PATENT SPECIFICATION 1,089,313

DRAWINGS ATTACHED.

1,089,313

Date of Application and filing Complete Specification:
March 1, 1966. *No. 8859/66.*

Application made in United States of America (No. 436,626) on March 2, 1965.

Complete Specification Published: Nov. 1, 1967.

© *Crown Copyright 1967.*

Index at Acceptance:—E1 F31 E.

Int. Cl.:—E 21 b 15/02.

COMPLETE SPECIFICATION.

Apparatus for Positioning a Derrick and Associated Drilling Equipment over a Marine Drilling Site.

We, BETHLEHEM STEEL CORPORATION, a corporation organised under the laws of the State of Delaware, United States of America, of 701 East Third Street, Bethlehem, State of Pennsylvania, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates generally to apparatus of the type known as a "skid unit" for precisely positioning over a marine site the derrick and associated drilling equipment of a marine drilling platform. Specifically, this invention relates to skid unit apparatus for adjusting the position of a derrick and associated drilling equipment longitudinally and transversely of a support marine drilling platform.

In marine drilling operations, it is often required to drill several wells at one site. Also, it frequently occurs that the derrick-supporting marine drilling platform shifts position on the marine bottom due, for instance, to settling, and the drill pipe must be relocated. Further, it is frequently necessary to redrill through an existing well structure, for one reason or another. Therefore, the portion of the derrick, drawworks and rotary table must be adjustable in two horizontal dimensions with precision. Heretofore, it was the practice to shift the crown block on top of the derrick and also to shift the rotary table to position these units. This practice is time consuming and quite inconvenient.

The present invention provides means for rapidly and accurately adjusting the position of a derrick and associated drilling equipment over a marine site. The position of the derrick and associated drilling equipment is adjusted both longitudinally and transversely of a supporting marine drilling platform.

Apparatus according to the invention comprises upper and lower portions for positioning marine-platform-supported drilling equipment over a drilling site. The invention is characterized in that the lower portion of the apparatus comprises a first carriage and means mounting the first carriage to the marine platform for movement in a first direction, and the upper portion comprises a second carriage supporting the drilling equipment and means mounting the second carriage to the first carriage for movement in a second direction.

Referring now to the drawings, in which like numerals represent like parts in the several views:

Figure 1 represents a view in plan of the present invention mounted on the deck of a marine drilling platform, omitting the derrick and associated drilling equipment.

Figure 2 represents a view in elevation of the present invention mounted on the deck of the marine drilling platform, taken along the line 2—2 of Figure 1 longitudinally of the marine drilling platform showing only the lower portions of the legs of the derrick and omitting the associated drilling equipment.

Figure 3 represents a view in elevation of the present invention mounted on the deck of the marine drilling platform, taken along the line 3—3 of Figure 1 transversely of the marine drilling platform showing only the lower portions of the legs of the derrick and omitting the associated drilling equipment.

Figure 4 represents an enlarged view in elevation, partially broken, of the jacking means and adjacent rail.

Figure 5 represents a view in plan, partially

[*Price* 4*s.* 6*d.*]

broken, of the jacking means and adjacent rail.

Figure 6 represents an enlarged vertical section of the ratchet, taken along the line 6—6 of Figure 4.

Figure 7 represents an enlarged vertical section of a typical rail and a foot slidably engaging the flange of the rail, taken along the line 7—7 of Figure 4.

Figure 8 represents a detailed view in plan of the rail.

Skid unit 1 comprises lower carriage 2 movable, by means hereinafter described, longitudinally of marine drilling platform 3 on rails 4 mounted to the said marine drilling platform 3 on either side of conventional drilling slot 5, and upper carriage 6 movable, by means hereinafter described, transversely of marine drilling platform 3 on rails 7 mounted to lower carriage 2.

