **2**, the weight of platform **1** will force the surface **32** of slip ring **26** down against wedging surface **31** of the wedges, thereby pressing the teeth **29** of wedges **28** into locking engagement with the spud. This permits removal of the jacking assembly **13**, thus freeing the same for use on another platform.

Operation

The jacking assemblies of my invention can be used to perform several distinct operations in connection with the marine platform, including (1) releasing all the spuds simultaneously so as to dry them through their respective wells into the sea bottom, thus anchoring the platform, (2) forcing the spuds down into the sea bottom, (3) raising the platform up on the spuds above the surface of the water, (4) lowering the platform from its raised position down to the surface of the water, and (5) jacking the spuds up from engagement with the sea bottom. Operations 2 to 5, inclusive, will be best understood by reference to Figs. 9 to 12, inclusive, which illustrate, respectively, the position of the horizontal and vertical jacks of the jacking assemblies at the start of each of these operations.

Dropping the spuds

As discussed above, at the start of an offshore drilling process, the platform is towed to its desired sea location with the spuds held in an upright position above the platform wells. The spuds are thus secured by virtue of engagement therewith of the horizontal jacks of both upper and lower gripping rings of the respective jacking assemblies. When the desired location is reached and the platform has been brought to a halt, the hydraulic line pressure is released, thus freeing the horizontal jacks substantially instantaneously and all spuds drop through the wells simultaneously and anchor the platform in position. The jacking assemblies are then used to force the spud into firm engagement with the sea bottom.

Forcing spuds down

When it is desired to perform this operation all jacking assemblies may be operated simultaneously to force all the spuds down at the same time or they may be operated singly to force one spud down at a time. In either event the jacks of each assembly operate as follows: As shown in Fig. 9, at the commencement of this operation the upper gripping ring **6** is vertically positioned so that its laterally extending flanges **13** are in engagement with the stop means **21** on the tie rods **15**. The horizontal jacks of ring **6** are released with respect to spud **2** as indicated by arrows A. The vertical jacks **18** are compressed with their pistons and cylinders in telescoping relation. The horizontal jacks of ring **17** are expanded into tight gripping relation with spud **2**, as indicated by arrows B. Vertical jacks **18** are then expanded. Since the upper ring **6** is held stationary by the platform **1** acting through the rods **15**, stop means **21** and flange **13**, the lower ring **17** will be forced downwardly in the direction of arrow C and the spud will be forced down through the well **5** in the platform and into the sea bottom. To return the jacking assembly to position for another driving stroke, the horizontal jacks of ring **6** are expanded into gripping relation with the spud, the horizontal jacks of ring **17** are released, the vertical jacks **18** are compressed, thus lifting lower ring **6**, and the assembly is again in position for starting another stroke.

Raising platform on spuds

After all of the spuds have been driven firmly into the sea bottom in the manner described above, the platform itself can be raised above the surface of the water on the spuds. To perform this operation, all of the jacking assemblies are operated simultaneously. As shown in Fig. 10, the jacks of each jacking assembly are positioned at the commencement of the action with their upper rings **6** having flanges **13** in engagement with the stop means **21** of tie rods **15**. The horizontal jacks of the upper rings **6** are released with respect to the spuds as shown by arrows D, the vertical jacks **18** are compressed and the horizontal jacks of rings **17** are expanded into tight gripping relation with the spuds as shown by arrows E. In other words, the jacks of each assembly are positioned exactly as they were at the start of the spud forcing operation shown in Fig. 9 and described above. However, now all the jacking assemblies are thus positioned and when the jacks **18** of all the jacking assemblies are expanded, since the spuds **2** are now firmly embedded in the sea bottom, the upper rings **6** will move upwardly relative to the spuds **2**, thereby transmitting the same lifting force through flanges **13**, stop means **21** and tie rods **15** to the platform **1** and raising the platform in the direction of arrow G on the spuds above the sea surface.

Lowering platform on spuds

When it is desired to move the platform to a new sea location, the platform is lowered to the surface of the water with all the jacking assemblies being in the position of Fig. 11 at the commencement of the operation. The upper rings **6** are vertically positioned on spuds **2** so that flanges **13** are engaged with stop means **21** on tie rods **15**, and the horizontal jacks of these rings are released as shown by arrows D'. The vertical jacks **18** of all jacking assemblies are expanded, and the jacks of lower ring **6** are expanded into tight gripping relation with spuds **2** as shown by arrows E'. The vertical jacks are then simultaneously and gradually released so as to permit their pistons and cylinders to telescope, thereby lowering rings **6** and with them the platform **1** in the direction of arrow G'. When the vertical jacks **18** have become fully compressed, the jacks of upper rings **6** are expanded, those of the lower rings **17** are released, and the vertical jacks once again expanded. The jacks of rings **17** are then expanded, those of rings **6** released and the jacking assemblies are once again in the position of Fig. 12 ready for another lowering stroke.

