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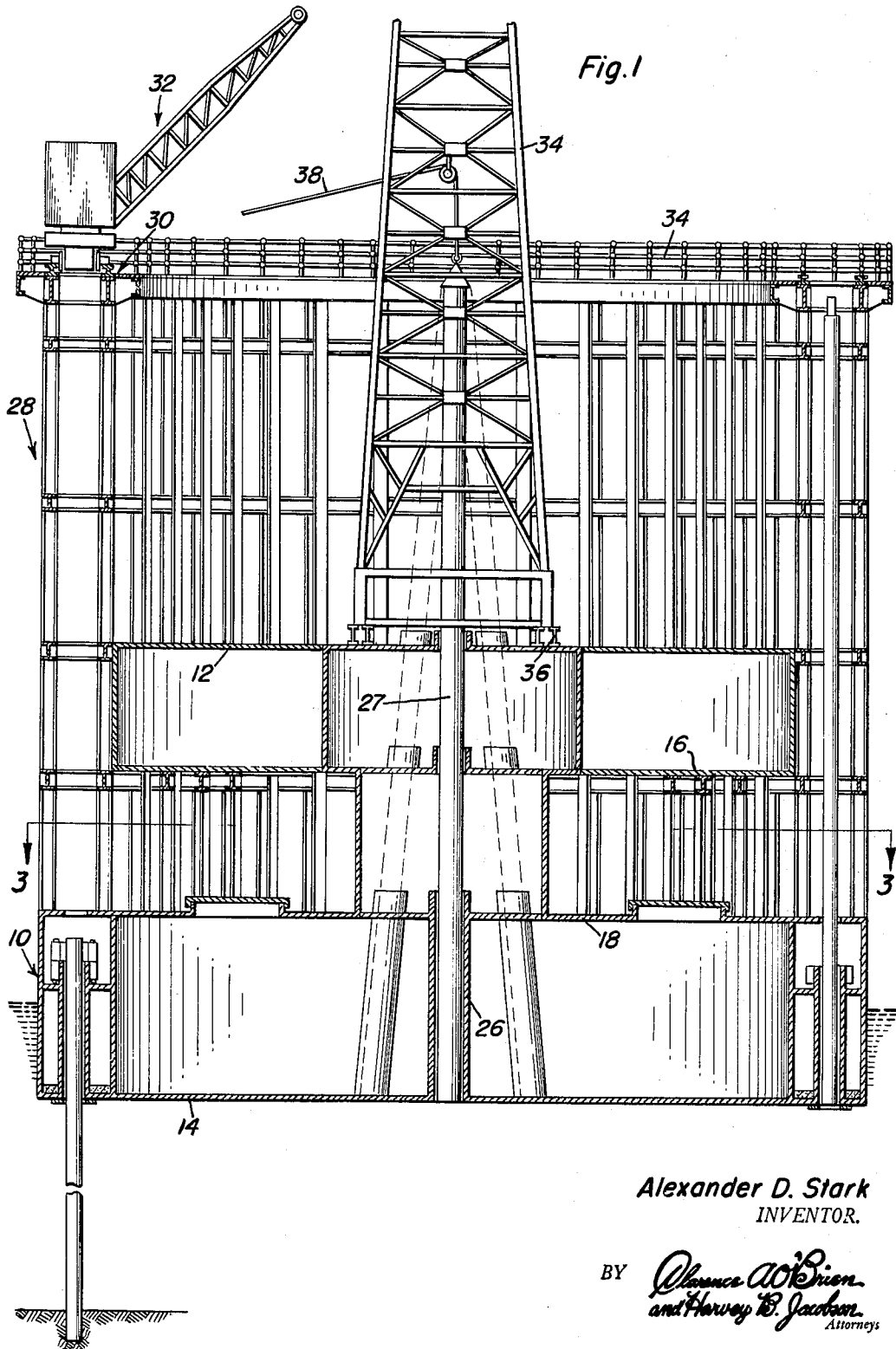
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2,740,261

