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SUBMERSIBLE BARGE FOR OFF-SHORE DRILLING

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Fig. 3

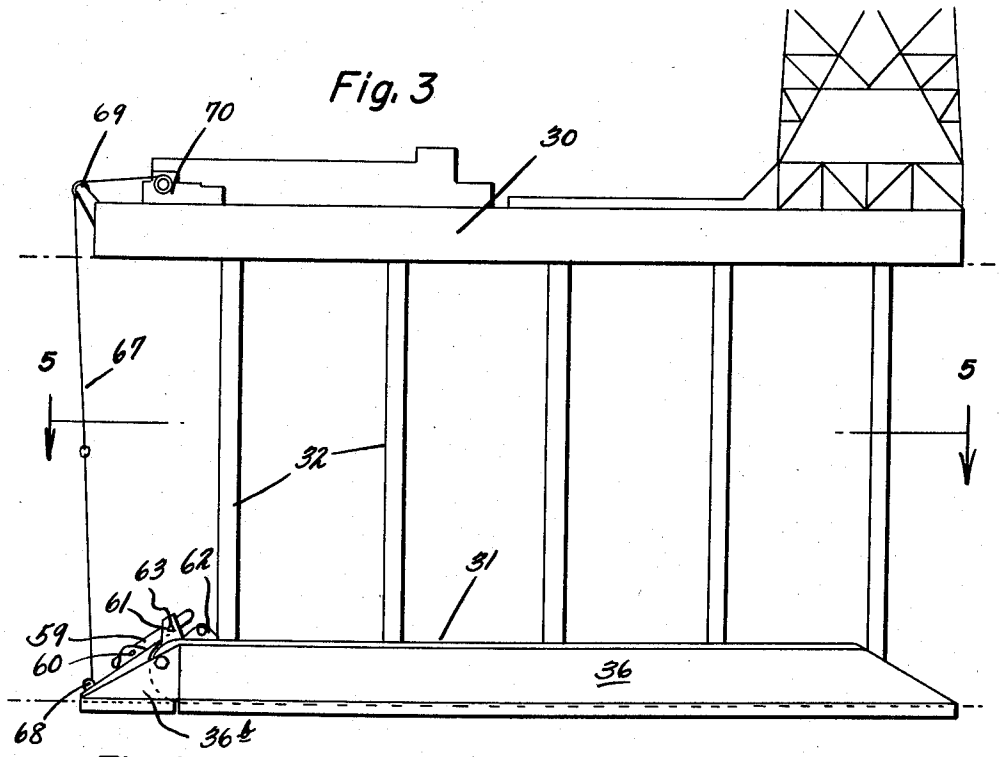


Fig. 1

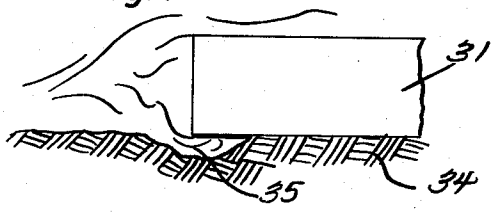


Fig. 2

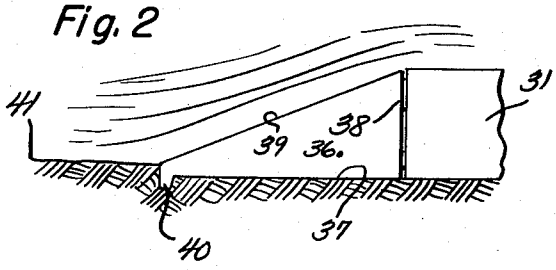
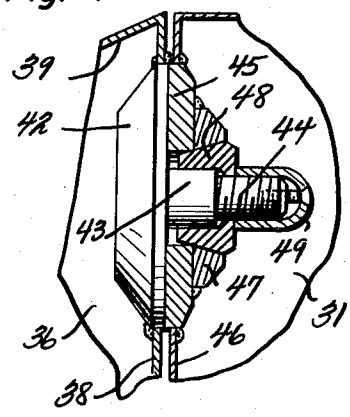


Fig. 4



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SUBMERSIBLE BARGE FOR OFF-SHORE DRILLING