Lower carriage 2 comprises four columnar members or legs 8 and 8^1, two longitudinal girders 9 secured to the upper ends of those pairs of legs 8, 8^1 on either side of the drilling slot 5, two transverse girders 10 supporting rails 7 and secured to the upper ends of those pairs of legs 8, 8^1 straddling the drilling slot 5, and bracing beams 11 secured to the said longitudinal girders 9 and transverse girders 10 as shown particularly in Figure 1. It will be noted that within the perimeter of lower carriage 2, as viewed in plan, an open bay 12 is provided, free of bracing beams 11 and of considerable expanse. The lower ends of the legs 8, 8^1 are each provided with a foot 13 adapted to slidably engage the upper and lower surfaces of the flange 14 of rail 4. As shown particularly in Figure 7, foot 13 comprises wear plate 15 adapted to slidably engage the upper surface of flange 14 and secured by bolts 16 to main plate 17, spacers 18, and lower plates 19 adapted to slidably engage, with small clearance, the lower surface of flange 14 and secured to main plate 17 by means of bolts 20 extending therethrough and through spacers 18. It will be noted that spacers 18 slidably engage, with small clearance, the sides of flange 14. In this manner, legs 8, 8^1 and hence lower carriage 2, can traverse rails 4 longitudinally thereof, and hence longitudinally of marine drilling platform 3, but are positively restrained against movement relative to said rails 4 in any other direction.

Upper carriage 6 comprises two main longitudinal girders 21, and several beams 22 spanning main girders 21 and otherwise bracing upper carriage 6. Four feet 23, similar to feet 13 are secured to main girders 21, and are adapted to slidably engage the upper and lower surfaces of flanges 14 of rails 7. In this manner, main girders 21, and hence upper carriage 6, can traverse rails 7 longitudinally thereof, and hence transversely of marine drilling platform 3, but are positively restrained against movement relative to said rails 7 in any other direction.

Upper carriage 6 supports derrick 24 and the associated drilling equipment (not shown) including the draw works and rotary table, and may be provided with deck plating (not shown).

The means for jacking upper carriage 6 along its rails 7 and lower carriage 2 along its rails 4 will now be described.

Rails 4 and 7 have slots 25 spaced longitudinally in and along their respective flanges 14, as best shown in Figure 8. Hydraulic cylinders 26, having piston rods 27 and fitted with the necessary hydraulic lines, valves, etc. (not shown), are pinned through ears 28 at the head ends of said hydraulic cylinders 26 by means of bolts 29 to brackets 29a secured to the lowermost portions of the two legs 8^1 of lower carriage 2 as shown in Figures 1 and 2, and to the main longitudinal girders 21 of upper carriage 6 as shown in Figures 1 and 3. Piston rods 27 have perforated ears 30 at the ends thereof and, by means of bolts 31, are pinned between the sides 32 of ratchet mechanisms 33. Ratchet mechanism 33 has feet 34 adapted to longitudinally slidably engage the upper and lower and side surfaces of flange 14 of rails 4 and 7, as shown in Figures 4 and 6. Ratchet 35 is pivotally mounted between the sides 32 by means of shaft 36 extending through holes 37 in sides 32 and secured to the said ratchet 35. Lever 38 is secured to one side of shaft 36 and it will be apparent that the position of ratchet 35 can be changed 180° by rotating lever 38 to the same extent.

Ratchet 35 has teeth 39 and 40. It will be apparent from Figure 4 that tooth 39 is adapted to engage the right hand edges of slots 25 and thus limit movement of ratchet 35 towards the right as viewed in Figure 4 while permitting ratcheting motion toward the left of Figure 4. It will also be apparent that tooth 40 is adapted to engage the left hand edges of slots 25 as viewed in the same figure thus limiting movement of ratchet 35 toward the left while permitting ratcheting motion toward the right. Operation of lever 38 selectively engages tooth 39 or tooth 40.

The operation of the jacking means above described will be explained in relation to shifting lower carriage 2 along rails 4, and reference should now be made specifically to Figure 4. It will, of course, be understood that the operation of this jacking means to shift upper carriage 6 along its rails 7 is identical.

If it is desired to shift lower carriage 2 to the left of Figure 4, with tooth 39 of ratchet mechanism 33 in operative position, the rod end of hydraulic cylinder 26 is pressurized and this will draw lower carriage 2 to the left. The head end of hydraulic cylinder 26 is then pressurized, and ratchet mechanism

33 will travel to the left, the inclined portion of tooth 39 riding up the left side of slot 25 and sliding along the top surface of flange 14 until it drops into the next slot 25 to the left. It will be understood that, on this stroke, if the travel of the piston is large enough, the ratchet 35 may be operated so that tooth 39 rides out of the next adjacent slot 25 and drops into a succeeding slot 25. Thereafter, the rod end of hydraulic cylinder 26 is again pressurized, and again lower carriage 2 will be drawn to the left. This process is repeated to the extent desired.