Jacking spuds up from sea bottom

After the platform has been lowered to sea level the spuds may be jacked up from the sea bottom by arranging the jacking assemblies in the position of Fig. 12. The spuds may all be jacked up simultaneously by employing all the jacking assemblies, or under certain conditions, it may be desirable or even necessary to jack them up individually, in which case only a single jacking assembly will be employed. In any event, the position of the jacks of each jacking assembly will correspond to that seen in Figure 12. There it will be observed that the lower gripping ring **17** is resting on the upper surface **33** of slip ring **26**, and the jacks of this ring are free with respect to spud **2** as shown by arrows B'. The vertical jacks are compressed and the jacks of upper ring **6** are expanded into tight gripping relation with the spud as shown by arrows A'. The vertical jacks on this one jacking assembly are then expanded, and, since the ring **17** of this particular assembly will be held stationary with respect to the platform via the slip ring **26**, the spud **2** will be jacked up through the well in the platform **1** in the direction of arrow C'. To return the jacking assembly once again to the position shown in Fig. 10, the jacks of lower ring **17** are expanded, the jacks of upper ring **6** released and finally the vertical jacks are allowed to gradually compress, permitting their pistons and cylinders to move into telescoping relation. After the spuds have cleared sea bottom jacking may be continued to bring the spuds all the way up to the barge to their position at the start of the entire operation or if desired they may be lifted by means of cranes. The platform may then be floated away to a new location.

Typical hydraulic systems for operating the vertical and hydraulic jacks of the jacking assemblies 13 are schematically illustrated in Figs. 5 and 6. However, it should be understood that the details of these systems are not essential to my invention. Any of the well known hydraulic circuits suited for use with my jacking assemblies can be employed. In Fig. 5 is shown the hydraulic circuit for operating the vertical double-acting jacks 18. Therein is shown a pump 40 driven by a motor 41, delivering hydraulic fluid from a tank 42 through lines 57 and 51 into main supply lines 43 or 44. For illustration purposes I have shown the vertical jacks of two jacking assemblies connected to the main lines by feeder lines 45, 46, but it is to be understood that the vertical jacks of all of the jacking assemblies 13 are similarly connected. Cut-off valves 49 are provided in each of the feeder lines thereby permitting separate operation of the vertical jacks of any specific jacking assembly or simultaneous operation of all the vertical jacks of all the jacking assemblies. A four-way valve 50 selectively interconnects main lines 43, 44 with pump supply line 51 and tank exhaust line 52. When it is desired to expand the vertical jacks 18, as for example when one of the spuds is to be driven into the sea bottom, valve 50 is positioned so that hydraulic fluid is pumped from tank 42 through main line 44 into feeder lines 46. Of course, the cut-off valves 49 are first set to connect only those jacking assemblies which are desired. The fluid passes through feeder lines 46 and connections 22 to the cylinders 20 and into engagement with the lower faces 23 of pistons 19, thereby forcing said pistons outwardly relative to said cylinders. When the desired pressure is reached in cylinders 20, a pressure release, by-pass valve 54 opens in line 51*a* and the pumped fluid shunts directly into tank 42. A relatively large accumulator 53 is located in each feeder line so as to absorb shocks which may be felt in the system by virtue of wave action against the spuds and platform, or by virtue of the descent of a spud into the sea bottom being momentarily halted because of rocks and the like. The accumulator may be of the ordinary air bladder type, and also serves to maintain even pressure in cylinders 20 when the pressure release, by-pass valve 54 is open. When it is desired to compress the vertical jacks, as for example when the lower ring 17 must be lifted up to upper ring 6, the valve 50 is positioned so as to connect pump supply line 51 with main line 43, and main line 44 with the tank discharge line 52. Fluid is then pumped through feeder lines 45 and connections 24 to the cylinder 21 and into engagement with the upper faces 25 of pistons 19, thereby forcing these pistons down into telescoping engagement with their cylinders. As the pistons are thus pushed down the hydraulic fluid in engagement with the lower faces 23 of the pistons is forced out of the cylinders 20 through feeder lines 46, main line 44 and tank discharge line 52 back into the tank 42. Relatively small accumulators 55 are provided in feeder lines 45 so as to maintain even pressure in the cylinder when pressure release by-pass valve 54 is open, and also to absorb shocks or sudden surges in the system. A throttling valve 56 is provided in discharge line 52, which can be adjusted to control the rate of discharge of fluid through feeder line 46 from cylinder 20 and thereby control the rate of telescoping movement between pistons 19 and cylinders 20. This valve is used for example during the operation of lowering the platform on the spuds (Fig. 11), when gradual compression of the vertical jacks is desired.