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Fig. 5

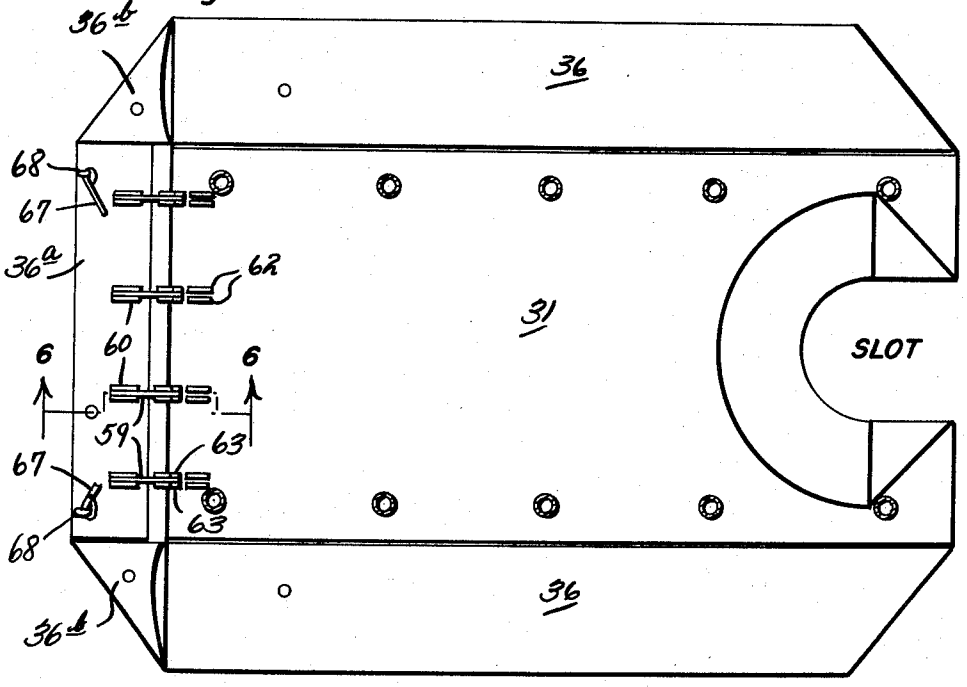

Fig. 6

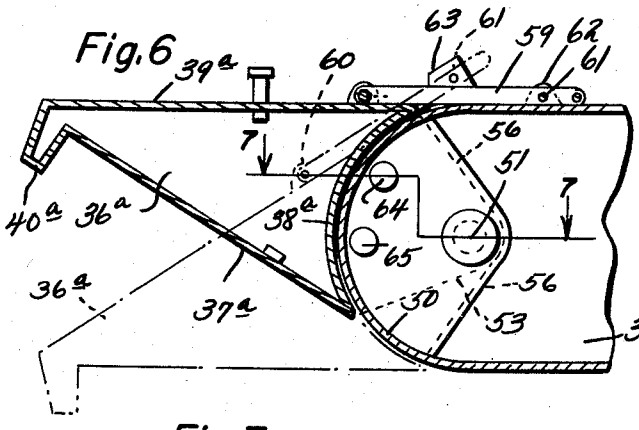

Fig. 8

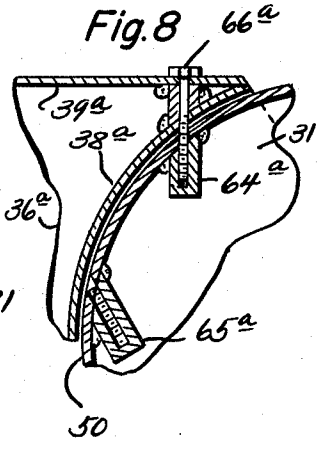

Fig. 7

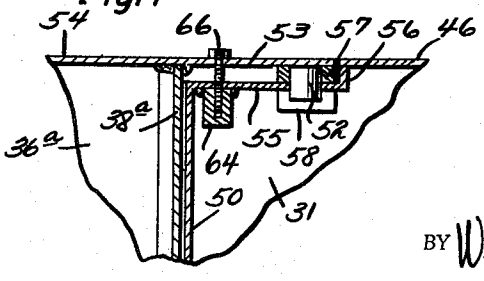

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Fig. 9

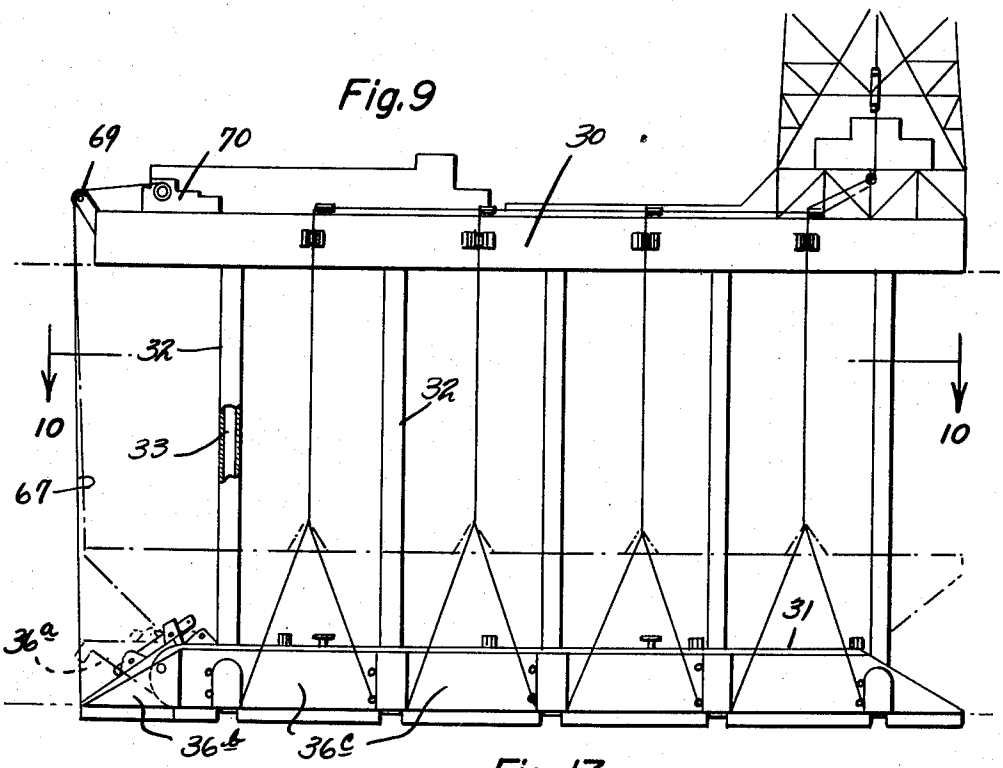

Fig. 21

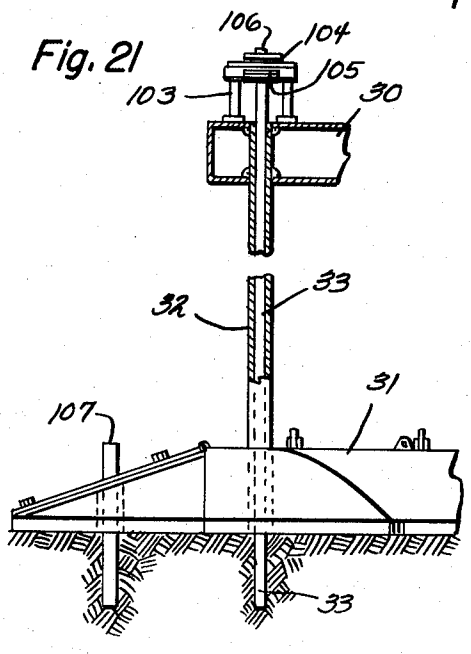

Fig. 17

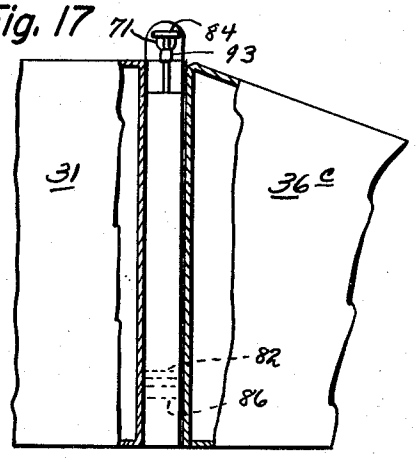

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Fig. 10