FLOATING HULLS FOR OFF SHORE OIL WELL DRILLING

Filed Nov. 6, 1950

7 Sheets-Sheet 1



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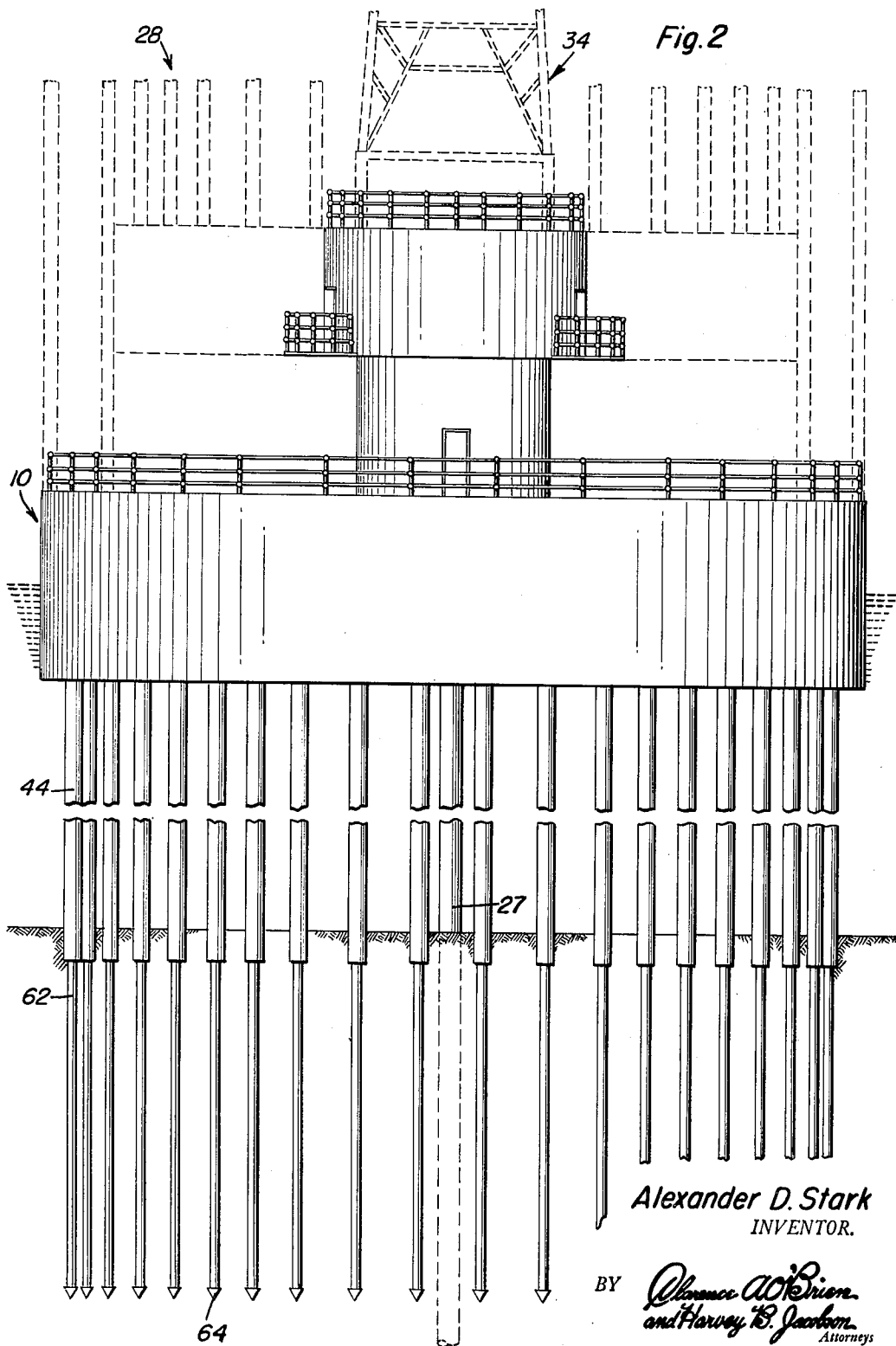
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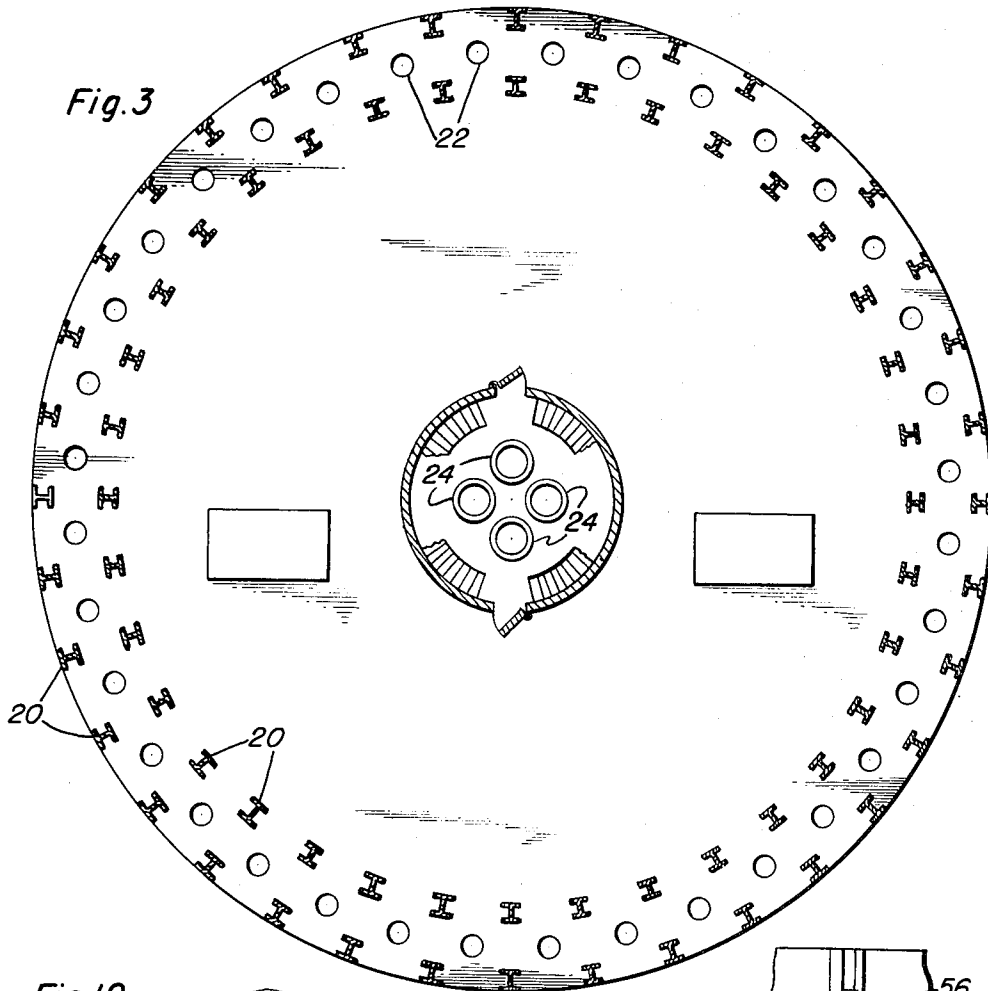