In Fig. 6 is shown schematically the hydraulic circuit for operating the horizontal jacks of upper ring 6. It is of course self-evident that an identical hydraulic circuit would be employed in conjunction with the horizontal jacks of lower ring 17. There a pump 60, driven by motor 61, delivers hydraulic fluid through lines 64 and 63 into a main supply line 65 which is connected by feeder lines 66 with the horizontal jacks 7 of the upper rings 6 of all of the jacking assemblies 13. Cut-off valves 67 are located in the feeder lines 66 so as to permit separate operation of the upper ring horizontal jacks of any one jacking assembly or simultaneous operation of those jacks in all the jacking assemblies. A three-way valve 68 is positioned so as to selectively interconnect pump line 63, main supply line 65 and discharge line 69. When it is desired to expand the horizontal jacks of an upper gripping ring or rings, valves 67 are adjusted so as to connect only those jacking assemblies desired. Hydraulic fluid is then pumped into the main supply line 65 with valve 68 so positioned as to close off discharge line 69. The fluid passes through feeder lines 66 and inlet passages 9 into the horizontal jacks 7 thereby expanding their pistons 8 against their respective gripping shoes 84 and forcing the latter into tight gripping relation with spud 2. When the pressure in line 63 and jacks 7 builds up to the desired amount a pressure control switch 71 shuts down motor 61 and pump 60. Each of the feeder lines 66 is provided with a standard type accumulator 70 which serves both to maintain the correct pressure in the jacks 7 when the pump is not operating and also to absorb momentary shocks and surges in the system. When it is desired to release the jacks 7, valve 68 is positioned to connect supply line 65 with discharge line 69, thereby permitting the hydraulic fluid to return to tank 62. As has been indicated above, an identically similar hydraulic circuit may be provided to operate the horizontal jacks of lower gripping ring 17.

All of the foregoing hydraulic lines and valves are designed of suitable size to permit substantially instantaneous evacuation of the hydraulic fluid from the cylinders upon release of line pressure.

While these simple hydraulic circuits have been shown for the purpose of simplicity herein, it is obviously within the realm of this invention to provide a single, more complex, yet standard hydraulic circuit for operating sequentially the horizontal jacks of both upper and lower gripping rings and the vertical jacks of all jacking assemblies. Such a system would be conveniently controlled from a control station 4 located centrally of platform 1 as shown in Fig. 1.

Although a preferred embodiment of my invention is herein described for purposes of explanation, various modifications thereof, after study of this specification, will be apparent to those skilled in the art to which this invention pertains. Reference should accordingly be had to the appended claim in determining the scope of my invention.

What is claimed and desired to be secured by Letters Patent is:

In a marine platform construction having apertures and spuds extending therethrough, a jacking assembly comprising upper and lower gripping rings located above the platform and encircling one of the spuds, each of said rings being provided with a plurality of generally horizontally disposed jacks, a plurality of vertical double acting hydraulically operable piston and cylinder jacks interconnecting said upper and lower rings, means for selectively delivering fluid under pressure to the horizontal jacks of either of said rings and to said vertical jacks whereby portions of the horizontal jacks may be moved into tight gripping relation with the spud, thereby preventing relative movement in either vertical direction between the spud and at least one of said rings so that the other of said rings may be moved vertically relatively to said one ring by said vertical jacks, each of said rings being free, when its horizontal jacks are released from the spud, for vertical movement relatively to the platform under the action of said vertical jacks, and stop means secured to the platform to limit the upward

travel of the upper ring and downward travel of the lower ring.

References Cited in the file of this patent

UNITED STATES PATENTS

2,090,854	Timbs	Aug. 24, 1937
2,352,370	Carruthers	June 27, 1944
2,540,679	Laffaille	Feb. 6, 1951
2,589,159	Stone	Mar. 11, 1952

2,775,869	Pointer	Jan. 1, 1957
2,822,670	Suderow	Feb. 11, 1958
2,841,961	Lucas	July 8, 1958

FOREIGN PATENTS

143,998	Australia	1951
1,014,974	France	June 25, 1952

OTHER REFERENCES

Pages 44–45 of Eng. News Record of May 29, 1952.