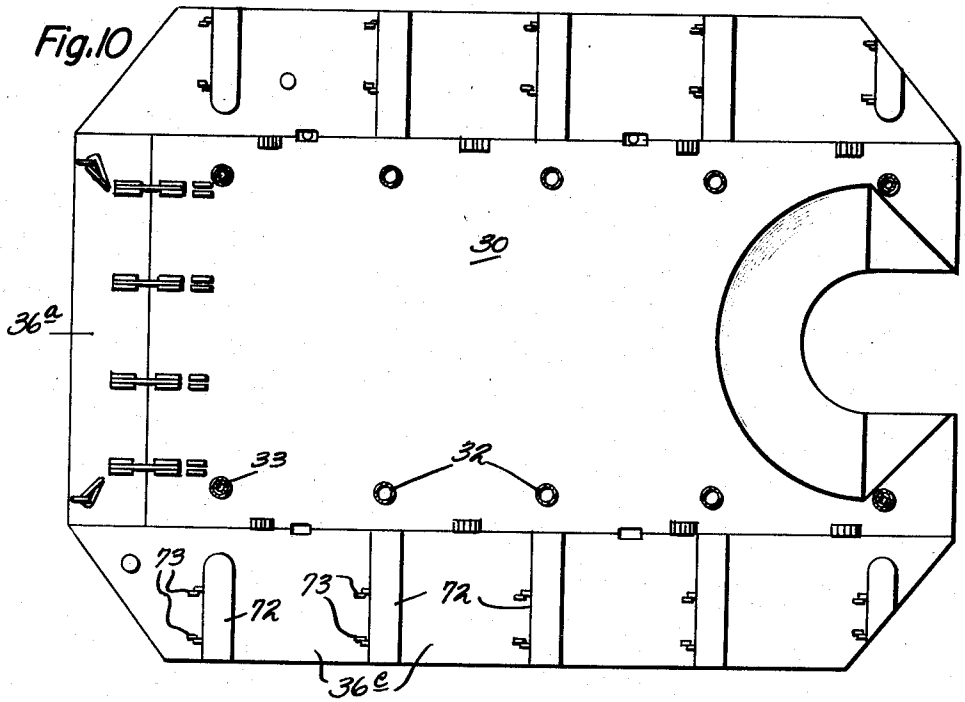

Fig. 11

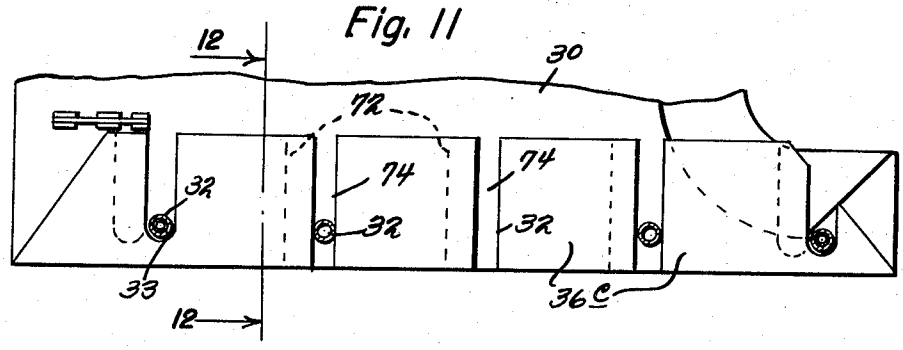

Fig. 12

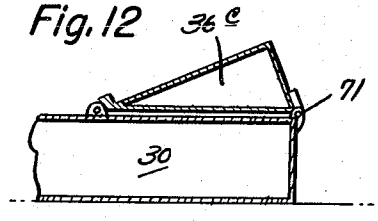

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Fig. 13

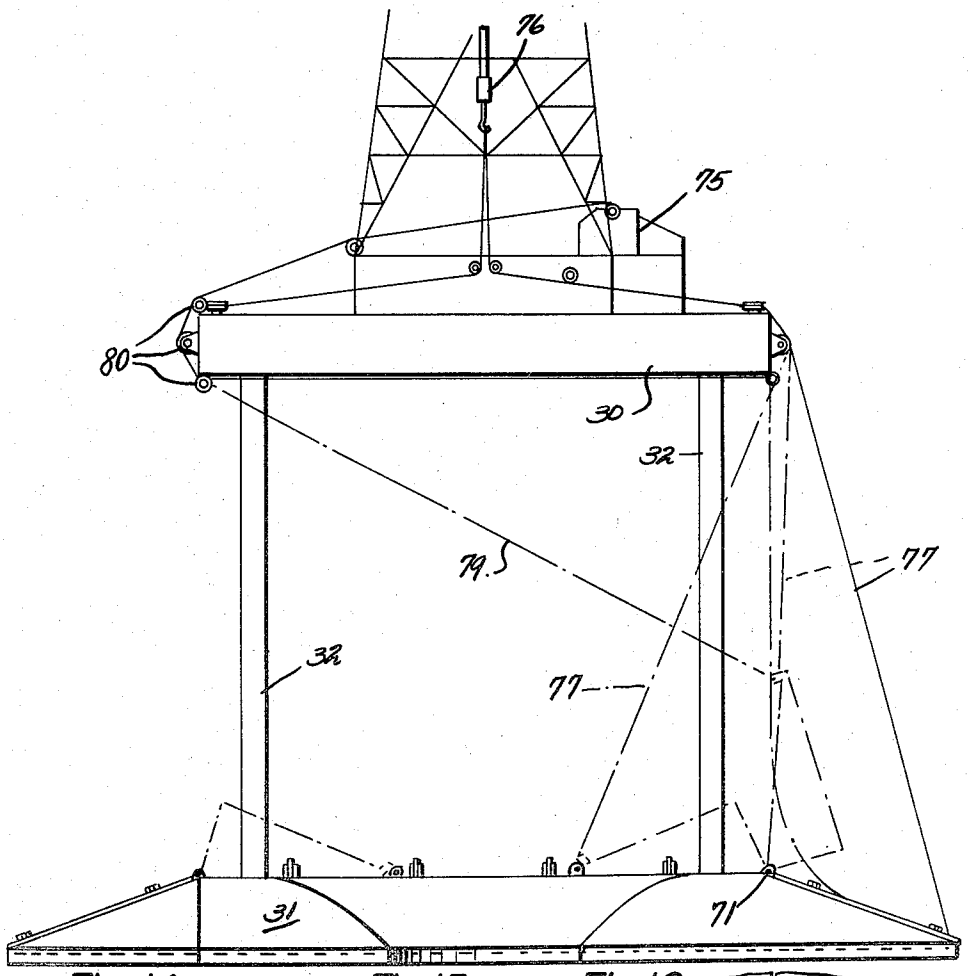

Fig. 14

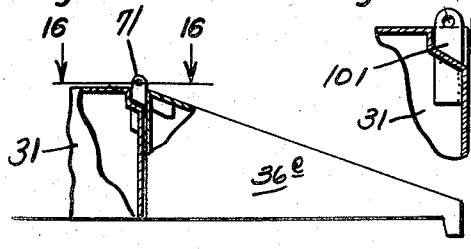

Fig. 15

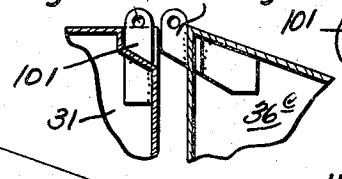

Fig. 16

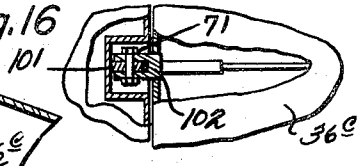

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Fig. 18

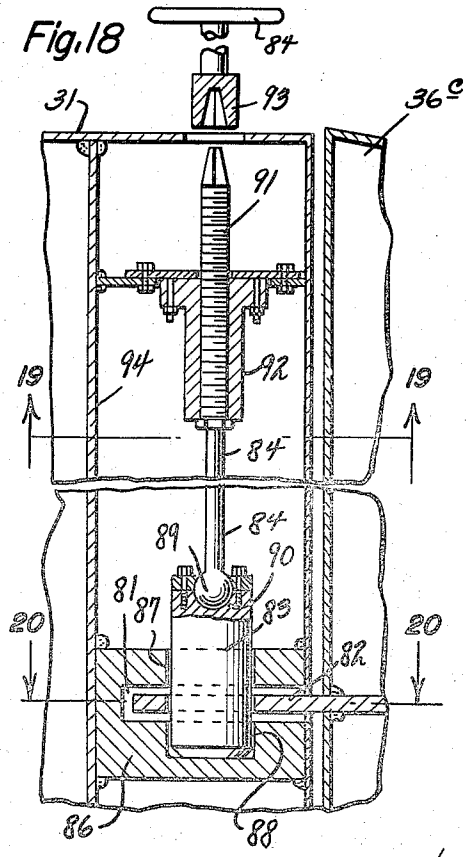