Fig. 12

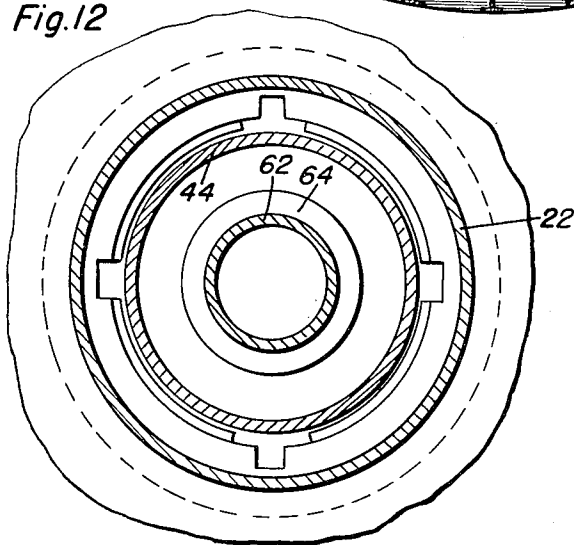
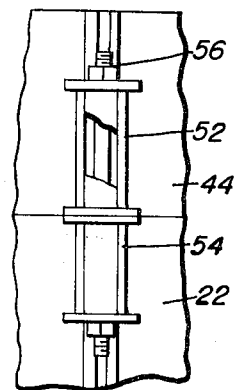


Fig. 13



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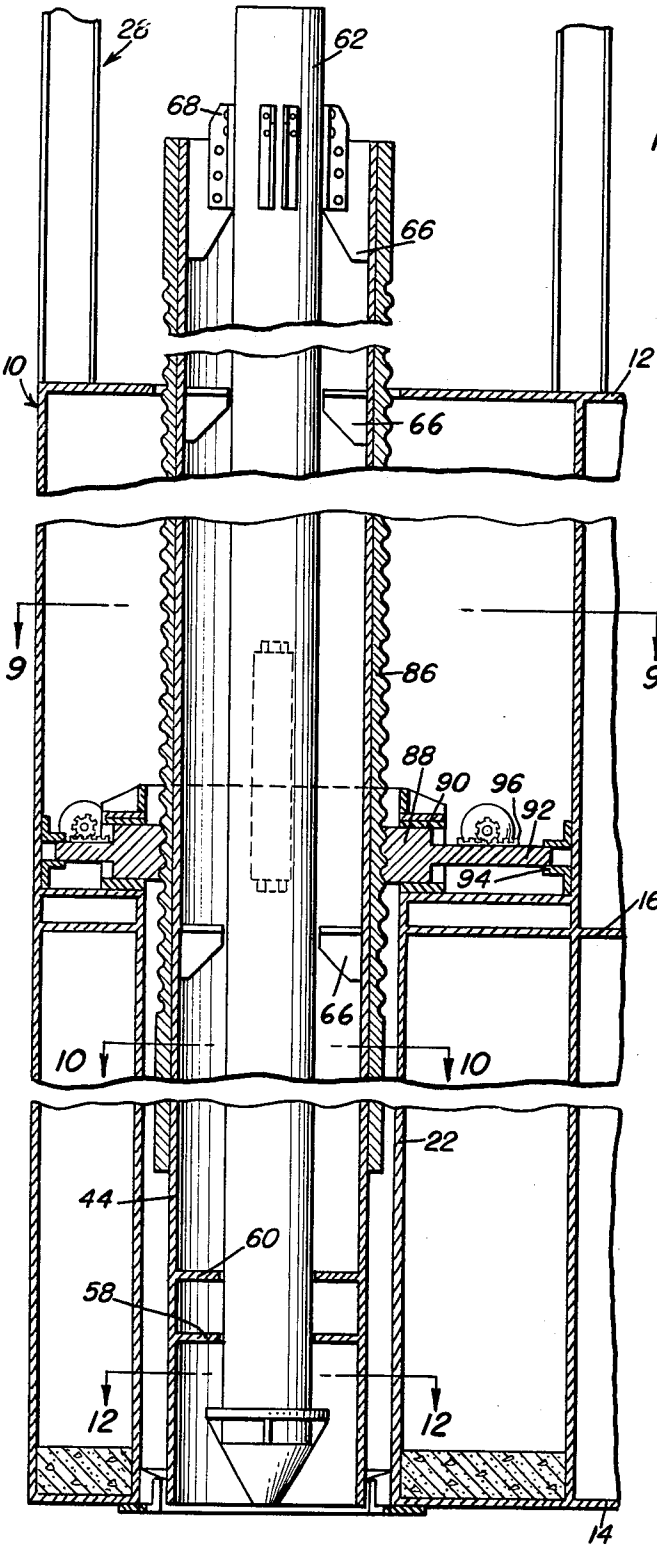