If it is desired to shift lower carriage 2 to the right of Figure 4, with tooth 40 of ratchet mechanism 33 in operative position, the head end of hydraulic cylinder 26 is pressurized and this will push lower carriage 2 to the right. The rod end of hydraulic cylinder 26 is then pressurized, and ratchet mechanism 33 will travel to the right, the inclined portion of tooth 40 riding up the right side of slot 25 and sliding along the top surface of flange 14 until it drops into the next slot 25 to the right. It will be understood that, on this stroke, if the travel of the piston is large enough, the ratchet 35 may be operated so that tooth 40 rides out of the next adjacent slot 25 and drops into a succeeding slot 25. Thereafter, the head end of hydraulic cylinder 26 is again pressurized and again lower carriage 2 will be pushed to the right. This process is repeated to the extent desired.

When lower carriage 2 is in the desired position, and either tooth 39 or tooth 40 is in operative position, ratchet 35 may be locked between sides 32 of ratchet mechanism 33 by means of a pin (not shown) inserted in holes 41 provided in sides 32 and ratchet 35, it being apparent that, when tooth 39 is in operative position, the right-hand holes 41 in sides 32 lining up with hole 41 in the ratchet 35 are used to receive the locking pin and, when tooth 40 is in operative position, the left-hand holes 41 in sides 32 will line up with hole 41 in the ratchet 35 to receive the locking pin.

At the ends of rails 4 and 7, stops 42 are provided to prevent lower carriage 2 or upper carriage 6 from accidentally leaving the ends of the said rails.

In the foregoing manner, both lower carriage 2 and upper carriage 6 may be shifted as required to locate the center of the rotary table, indicated by crossed lines identified as 43 in Figure 1, precisely over the desired site. It will be noted that the center of the rotary table, mounted on upper carriage 6, can be shifted over a wide range in two horizontal dimensions to drill through openings 12 in lower carriage 2.

The skid unit 1 herein described may be used to shift the derrick and associated drilling equipment from marine drilling platform 3 to an adjacent structure such as a permanent drilling platform and, from the adjacent structure back to marine drilling platform 3. This may be done by providing additional sections of rail on the said adjacent structure, which sections of rail are aligned with rails 4 so as to constitute, in effect, extensions of the said rails 4, said sections of rail having spaced openings similar to openings 25 so arranged as to continue the pattern of spacing therebetween. Stops 42 at those ends of rails 4 adjacent the open end of the drilling slot 5 are removed, and the jacking means operatively associated between the lower carriage 2 and rails 4 may then be operated to shift lower carriage 2 from marine drilling platform 3 to the adjacent marine platform or structure and back again to marine drilling platform 3. It will, of course, be apparent that when the skid unit 1 has been positioned on the adjacent marine structure, the derrick and associated drilling equipment may be precisely positioned over a particlar site in two horizontal dimensions in the same manner as previously described.

WHAT WE CLAIM IS:—

1. Apparatus having upper and lower portions for positioning marine-platform-supported drilling equipment over a drilling site, wherein said lower portion comprises a first carriage and means mounting said first carriage to the marine platform for movement in a first direction, and said upper portion comprises a second carriage supporting the drilling equipment and means mounting said second carriage to said first carriage for movement in a second direction.

2. Apparatus according to claim 1, including an opening in the first carriage providing direct access from said drilling equipment on said second carriage to said drilling site.

3. Apparatus according to claim 1 or 2, wherein the mounting means for the first carriage includes rail means secured to the marine platform parallel to said first direction, and jacking means is operatively interposed between said rail means and said first carriage.

4. Apparatus according to claim 1, 2, or 3, wherein the mounting means for the second carriage includes rail means secured to the first carriage parallel to said second direction, and jacking means is operatively interposed between said rail means and said second carriage.

5. Apparatus according to claim 3 or 4, including ratchet means engaging said rail means for selective unidirectional movement parallel thereto, said jacking means being

33 will travel to the left, the inclined portion of tooth 39 riding up the left side of slot 25 and sliding along the top surface of flange 14 until it drops into the next slot 25 to the left. It will be understood that, on this stroke, if the travel of the piston is large enough, the ratchet 35 may be operated so that tooth 39 rides out of the next adjacent slot 25 and drops into a succeeding slot 25. Thereafter, the rod end of hydraulic cylinder 26 is again pressurized, and again lower carriage 2 will be drawn to the left. This process is repeated to the extent desired.