Fig. 19

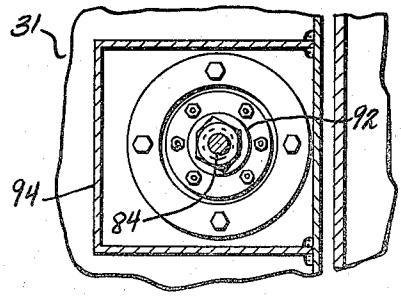


Fig. 20

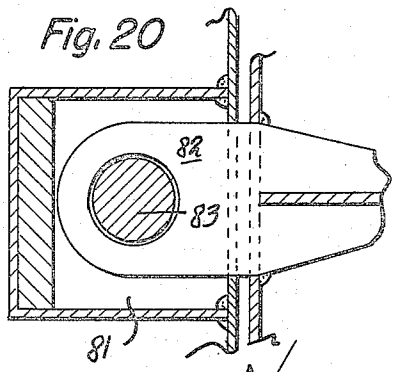


Fig. 22

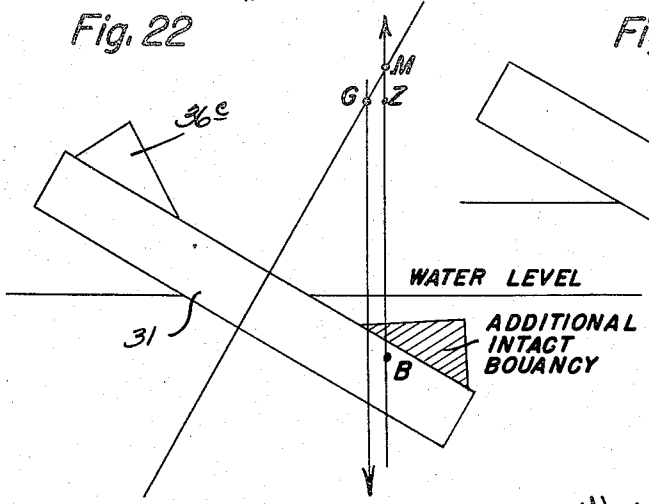
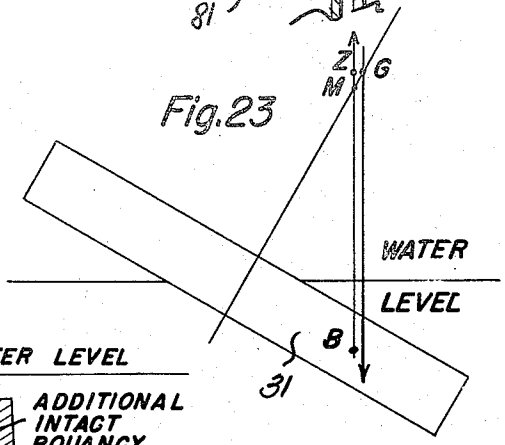


Fig. 23



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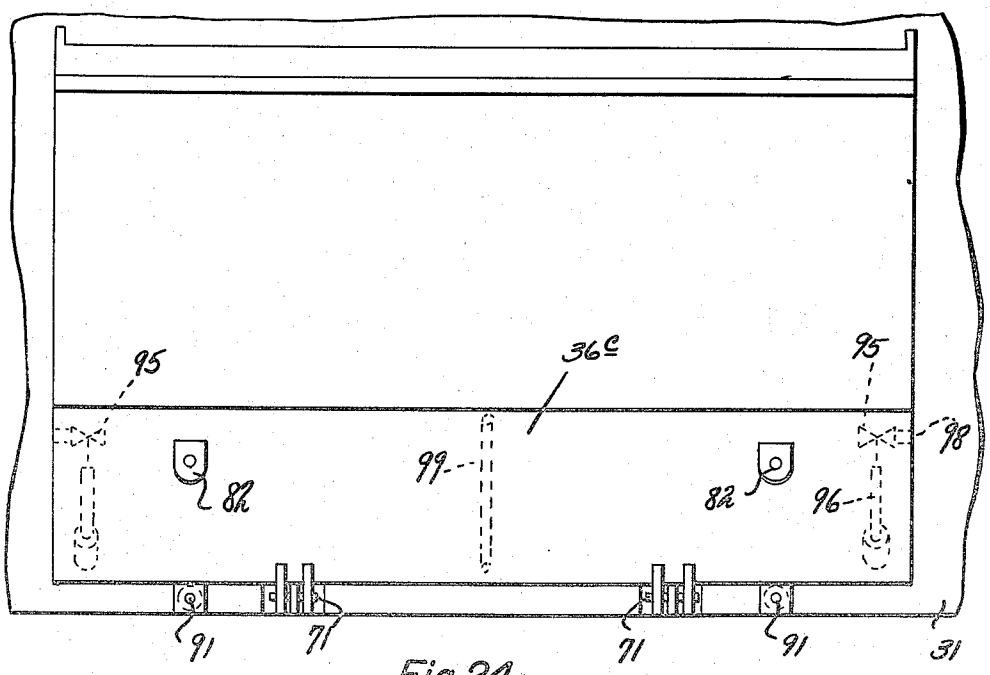

Fig.24

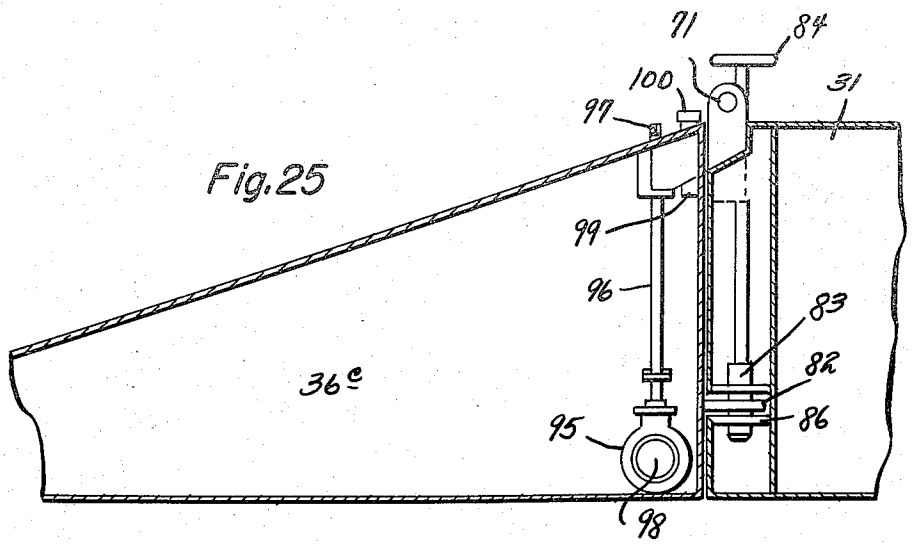

Fig.25

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2,924,946

SUBMERSIBLE BARGE FOR OFF-SHORE DRILLING

Jerome L. Goldman, New Orleans, La.