Fig. 4

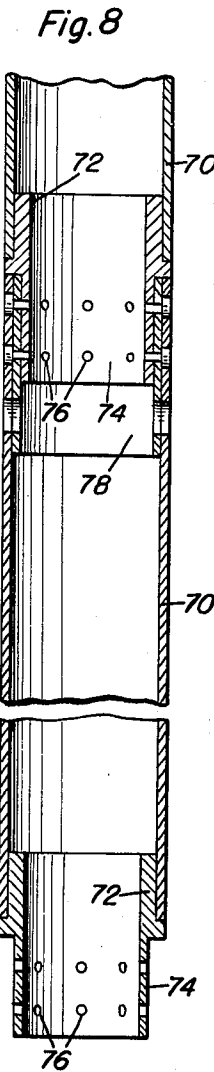


Fig. 8

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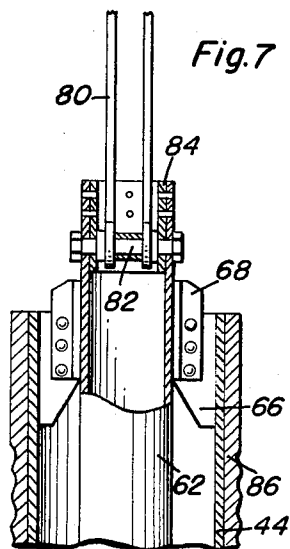
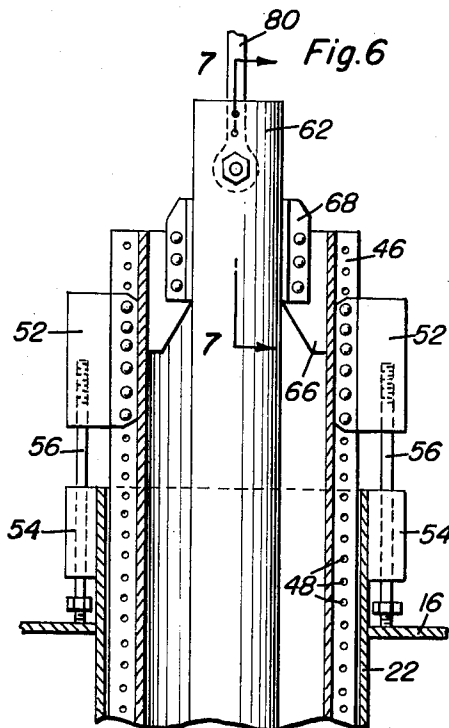
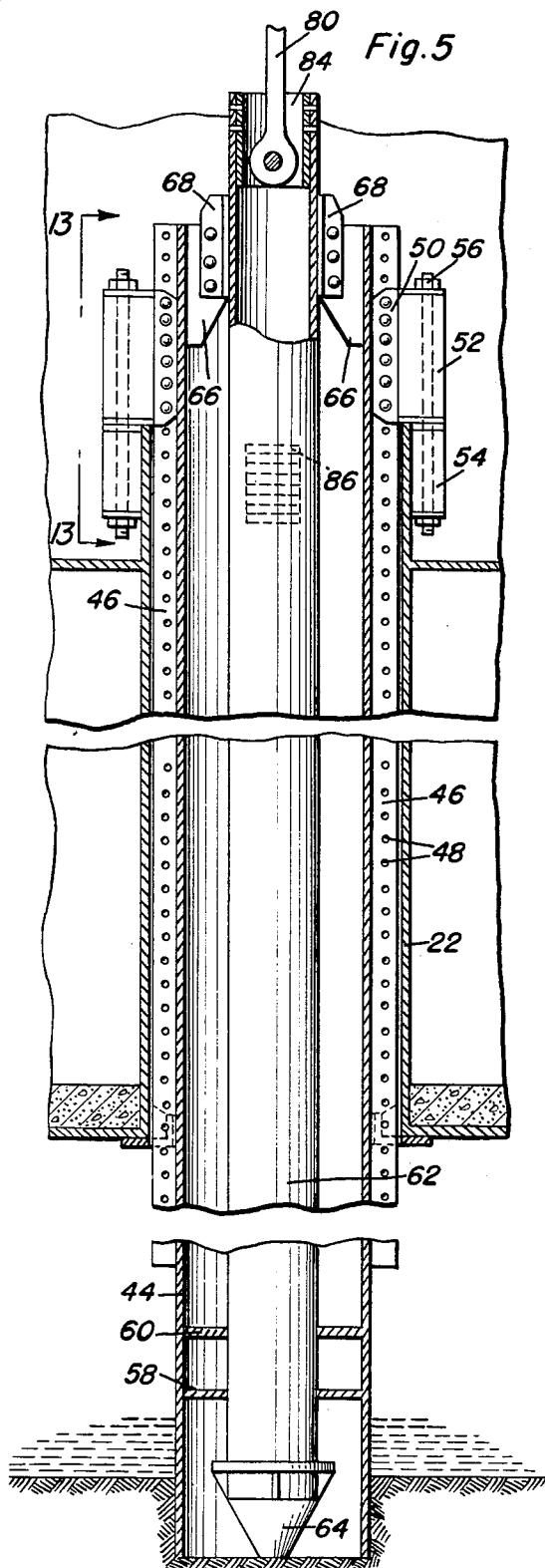
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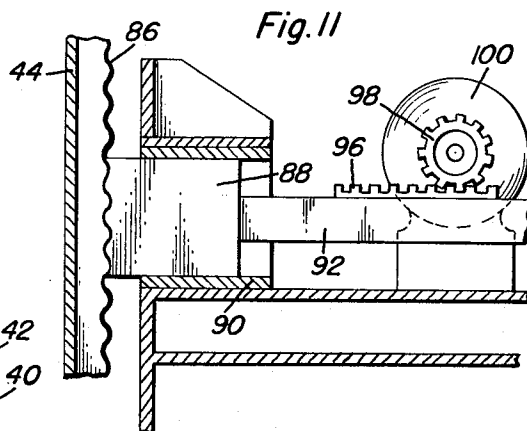
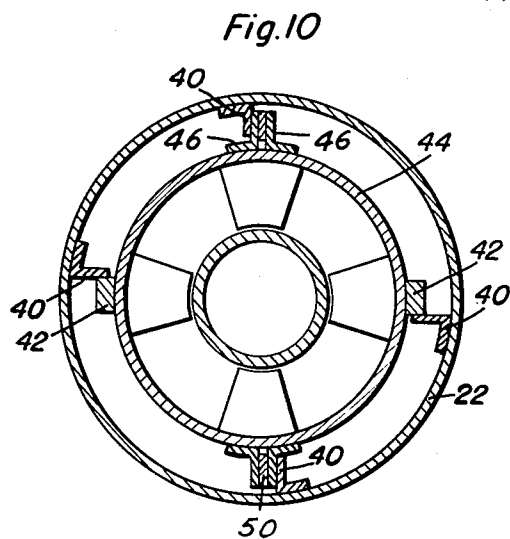
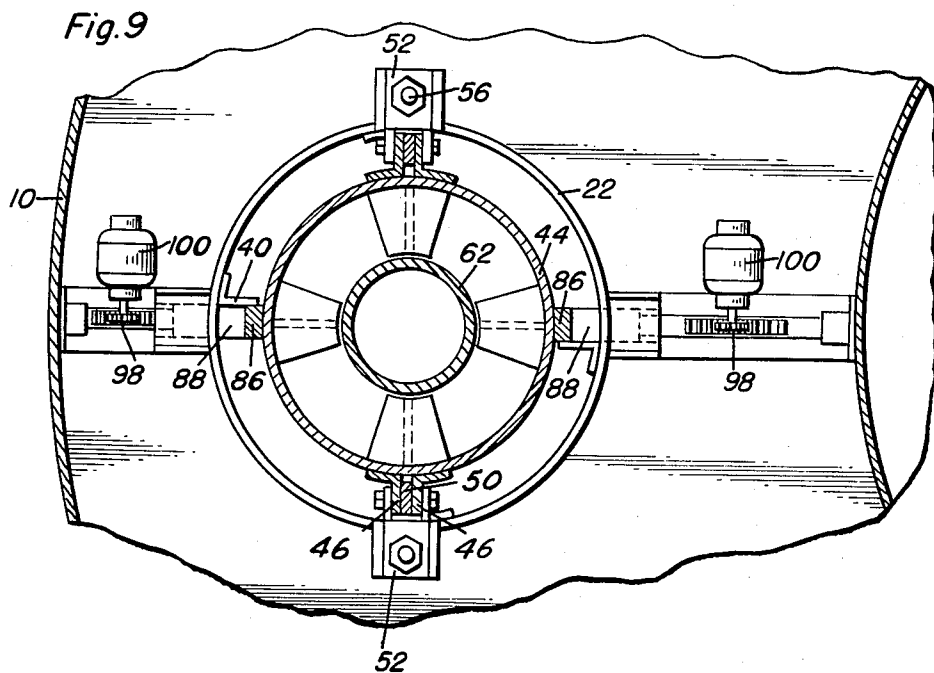
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FLOATING HULLS FOR OFF SHORE OIL WELL DRILLING