If it is desired to shift lower carriage 2 to the right of Figure 4, with tooth 40 of ratchet mechanism 33 in operative position, the head end of hydraulic cylinder 26 is pressurized and this will push lower carriage 2 to the right. The rod end of hydraulic cylinder 26 is then pressurized, and ratchet mechanism 33 will travel to the right, the inclined portion of tooth 40 riding up the right side of slot 25 and sliding along the top surface of flange 14 until it drops into the next slot 25 to the right. It will be understood that, on this stroke, if the travel of the piston is large enough, the ratchet 35 may be operated so that tooth 40 rides out of the next adjacent slot 25 and drops into a succeeding slot 25. Thereafter, the head end of hydraulic cylinder 26 is again pressurized and again lower carriage 2 will be pushed to the right. This process is repeated to the extent desired.

When lower carriage 2 is in the desired position, and either tooth 39 or tooth 40 is in operative position, ratchet 35 may be locked between sides 32 of ratchet mechanism 33 by means of a pin (not shown) inserted in holes 41 provided in sides 32 and ratchet 35, it being apparent that, when tooth 39 is in operative position, the right-hand holes 41 in sides 32 lining up with hole 41 in the ratchet 35 are used to receive the locking pin and, when tooth 40 is in operative position, the left-hand holes 41 in sides 32 will line up with hole 41 in the ratchet 35 to receive the locking pin.

At the ends of rails 4 and 7, stops 42 are provided to prevent lower carriage 2 or upper carriage 6 from accidentally leaving the ends of the said rails.

In the foregoing manner, both lower carriage 2 and upper carriage 6 may be shifted as required to locate the center of the rotary table, indicated by crossed lines identified as 43 in Figure 1, precisely over the desired site. It will be noted that the center of the rotary table, mounted on upper carriage 6, can be shifted over a wide range in two horizontal dimensions to drill through openings 12 in lower carriage 2.

The skid unit 1 herein described may be used to shift the derrick and associated drilling equipment from marine drilling platform 3 to an adjacent structure such as a permanent drilling platform and, from the adjacent structure back to marine drilling platform 3. This may be done by providing additional sections of rail on the said adjacent structure, which sections of rail are aligned with rails 4 so as to constitute, in effect, extensions of the said rails 4, said sections of rail having spaced openings similar to openings 25 so arranged as to continue the pattern of spacing therebetween. Stops 42 at those ends of rails 4 adjacent the open end of the drilling slot 5 are removed, and the jacking means operatively associated between the lower carriage 2 and rails 4 may then be operated to shift lower carriage 2 from marine drilling platform 3 to the adjacent marine platform or structure and back again to marine drilling platform 3. It will, of course, be apparent that when the skid unit 1 has been positioned on the adjacent marine structure, the derrick and associated drilling equipment may be precisely positioned over a particlar site in two horizontal dimensions in the same manner as previously described.

WHAT WE CLAIM IS:—

1. Apparatus having upper and lower portions for positioning marine-platform-supported drilling equipment over a drilling site, wherein said lower portion comprises a first carriage and means mounting said first carriage to the marine platform for movement in a first direction, and said upper portion comprises a second carriage supporting the drilling equipment and means mounting said second carriage to said first carriage for movement in a second direction.

2. Apparatus according to claim 1, including an opening in the first carriage providing direct access from said drilling equipment on said second carriage to said drilling site.

3. Apparatus according to claim 1 or 2, wherein the mounting means for the first carriage includes rail means secured to the marine platform parallel to said first direction, and jacking means is operatively interposed between said rail means and said first carriage.

4. Apparatus according to claim 1, 2, or 3, wherein the mounting means for the second carriage includes rail means secured to the first carriage parallel to said second direction, and jacking means is operatively interposed between said rail means and said second carriage.

5. Apparatus according to claim 3 or 4, including ratchet means engaging said rail means for selective unidirectional movement parallel thereto, said jacking means being

* C L M S *

operatively interposed between said ratchet means and said carriage.

6. Apparatus substantially as hereinbefore described and/or illustrated in the accompanying drawings.

For the Applicants:
MATTHEWS, HADDAN & CO.,
Chartered Patent Agents,
31—32, Bedford Street,
London, W.C.2.

Abingdon: Printed for Her Majesty's Stationery Office, by Burgess & Son (Abingdon), Ltd.—1967.
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2,
from which copies may be obtained.