Application December 3, 1954, Serial No. 472,931

10 Claims. (Cl. 61—46.5)

The present invention relates to submersible barge for off-shore drilling and involves certain improvements over the apparatus disclosed in my prior applications Serial No. 374,225, filed August 14, 1953, and now abandoned, and Serial No. 379,843, filed September 14, 1953, and now abandoned.

The invention also constitutes certain improvements over the Hayward Patents 2,540,878 and 2,612,759, all of which will become apparent as the description proceeds.

Submersible barge hulls, as used for drilling oil wells in off-shore locations, have heretofore assumed a substantially rectangular box shape with vertical or near-vertical sides and a bow which may be vertical or raked for improved towing characteristics. The stern is usually slotted with vertical sides to the slot and on the transom of the vessel. These barges are lowered to the bottom in water exceeding the depth of the hull by stabilizing according to one of a number of systems. It is not the object of this invention to propose a new system of stabilizing during the lowering and raising of the barge. However, these submersible barges are used frequently in locations exposed to wave motion set up by storms and natural currents. The motion of the water, when acting against a vertical side, or the slightly beveled side of the present day barge hull, exerts considerable forces against the hull. In addition, these vertical sides cause considerable disturbance of flow of the water with the result that scouring may take place under the barge hull which can result in very serious difficulties occurring when a spread foot foundation is undermined. In addition, the horizontal impact of forces upon the hull tend to produce horizontal movement of the vessel which endangers the oil well structure located in the slot of the vessel. Recent actual experience with a number of such barges has shown the problems as stated above to be most acute and requiring a suitable solution.

Pursuant to the foregoing, the invention has for an object a system of permanently attached or removable appendages to the hull which provide for streamline flow of water past the hull when the hull is located on the ocean floor. It is also an object of the invention to provide suitable pinning of the hull on location by spuds or piles to prevent shifting. Three very desirable effects result from this invention: Firstly; the streamline shape decreases the impact force of the moving water upon the hull. Secondly; the streamline shape reduces scouring tendencies. Thirdly; the pinning spuds or pile keep the hull from moving horizontally.

The extreme breadth of the barge is often limited by the capacity of shipbuilding ways, dry dock facilities, bridges, canals, locks, etc. This limitation of breadth makes it frequently impracticable to construct a single

hull of sufficient width to embody the streamline shaping transversely necessary to obtain streamline flow; also experiments have shown that a lesser degree of shaping is not of material benefit. It is therefore a further object of the invention to provide for the normally rectangular vertical-sided barge to be provided with a system of articulated or non-articulated removable streamline appendages fitted to the hull which provide the desired shaping when drilling off-shore and yet can be removed or reclocated when necessary so that the vessel can be dry docked or taken through narrow waters. Where lateral restriction is not a requirement, these appendages can be permanently attached to the hull.

In addition the invention contemplates a system of spuds or piles to fix the vessel with respect to movement in a horizontal plane while on the ocean bottom.

It is a still further object of the invention to provide a hull which combines the ability of doing two very difficult jobs. The first is to tow reasonably well at sea. The second job is to act as the ideal marine foundation while on bottom. For towing purposes a ship-shape vessel would undoubtedly give the very best result. However, as such a shape would be totally unsuitable as a marine foundation, a reasonable acceptable solution is to provide a hull with a barge type rake. The invention enables such a rake to be provided, making for a hull that will tow reasonably well. The ideal marine foundation would consist of a large flat horizontal surface infinitely thin. This would provide a large bearing area with no obstruction to the movement of water. Such an infinitely thin foundation is not physically obtainable due to the need for a barge hull to have reasonable depth for floatation, strength, stability and other purposes. However, the depth should be kept as small as consistent with safety and good practice. In turn this hull should be provided with a sufficient slope which enables the water to flow freely around the hull with a minimum disturbance. Hydraulic experiments have indicated that the slope up and down which water will flow without turbulence at moderate speeds is approximately twenty degrees. It is the object of this invention to provide slopes which will be approximately this amount, being less where possible and slightly greater if necessary.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views:

Figure 1 is a fragmentary side elevation view of a form of submersible barge having substantially vertical side walls and indicating diagrammatically the action of scouring incident to water movement.

Figure 2 is a similar view with one of the streamlined appendages attached to the barge and in a lowered position on the ocean floor showing the deflection of the waves in avoidance of scouring.

Figure 3 is a side elevational view of a form of submersible barge constructed in accordance with the present invention shown as resting on the ocean floor below the upper barge or vessel which constitutes the platform for the drilling rig and other equipment.

Figure 4 is a fragmentary vertical sectional view of a hollow submersible barge and a hollow streamlined side appendange or extension with one form of device for permanently attaching the appendage to the barge.

Figure 5 is a horizontal sectional view taken on the line 5—5 of Figure 3.

Figure 6 is a vertical sectional view taken on an enlarged scale on the line 6—6 in Figure 5 and showing the bow section of the system of appendages in raised position in full lines for towing and in the dropped position in dotted line when the barge is in the lowered position on the ocean floor.

Figure 7 is a fragmentary horizontal sectional view taken on the line 7—7 of Figure 6.

Figure 8 is a fragmentary vertical section similar to Figure 6 showing a modified form of means for holding the bow section in elevated position.

Figure 9 is a side elevational view of an apparatus constructed according to the invention with sectionalized side appendages hinged to the submerged barge and showing one form of means for raising and lowering the sections about their hinged mountings.

Figure 10 is a horizontal sectional view taken on the line 10—10 in Figure 9 with the appendages in the outboard position.

Figure 11 is a view similar to Figure 10 with parts removed and showing the sectionalized appendages folded inboard on one side of the submersible barge.

Figure 12 is a transverse vertical section taken on the line 12—12 in Figure 11.

Figure 13 is an end elevational view of an apparatus constructed in accordance with the present invention with the appendages shown in full line position in the outboard position and in dotted lines in the inboard folded position, with a system of tackle for raising and lowering the sections.

Figure 14 is a fragmentary end elevational view, with parts broken away and parts shown in section of the hollow barge and one of the hollow appendages with a form of pivotal or hinged joint therebetween.

Figure 15 is a fragmentary vertical sectional view, taken on an enlarged scale, of parts of the hull and the appendage with the parts of the hinge joint separated.

Figure 16 is a horizontal sectional view taken on an enlarged scale on the line 16—16 of Figure 14.

Figure 17 is an end elevational view of the barge and an appendage taken on an enlarged scale with parts broken away and parts shown in section and illustrating a form of locking device for locking the appendage in the lowered outboard position.

Figure 18 is a vertical sectional view taken on a much magnified scale, through a form of locking means, showing the parts in the locked position.

Figure 19 is a horizontal sectional view taken on the line 19—19 of Figure 18.

Figure 20 is a similar view taken on the line 20—20 of Figure 18.