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2,740,261

FLOATING HULLS FOR OFF SHORE OIL WELL DRILLING

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Application November 6, 1950, Serial No. 194,236

3 Claims. (Cl. 61—46.5)

This invention comprises novel and useful improvements in floating hulls for offshore oil well drilling and more specifically pertains to an apparatus and method to facilitate and render more economical the drilling of oil wells in offshore and submerged locations.

The primary object of this invention is to render more certain, easier and more economical, the drilling of oil wells and the like in formations which are offshore and underwater and especially to improve the drilling of such wells in locations in which the drilling apparatus is necessarily conducted at relatively great depths of water and in locations which are subjected to the detrimental effects of waves, tides and the like.

A very important object of the invention is to provide a marine drilling apparatus for oil wells of such a character that the same may be advantageously floated to its desired location for drilling a well, and may be readily moved to a new location if the selected site of the well proves to be impracticable.

A further object of the invention is to provide an improved oil well drilling apparatus in conformity with the preceding objects in which a floating hull may be towed to a desired location either with or without the necessary superstructure and derrick for drilling an oil well thereon; may be securely and firmly anchored in place until the drilling operation has been completed; and wherein the superstructure may be salvaged or reclaimed readily for subsequent use once the well has been brought in.

A still further object of the invention is to provide a well drilling apparatus as set forth in the preceding objects in which a greatly improved, readily adjustable and highly serviceable anchoring means is provided for securely positioning the hull of the device in the desired location for drilling a well.

A still further object of the invention is to provide a well drilling apparatus as set forth in the foregoing objects, in which a releasable, but permanent fastening means is provided for anchoring the apparatus in position, and wherein a supplemental fastening or securing means is provided for adjustably and temporarily attaching the hull to the anchoring means.

Yet another important object of the invention is to provide a well drilling apparatus as stated in the above mentioned objects, which may be effectively operated and employed for much greater depths than heretofore considered possible, and wherein a plurality of units may be assembled in superposed relation upon each other to permit anchoring the device and operating the device in extremely great depths of water.

A still further important object of the invention is to provide an improved oil well drilling apparatus for marine use as stated in the preceding objects in which a plurality of anchoring spuds are slidably received in tunnels in the hull; are guided for vertical sliding movement in these tunnels; and are provided with improved means for clamping the spuds in longitudinally adjusted position

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with respect to the hull; together with vertically movable piles guidingly and slidably received within the spuds for driving below the lower end of the same; and wherein the piles are provided with longitudinal extensible members for increasing the effective length of the same.

Yet another important object of the invention is to provide, in an apparatus as set forth in the preceding object, means whereby the piles and spuds are guided for slidable, non-rotative movement, together with means whereby the same may be compactly retracted into the hull when it is desired to release the anchoring means.

These, together with various ancillary features and objects of the invention, which will later become apparent as the following description proceeds, are attained by the present invention, a preferred embodiment of which has been illustrated, by way of example only, in the accompanying drawings, wherein:

Figure 1 is a vertical, central sectional view through an embodiment of the invention, the device being shown in anchored position for drilling a well with one spud being shown in its lowered position, the well drilling member being indicated in operative position for drilling a well bore, and being shown in dotted line positions for drilling bores at various inclinations with respect to the vertical, parts being broken away;

Figure 2 is an elevational view of the apparatus in its anchored position, the superstructure removed after the well has been brought in, being shown in dotted lines therein;

Figure 3 is a horizontal sectional view of the invention, taken substantially upon the plane indicated by the section line 3—3 of Figure 1;

Figure 4 is a detail view in vertical section of one of the spuds in its retracted position and showing the associated mechanism, parts being broken away;

Figure 5 is a view similar to Figure 4, but showing the spud in its lowered position, with a pile having a lifting means thereon and in its raised position within the spud;

Figure 6 is a view of the upper portion of Figure 5, but showing the spud partially lifted by the pile and its lifting means;

Figure 7 is a vertical sectional detail view, taken substantially upon the plane indicated by the section line 7—7 of Figure 6;

Figure 8 is a vertical sectional view through an extension member used for driving piles through the spuds;

Figure 9 is a fragmentary horizontal sectional detail view, taken substantially upon the plane indicated by the section line 9—9 of Figure 4, showing the spud clamping mechanism;

Figure 10 is a horizontal sectional view taken substantially upon the plane indicated by the section line 10—10 of Figure 4 and illustrating a rotation preventing guide means for the spuds;

Figure 11 is a fragmentary detail view, in vertical section of a part of the spud clamping means;

Figure 12 is a horizontal sectional view taken substantially upon the plane indicated by the section line 12—12 of Figure 4;

Figure 13 is a fragmentary detail view in elevation of part of the spud securing means; and

Figure 14 is an elevational view, similar to Figure 2, parts being broken away and shown in section, of a modified use of the invention, employing a pair of units for operation at greater depths.