Figure 21 is a rear elevational view of the barge, partly broken away and one of the side appendages in place on the ocean floor and illustrating systems of pinning both barge and appendage to the floor to prevent casual shifting of the same on such floor, the view also showing fragmentarily the upper barge in section, a lifting column partly in section and partly in elevation and a jacking means for driving the spud or pile down through the column and into the mud.

Figure 22 is a diagrammatic view showing a barge constructed in accordance with the present invention and having the appendages folded inboard and illustrated in a heeled-over position to demonstrate stability.

Figure 23 is a similar view showing a conventional barge in a similar position on the point of capsizing.

Figure 24 is a fragmentary top plan view of the submersible barge with an appendage provided with means for introducing sea water into its interior space and also for introducing air under pressure to drive out the sea water to give buoyancy in raising the barge.

Figure 25 is a fragmentary vertical section taken through the barge and an appendage showing a sea cock and a vent pipe and air hose connection.

Referring more particularly to the drawings, 30 in Figures 3, 9 and 13 designates the upper barge which on location becomes a deck or platform for the drill rig and other parts, while 31 represents the lower submersible barge, there being support columns 32 between the two barges down through which spuds or piles 33 may be driven into the ocean floor as indicated in Figure 21.

The barges 30 and 31 are nested together, that is the lower barge 31 is located immediately below the upper barge 30 for floating the equipment to location. Alternately, 30 can represent a structure at a fixed elevation above 31.

On reaching location the lower barge 31 is submerged, as by flooding its hollow internal space or tanks or the barge is otherwise driven down to the ocean floor. The upper barge 30 is thereupon jacked up on the columns 32 to a suitable height above sea level for constituting a suitable platform or deck or other support for the rig and other equipment well above wave action.

This construction and mode of operation are more particularly disclosed in my two prior copending applications aforesaid.

Referring more particularly to Figure 1, a typical barge 31 is shown on the bottom 34 of the ocean. Wave action against the vertical side or end of the barge 31 creates eddies which form in the area 35 resulting in violent agitation of the water, causing scouring and the undermining of the bottom beneath the barge 31.

Referring more particularly to Figure 2, the same barge 31 is shown as provided with an appendage or extension according to the present invention. The appendage 36 is shown to be generally of wedge form having a bottom wall 37 which is substantially horizontal and forms in effect an extension of the bottom of the barge 31. An inner end wall 38 rises from the bottom wall 37 adjacent the vertical side wall of the barge 31. This inner wall can be eliminated when the appendages are fully welded to the main hull. The appendage 36 is completed by a sloping or diagonal top wall 39 which extends downwardly and outwardly from the upper edge of the inner end wall 38 down approximately to the vicinity of the outer edge of the bottom 37. This sloping wall 39 at its lower outer end merges into a toe or flange 40 which projects down below the base line 37. The angle of slope of the upper wall 39 may be of the order of twenty degrees. The action of waves is indicated in this Figure 2, such waves being deflected up the inclined plane 39. In other words, the current assumes a smooth streamline flow, minimizing scouring in the area in and about the toe 40. Adding the appendage to a typical barge results in a streamline wave effect, not only reducing scouring but also reducing drag effect. The toe 40 also tends to prevent the water from getting beneath the appendage 36 and of course beneath the barge 31. As a matter of fact the reaction of the flow of water along and up and over the inclined wall 39 tends to cause the barge 31 and its appendages 36 to move downwardly so that the submersible hull 31 and its appendages settle below the mudline indicated at 41. This depressed position brings the mud against the toe 40 and further prevents any eddie currents from getting beneath this toe or the appendage 36.

Referring more particularly to Figure 4, where the side appendages are to be permanently affixed in place to the side walls of the barge 31, at appropriate intervals a form of fastening as shown in Figure 4 may be used. In this form the head 42 of a steel pin is welded or otherwise secured to the end wall 38 of the appendage 36, such head having a smooth shank 43 and a threaded shank section 44 which is reduced in diameter from the diameter of the smooth portion 43. The shank sections 43, 44 project toward and through an opening made in the end wall of the barge 31. In this opening a steel or other flange 45 is welded in place to the side wall 46 of the barge. A steel retainer ring 47 is mounted against

the flange 45 and about a bronze tapered liner 48. A steel nut 49 is threaded upon the threaded section 44 of the shank and abuts against the outer end of the liner 48 to drive the liner along the smooth shank portion 43 with its outer tapering wall riding upon a complementally tapered inner bore surface of the ring 47. The ring 47 may be welded if desired to the flange 45. In lieu of bolting, welding may be utilized as a means of structural connection.

Figure 5 shows a conventional rectangular hull 31 to which are attached a number of the appendages. The lateral or side appendages 36 may be continuous from one end to the other of the hull 31. These appendages are affixed to the side walls of the hull 31 in the manner indicated in Figure 4. Other appendages illustrated in Figure 5 comprise a bow section 36^a and corner appendages 36^b. The bow section 36^a is hinged to the hull 31 in the manner more particularly illustrated in Figures 6 and 7. The corner appendages 36^b are also preferably of the hinged type and in this instance may be hinged to the side appendages 36.

Referring more particularly to Figures 6 and 7, the bow appendage 36^a is of the general wedge shape of appendages previously described and has a similar bottom wall 37^a, similar top wall 39^a and a similar toe portion 40^a. In this instance however the inner end wall 38^a is curved, as more particularly shown in Figure 6, to present its concave side to the convex face of a complementally curved front barge wall 50. The walls 38^a and 50 are struck from a center 51. Such center 51 coincides with the center lines of hinge pins 52 affixed in the sector-shaped extension plates 53 of the side walls 54 of the bow appendage 36^a. The extension plates 53 extend outwardly of and overlap the inwardly-offset front extension walls 55 of the side walls 46 of the hull 31. Such extension walls 55 together with the offsetting walls 56 provide recesses for receiving the plates 53 and the hinge pins 52 together with the spacing collars 57 which surround outer portions of the pins 52 and avoid undue lateral movement of the extension plates 53. The inner ends of the hinge pins 52 are received in socket blocks 58 carried inwardly of the front extension walls 55. The front extension walls 55 are connected at their outer ends to the curved front barge wall 50. The offsetting walls 56, as appears from Figure 6, define sector shaped recesses which are larger than the dimensions of the sector plates 53 in order to permit the bow appendage 36^a to move up and down between the positions shown in full and dotted lines in Figure 6.

When in the full line position as shown in Figure 6, which is the towing position of the bow apendage 36^a, the base wall 37^a presents a suitable angle of rake to facilitate the forward movement of the barge 31 through the water. When the bow appendage 36^a is lowered to the dotted line position shown in Figure 6, it rests with barge 31 upon the bottom of the ocean and has the advantages previously illustrated and described in connection with Figure 2.

The bow appendage 36^a may be held in the elevated position shown in full lines in Figure 6 by any suitable means. In Figure 6 a rod or bar 59 is shown as being pivoted at one end 60 to the top wall 39^a of the bow appendage 36^a while its other perforated end is adapted to removably receive a locking pin 61 which is also passed through a pair of perforated ears 62 or a pair of perforated ears 63 which are mounted in spaced positions on the barge 31. When the pin 61 is engaged with the perforated ears 62 the bow appendage 36^a is held in the raised position, when engaged with the set of perforated ears 63, the bow section 36^a is in the lowered dotted line position of Figure 6.

In Figure 6 threaded sockets 64, 65 are shown as spaced apart on an arcuate path intersected by openings in the side extension plates 53 through which are inserted threaded locking pins 66. In the raised position of the bow appendage 36^a the threaded locking pins 66 register with the upper threaded sockets 64 and in the lower position of the bow appendage 36^a the locking pins 66 align with the lower threaded sockets 65.

In Figure 8 the threaded sockets 64^a and 65^a open through the curved wall 50 at the front of the barge while the locking pin 66^a extends down through an opening in the top wall 39^a of the bow appendage 36^a. As shown in Figure 8 the pin 66^a is occupying the socket 64^a and thus holding the bow appendage 36^a in the raised towing position. By withdrawing the threaded pin 66^a from the socket 64^a, lowering the bow appendage 36^a and reinserting the pin 66^a in the lower socket 65^a the bow appendage 36^a will be maintained in the dropped position.

Referring more particularly to Figures 3, 5 and 9, a form of device for raising and lowering the bow appendage 36^a is shown to comprise wire rope 67 attached to appropriate eyes 68 on the bow appendage at spaced points thereof, which wire rope passes about sheaves 69 on the upper barge 30 by which the wire rope 67 is directed to the anchor winches 70.

Referring more particularly to Figures 9–13 inclusive, instead of providing one continuous lateral appendage 36 at each side of the hull 31 as illustrated in Figure 5, sectionalized lateral appendages 36^c are shown which are hinged at 71 to the hull so as to swing inboard thereof. In so doing in order to avoid interference from the columns 32, the sections 36^c are separated by slots 74. The cover plates 72 are shown in the extended position in Figure 10 as closing the gaps or slots 74. For stowing the appendages 36^c inboard, the cover plates 72 are first rotated about their hinges 73 so as to overlie upper walls of the appendages to which the cover plates are attached adjacent the slots 74. The appendages 36^c are thereupon rotated around their hinged connections 71 and folded inboard as indicated in Figures 11 and 12. In this way the appendage sections 36^c lie between adjacent columns 32.

Four appendages 36^c are illustrated but it will be understood that any number of such appendages may be fitted to each side of the barge hull. These appendages are fitted to the main hull by means of preferably two hinges per appendage so that they may be swung from the deck into the water.

Each appendage 36^c is raised and lowered independently by means of the draw work 75 and traveling block 76 employing the use of wire ropes 77 and sheaves 78.

The rotary on the drilling substructure is removed and a line led down through and onto a sheave directly under. The line is then led onto a sheave 78 on the side of the upper deck and down to an appendage 36^c. The lower end of the wire ropes 77 may be branched so that the lower ends thereof may be affixed in eyes to the free end portions of the appendages 36^c. In this way the lifting effort will be applied to the appendages 36^c at points most remote from the hinge joints 71. By pulling upwardly upon the wire rope 77 the appendages 36^c will be raised from the deck, in other words from the dotted line position of Figure 13. As the appendages raise to a vertically erect position, also shown in dotted lines in Figure 13, the center of gravity of the appendage passes the center 71 of the hinge. The appendage will thereupon ease down into the water under its weight. When the appendage is down and in place, as shown in full lines in Figure 13, the connection 77 is broken at the sheave 78 and then secured to the deck or side of the upper hull 30. Each appendage will be lowered in a similar manner.

For raising the appendages 36^c, the connection is once again made between the line 77 from the appendage and the traveling block 76. The procedure is similar to the lowering of the appendages except that it will be necessary to burton in the appendage. This is required because the center of gravity of the appendage will not have

passed the center of the hinge **71** when the hauling line **77** is taut over the sheave **78**. The burtoning line **79** is led from the nigger head of the draw works **75** over a system of sheaves **80** on the opposite side of the hull **30** and downwardly diagonally across to the appendage as shown in Figure 13. By drawing upwardly upon this line **79** the appendage may be swung over inboard to a position where its center of gravity passes inwardly of the center line **71**, whereupon the appendage may be eased down to the deck of the lower barge **31** by paying out the taut line **77** slowly.

Referring more particularly to Figures 18, 19, 24 and **25**, a means of locking the appendages **36c** to the lower hull **31** is illustrated in which a recess in the side of the hull **31** for each appendage is adapted to removably receive a plate or locking tongue **82** projecting from the inner end wall of the appendage so that when the appendage is swung down to the lowered operative position the plate or locking tongue **82** will enter the recess **81** as shown in Figure 18 and Figure 20. The plate or locking tongue **82** is perforated to receive a locking bolt or pin **83** which may be moved up and down by a rod extension **84** carried up to the deck of the barge and operated by a hand wheel **85**.

The recess **81** may be formed in a block **86** which also contains guide openings **87** and **88** for the locking pin **83**. The rod **84** is connected to the locking pin **83** preferably by a ball **89** and socket joint **90**. The upper section of the rod **84** is threaded as indicated at **91** to move up and down in a stationary internally threaded screw sleeve **92**. The hand wheel **85** may be removable from the screw rod **91** and for this purpose a square or other socket **93** on the hand wheel **85** is adapted to be removably fitted to the squared and preferably tapered upper portion of the screw rod **91**. A housing **94** on the lower barge **31** is provided for these various parts as shown in Figures 18, 19 and 20.

There are preferably two of the locking devices for each appendage.

In lowering the appendages **36c** down to make the locking connection with the sides of the lower barge **31**, it will be necessary to let water into the appendages in order to sink them a sufficient amount for them to overcome their own buoyancy. To facilitate this, each appendage is fitted with preferably two pressure valves **95**. These valves are in the nature of flood valves. Each valve is operated by a rod **96** which has a connection **97** for a socketed hand wheel which can be operated from the deck of the barge, so that the valves or cocks may be opened at **98** to the sea whereby to flood the ballast tanks or internal space of the appendages **36c** and thereby give them negative buoyancy.

Once the contact is made between the appendage and the side of the barge, the locking pin **83** is dropped into place and the appendage is emptied of the water. For this purpose each appendage is fitted with a vent pipe **99**. Portable air hose is connected to this pipe and air pumped into the appendage forcing the pressure valves **95** to open and so let the water out. When the appendage is empty, the air hose is removed and a cap placed on the vent pipe. This cap is indicated at **100** in Figure 25.

Referring more particularly to Figures 14, 15 and 16, a typical hinge connection for the appendage **36c** to the barge **31** is illustrated as comprising an upstanding central eye **101** on the barge which is adapted to be embraced by bifurcated perforated lugs **102** on the appendage. The perforations of the eye and lugs are brought into alignment and the hinge pin **71** inserted therethrough. This hinge or pivotal connection is preferably made at the upper inner portion of the appendage **36c** and it swings about a center which is at or above the deck line of the lower barge **31**. In this way it may be conveniently folded up and down to inboard and outboard positions.