In drilling oil wells, it frequently occurs that the dome of an oil deposit is positioned off shore at varying depths. Heretofore, it has been necessary to drill an oil well shaft at an inclination with respect to the vertical in order to tap the oil deposit at the top of the dome when located off shore. While heretofore attempts have been made to

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erect a well drilling assembly off shore above the dome of the deposit, such efforts have been frequently defeated and rendered unsatisfactory by virtue of the great depths sometimes encountered; by reason of the difficulties arising from waves caused by storms and the like; and further by virtue of the extremely heavy expense incurred in creating a satisfactory base or foundation for the drilling assembly which is either a total loss if the well fails to reach the dome of the oil deposit; or is an exceptionally heavy expense by virtue of the fact that the cost of recovering or salvaging the well drilling foundation or base and its superstructure is prohibitive.

It is the primary intent of the present invention to provide an apparatus and a method of operating the same for drilling oil wells which shall largely overcome the above mentioned disadvantages and enable the driller to operate successfully and economically under relatively very great depths of water as for example in some instances at several hundred feet; to provide an apparatus which may be substantially completely recovered and reclaimed when the drilling site is to be abandoned either as a result of an unsuccessful drilling operation, or after the oil deposit ceases to flow from the well; and wherein the entire drilling superstructure may be readily removed and salvaged as soon as a flowing well is brought in.

Referring now more specifically to the accompanying drawings, wherein like numerals designate similar parts throughout the various views, it will be seen by particular reference to Figures 1 and 2 that the apparatus according to the principles of this invention includes a cylindrical, drum-like hull section 10 fabricated of steel plates and the like in any desired dimension and size, this hull section having what may be termed a top deck 12, a base or bottom wall 14, a plurality of intermediate decks, two of which are shown at 16 and 18, together with suitable partition walls whereby the interior of the hull 10 is divided into a plurality of compartments.

The actual compartmental arrangement inside the hull does not in itself form any particular part of the present invention, it being understood that the various compartments are employed for ballast tanks in order to cause the hull to settle into the desired location below the surface of the water; machine rooms, fuel and oil supply storage rooms, crews quarters, and for any other desired purposes.

However, it is an essential part of this invention that this hollow hull shall be provided with the requisite number of vertical and horizontal structural members such as the vertical I-beams 20, see Figure 3, which are preferably disposed in two annular rows adjacent the circumference or periphery of the hull. Located between these two rows of I-beams, is annular series of vertically disposed tunnels consisting of vertical sleeves or casings 22 which constitute tunnels, see in particular Figures 4 and 5, which extend through and are secured in a watertight manner to the top and intermediate decks and the bottom wall or base 14. Also, the hull is provided with a relatively large axial or central opening or bore there-through which constitutes an opening for receiving a well drilling apparatus, the base being provided with a plurality of spaced openings such as those indicated at 24 in Figure 3, while suitable sleeves or tubes 26 extend through the top and intermediate decks and the bottom wall in proper alignment to permit the well drilling tools 27 to be employed in selected various angular inclinations with respect to the vertical plane for drilling a well.

In accordance with this invention, a removable superstructure indicated generally by the numeral 28 is removably erected upon and supported by the top deck 12, this superstructure providing continuations for the above mentioned tunnel casings 22 and for the central drilling opening. Upon the top of the superstructure, an annular railway track 30 is provided for receiving a portable crane 32 of any desired character and size. A guard rail or the like 34 is mounted upon the top of the super-

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structure 28 surrounding the track and providing a catwalk and the like upon the top of the superstructure.

As set forth hereinafter, the portable crane 32 is provided for lowering or raising spuds and the piles slidably received therein through the tunnels, for positioning the pile driving mechanism, to assist in erecting or removing the superstructure; and to handle supplies and equipment for depositing the same into the compartments of the hull.

Above the central portion of the top deck 12, and over the central opening disposed through the hull, and within a central clearance provided in the superstructure 28, is erected any desired form of derrick 34 which is employed in accordance with conventional practice for drilling a well bore. It may be here noted, however, that this derrick may conveniently be mounted upon an annular track or the like 36 upon the top deck 12 whereby the derrick may be centered with respect to the upper end of any of the inclined axes along which it is desired to drill the well bore.

A cable 38, operated from the power source of the portable crane 32 or any other suitable power source desired, is employed to raise or lower the well drilling member 27. This latter member may be of any conventional type desired.

As so far described, it will now be understood that the hull 10 either with or without the superstructure 28 may be towed and floated to the site desired, whereupon ballast tanks may be filled and the hull submerged upon the bottom. The hull will then be anchored by spuds in a manner to be subsequently set forth, and by properly positioning the drilling member 27 through one of the drilling apertures 24 in the bottom wall 14, after the derrick 34 has been erected, a well bore may be drilled as desired.

It will further be seen that the superstructure, the derrick and the associated equipment may be readily removed, the ballast tanks blown and the hull refloated when it is desired to move the same to a new location for further drilling; and once a well has been brought in, the derrick 34 and superstructure 28 may be removed leaving the hull in place to house the machinery for operating the flowing well.

Obviously, therefore, a single superstructure and drilling derrick may be employed successively for a plurality of hulls for developing an underwater oil field, obviously lessening the capital investment in equipment and the over all cost of the same.

In Figure 1 is clearly shown the apparatus in its well drilling position, while in Figure 2 the removable superstructure and the drilling derrick 34 are indicated in dotted lines, the hull being shown in its anchored position, with the spuds being embedded in the sea bottom, and the piles driven and extended therethrough, and with the well casing or bore being shown driven down through the center of the device. As shown in Figures 1 and 2, the hull 10 is shown as anchored above the sea bottom, although it will be readily understood that the same may rest upon the bottom in some instances, depending upon the depths at which the device is employed. In any event, it is obvious that the large number of spuds together with the piles driven therethrough will securely anchor and fixedly maintain the hull in the desired position, and this despite the stresses produced by waves, tides and the like.

However, the invention particularly contemplates an improved and novel spud and pile assembly whereby the hull may be readily adjusted upon the spud and pile once the same have been anchored, as occasion may require; in order to obtain the optimum results and performance.

Referring now more particularly to Figures 4 and 5, it will be seen that the tunnel casing member 22 above mentioned extends from the hull bottom wall 14 to a second or intermediate hull deck 16. The casing 22

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thus extends through the third deck 18, and terminates at or just above the second deck 16, as shown in Figures 4 and 5. As shown more clearly in Figures 9 and 10, the interior of the casing is provided with suitable inwardly extending angle iron bracket members 40 which are disposed in diametrically opposite pairs upon the interior of the casing member and extending radially inwardly thereof. Any desired number of pairs of these guide members may be provided, and the same cooperate with radially outwardly extending guide lugs 42, likewise disposed in diametrically opposite pairs, upon the exterior surface of a tubular spud 44. Extending longitudinally upon the exterior surface of the spud are secured diametrically disposed pairs of clamping bracket flanges 46 provided with longitudinally spaced apertures 48. As will be best seen from Figure 10, the clamping bracket flanges 46 are disposed in parallel pairs, the pairs being disposed on diametrically opposite sides of the spud, and adjustable mounting brackets 50 are secured between the pairs of flanges 46 in longitudinally or vertically adjusted position therebetween by means of bolts secured to the aligned apertures 48 of the flanges and corresponding apertures of the brackets 50. The brackets 50 have laterally extending vertically disposed cylindrical sleeves 52 whose cylindrical bores or openings are aligned with those of corresponding sleeves 54 fixedly secured to the upper end of the tunnel casing member 22.

The arrangement is such that the mounting brackets 50 may be adjusted longitudinally of the spud as desired; and when so adjusted may be seated upon the seating brackets 54 carried by the tunnel casing 22, and may be clamped or anchored thereto as by fastening bolts 56 which extend through the aligned cylindrical members 52 and 54.

By reference to Figure 10 it will be seen that the guide brackets 40 carried by the tunnel casing 22 are so disposed with respect to the guide lugs 42 and the clamping flanges 46 as to not only guide the spud in the tunnel casing for vertical sliding movement therein, but to also prevent relative rotation of these members.

The spuds 44 are open at their lower ends as clearly shown in Figures 4 and 5, and adjacent their open lower ends are provided with two or more horizontally extending partitions 58 and 60. These partitions may be of any desired construction, at least one of these constituting a guide for slidably receiving a pile 62 of any desired character, such for example as a reinforced concrete pile, but preferably a tubular steel shaft or sleeve having a conically headed lower end 64 for anchoring the same. One or both of the partitions 58 and 60 may constitute the above mentioned guide or guides for the pile and may also constitute a watertight seal for the same if desired.

However, it is to be understood that the principles of this invention are not limited to a construction wherein the entry of water into the space within the spud is prevented.

Adjacent their upper ends, the spuds 44 are provided with cooperating sets of brackets, comprising inwardly extending, diametrically disposed pairs of plates or brackets 66, which at their radially inward ears are embraced by parallel pairs of diametrically disposed pairs of brackets or ears 68 mounted upon the exterior of the pile 62.

The brackets 68 may be secured in any desired manner as by welding or the like to the exterior surface of the piles 62 adjacent their upper ends and serve the dual functions of guiding and preventing rotation of the piles while the same are being driven in the upper end of the spuds, and also by means of vertically disposed series of apertures serve to permit anchoring or locking of the piles to the spuds when the piles are in their raised position or retracted position within the spuds such as shown in Figures 4 and 5.

Preferably the upper ends of the piles are open and are adapted to receive tubular pile extension members,

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see Figure 8, which consist of tubular sleeves or casings 70 of the same diameter and material as that of the pile 62, these sleeves having connecting bushings 72 at their opposite ends, the bushings being received within the ends of the extensions 70, and having diametrically reduced sleeve portions 74 extending axially therefrom. These sleeve portions are apertured as at 76 whereby the same may be bolted or coupled detachably to the corresponding ends of the piles 62 or to similar extensions as shown in Figure 8. The upper ends or extension receiving ends of the piles 62 and of the next adjacent extensions 70 may be provided with reinforcing sleeves 78 which are similarly apertured as illustrated.

It will now be readily understood that normally the spud and pile will be retained in their raised position within the tunnels of the hull, the pile being clamped by securing its flanges 68 to the lugs 66 on the spud in the retracted position of the pile within the spud, while the spud in turn is retained in its raised position by the clamping brackets 50 resting upon the bracket seats 54 as illustrated in Figure 5. When it is desired to work and anchor the spud and pile assembly, a U-shaped hook or swivel 80 operated by the crane 32, has its legs secured by pivot pin 82 at their lower ends to a sleeve member 84 which is received within the upper end of a pile 62 or any pile extension 70 which may be mounted thereon, to thereby support the weight of the spud which is secured to the pile.

The spud with the pile bolted thereto may then be lowered until the bottom end of the spud engages in the surface of the soil below the water, the spud thus moving from the position shown in Figure 4 to that shown in Figure 5. As will now be readily understood, the clamping brackets 50 are suitably adjusted along the length of the clamping flanges 46 to cause the brackets to seat upon the bracket seats 54, whereupon the bolts 56 are applied and the spuds are then anchored or permanently secured, but in a detachable manner, in their lowered or anchoring position. At this time, the bolts securing the brackets 68 of the pile to the lugs 66 in the spuds are released, and by means of any conventional construction of steam hammer or the like, the pile may then be driven from its rest position shown in Figure 5 to its lowered or anchored position shown in Figure 2.

In addition to the above mentioned clamping means which is relied upon as the main or permanent means for adjustably locking the spud to the hull in either raised or lowered position, a temporary friction securing means is provided. This means comprises, as will be best apparent from Figures 4, 9 and 11, a pair of rack or friction bars 86 having teeth or serrations, which are welded or otherwise fixedly secured to diametrically opposite sides of the spud and throughout any desired portion of the length of the same, these friction bars being preferably disposed at right angles to the clamping brackets, as will be apparent from Figure 10. In some instances, the friction bars 86 may be relied upon to constitute the guiding lugs 42 previously mentioned and as being associated with the guide brackets 40.

Friction blocks 88 are received in slide channels 90 suitably anchored to the hull framework or to the tunnel casing 22, and serve to retain and slidably guide the same for movement transversely and diametrically of the spuds and rack bars. To operate these friction blocks, the same are provided with stems 92 which are slidably received in guides 94, these stems having rack bars 96 which are engageable by pinions 98 carried by electric motors or the like 100. As will now be readily understood, any suitable control means may be provided for simultaneously operating the pair of motors on opposite sides of each spud whereby the two friction blocks 88 may be simultaneously moved into or out of frictional locking engagement with the rack bars 86 carried by the spuds. Thus, the spuds may be temporarily locked in any desired position while the retracting means carried

by the crane 32 or extensions of the pile are applied; and while the clamping means is adjusted or clamped upon the spud.

As will be readily understood, access may be had to the clamping means, to the frictional locking means, and to the upper end of the pile and spud for applying the extensions or the fastening means from the various decks of the hull.

It should be observed, that as shown in Figure 4, the spud is completely retracted into its tunnel in the tank, while the pile may be completely retracted into the spud when the anchoring means is not in use.

From the foregoing, it is thought to be apparent that the drilling apparatus as shown may be securely anchored and yet readily removable from selected sites at varying depths below the surface of the water.

However, even though the apparatus as so far described is intended to be able to accommodate itself to depths of as much as one hundred to one hundred and fifty feet, it is possible to employ the principle of this invention, without change, at considerably greater depths.

For an understanding of one manner in which the device as so far described can be employed at even greater depths, attention is directed to Figure 14 wherein there is disclosed a novel manner in which two hulls of identical construction, the lower being indicated at 10 and the upper at 11, are employed. The lower hull is completely stripped of all superstructure, above the top deck 12 of the same, and the bottom wall 14 of the upper hull 11 rests flat upon the top deck 12 of the lower hull with the vertical tunnels of the same in vertical alignment as shown. The upper hull 11 is of course provided with the customary superstructure previously described, as indicated in dotted lines. The hulls may be separately towed to position, or may be assembled one upon the other and then towed as a unit to position. When the desired location has been reached, the hulls singly or as a unit are sunk into operative position as shown, and the spuds 44 of the lower hull are then embedded in the bottom of the sea in the same manner previously described, while the spuds 45 of the upper section are inserted downwardly through the vertical tunnels of the lower section and into abutting relation with the upper ends of the spuds 44 therein. Piles and their extensions are then driven downwardly through the aligned upper and lower spuds of the two hulls until the device has been anchored to the bottom in the required position. The clamping means for each of the hulls functions as previously described, and similarly, the frictional securing means is utilized. When once assembled and anchored, the superposed hulls function in exactly the same manner as a single hull, but obviously at a much greater depth. It will further be apparent that the principles of this invention may be applied to any convenient number of hulls in order to reach much greater depths than have been hitherto accessible for use in drilling off shore oil wells.

From the foregoing, the construction and operation of the device will be readily understood and further

explanation is believed to be unnecessary. However, since numerous modifications and changes will readily occur to those skilled in the art after a consideration of the foregoing specification and accompanying drawings, it is not desired to limit the invention to the exact construction shown and described, but all suitable modifications and equivalents may be resorted to, falling within the scope of the appended claims.

Having described the invention, what is claimed as new is:

1. In a marine well drilling apparatus including a floating hull, means for anchoring said hull to a submerged surface, said anchoring means including tubular spuds having pilings telescopically disposed therein, tubular casings in said hull forming tunnels therethrough, said spuds slidably extending through said tunnels, radially outwardly projecting flanges secured to said spuds and extending longitudinally therealong, inwardly projecting brackets on said casings slidably engaging said spud flanges and preventing rotation of the spuds, said flanges and said brackets having registrable apertures there-through for the reception of fastening elements to hold said spuds in adjusted positions within said casings, and cooperating sets of brackets extending from the inner surfaces of said spuds and the outer surfaces of said piles slidably guiding said piles through said spuds, and fastening means for securing said sets of brackets to one another to retain the piles in adjusted positions within the spuds.

2. The combination of claim 1 including means for frictionally clamping said spuds in vertically adjusted position in said casings and comprising longitudinally extending friction bars on the exterior of said spuds, friction blocks carried by said casings and engageable with said friction bars.

3. The combination of claim 1 including means for frictionally clamping said spuds in vertically adjusted position in said casings and comprising longitudinally extending friction bars on the exterior of said spuds, friction blocks carried by said casings and engageable with said friction bars, said casings having apertures, said friction blocks being slidable through said apertures for selective engagement with and disengagement from said friction bars.

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