Figures 22 and 23 illustrate a stability comparison of the lower hull **31** with and without the appendages **36c**. Figure 22 shows a barge hull with appendages. At a large angle of heel, the barge hull will still return to its original upright position after being inclined to the large angle shown, due to the additional buoyancy of the appendage. Whereas, without the appendage as in Figure 23, there is found a negative righting lever, which means that at this angle, without appendages, the barge has already started to capsize.

Referring more particularly to Figures 9 and 21, two methods of pinning down the barge hull are shown. The first method is by driving the spuds **33** through the support columns **32**, using the jacks **103** and the clamps **104** and **105**. These clamps are connected to the spud extension **106** which extends above the column **32**, as shown in Figure 21. The spud extension **106** is acted on by the jacks and the clamps for driving or raising the spuds **33**. This method of jacking is more particularly disclosed in my prior applications aforesaid.

An alternate method of pinning is by driving spuds **107** through apertures made through the appendages, using a pile driver or other methods.

It will be appreciated by those in the art that the invention is attended with many advantages, some of which may be briefly referred to as follows.

The appendages enlarge the bottom foundation area which has the beneficial effect of decreasing unit foundation loading.

The increased bottom area also provides an increased stability to resist horizontal shifting.

The shape of the appendages is such that additional water plane area is provided while afloat with the result that the stability characteristics are decidedly improved, making for a safer barge while afloat.

The buoyancy of the appendages help support the weight of the hull with a consequent reduction in draft, this having beneficial effects upon freeboard and stability.

The combination of reduced draft and greater stability attributed to these appendages enables a shallower hull to be employed, which in turn reduces construction cost and gives a decrease height of obstruction to flow of water while the vessel is on bottom.

The greatly increased width of the foundation decreases the tipping loads borne by the foundation due to wave force on the hull and columns exposed to wave motion.

The bow appendages are movable to provide a reasonably good bow shape which will increase towing speed and make the vessel more readily handled than will a barge with vertical forward end, and even more so in comparison to a vessel with a deck line sloping down towards the bow as revealed in the Hayward Patent 2,612,579.

Although I have disclosed herein the best form of the invention known to me at this time, I reserve the right to all such modifications and changes as may come within the scope of the following claims.

What is claimed is:

1. In a submersible barge for off-shore drilling adapted to rest upon the upper surface of a water bed, an upper barge member defining a work platform, a lower barge member having buoyant characteristics spaced from said supper member and adapted to be submerged during normal drilling operations, support means interconnecting said spaced upper and lower barge members, and at least one appendage removably connected to said lower barge member and forming an extension thereof, said appendage defining a water-tight enclosure having buoyant characteristics for providing reserve buoyancy for said barge thereby increasing stability of said barge under tow, and being submersible with said lower barge member for anchoring said barge in the submerged position thereof, said enclosure being wedge-shaped and

having a bottom wall that is substantially horizontal in the submerged position and that forms an extension of the bottom of said lower barge member, an inner wall adjacent the side wall of said lower barge member, a top wall that is inclined in the submerged position thereof, said inclined top wall extending outwardly and downwardly from the upper surface of said lower barge member to the upper surface of said water bed, said top wall having a slope of approximately 20° to the horizontal and defining a deflecting streamlined surface for reducing scouring and drag effect.

2. In a submersible barge as set forth in claim 1, which includes a downwardly projecting toe portion formed on the outer ends of said top wall and said bottom wall and being adapted to be embedded in said water bed thereby anchoring said appendage in the submerged position thereof.

3. In a submersible barge as set forth in claim 1, the side wall of said lower barge member and said inner wall being arcuate in configuration, said appendage being movable relative to said lower barge member so that said inner wall slidably engages said side wall, and means for positioning said appendage between a position in which said bottom wall rests on said water bed and a position in which it assumes an angle of rake with respect to the forward movement of said barge.

4. In a submersible barge as set forth in claim 1, said appendage being pivotally movable to an upper position for towing whereby said inclined wall assumes a horizontal position and said bottom wall assumes an inclined position, and means for selectively securing said appendage in the upper or lower positions.

5. In a submersible barge as set forth in claim 4, said securing means including screw sockets formed in said lower barge member in spaced relation, and a screw pen carried by said appendage for selectively engaging and interlocking with either of said screw sockets in accordance with the upper or lower position of said appendage.

6. In a submersible barge for off-shore drilling adapted to rest upon the upper surface of a water bed, an upper barge member defining a work platform, a lower barge member spaced from said upper barge member having buoyant characteristics and adapted to be submerged during normal drilling operations, support means interconnecting said spaced upper and lower barge members, and at least one appendage removably secured to said lower barge member and forming an extension thereof, said appendage defining an enclosure having buoyant characteristics for providing reserve buoyancy for said barge thereby increasing stability of said barge under tow, and being adapted to be submerged with said lower barge member for anchoring said barge in the submerged position thereof, said enclosure being wedge-shaped in configuration and including a bottom wall that is substantially horizontal in the submerged position and that forms an extension of the bottom of said lower barge member, and a top wall that is inclined to the horizontal in the submerged position thereof, said inclined top wall extending outwardly and downwardly from the upper surface of said lower barge member to the upper surface of said water bed, said top wall defining a deflecting streamlined surface for causing adjacent currents to assume a streamlined flow, thereby reducing scouring and drag effect.

7. In a submersible barge as set forth in claim 6, said appendage being adjustably positioned relative to said lower barge member, and means for securing said appendage in the adjusted position thereof.

8. In a submersible barge for off-shore drilling, an upper barge member defining a work platform, a lower barge member spaced from said upper barge member having buoyant characteristics and adapted to be submerged during normal drilling operations, support means interconnecting said spaced upper and lower barge members, and at least one appendage formed as an independent unit and removably secured to said lower barge member and forming an extension thereof, said appendage defining an enclosure having buoyant characteristics for providing reserve buoyancy for said barge thereby increasing stability of said barge under tow, and being adapted to be submerged with said lower barge member for anchoring said barge in the submerged position thereof, said enclosure being wedge-shaped in configuration and including a bottom wall that is substantially horizontal in the submerged position and that forms an extension of the bottom of said lower barge member, and a top wall that is inclined to the horizontal in the submerged position thereof, and that defines a deflecting streamlined surface for causing adjacent currents to assume a streamlined flow and thereby reducing scouring and drag effect.

9. In a submersible barge for off-shore drilling adapted to rest upon the upper surface of a water bed, an upper barge member defining a work platform, a lower barge member spaced from said upper barge member having bouyant characteristics and adapted to be submerged during normal drilling operations, support means interconnecting said spaced upper and lower barge members, and at least one appendage joined to said lower barge member and forming an extension thereof, said appendage defining an enclosure having buoyant characteristics for providing reserve buoyancy for said barge thereby increasing stability of said barge under tow, and being adapted to be submerged with said lower barge member for anchoring said barge in the submerged position thereof, said enclosure being wedge-shaped in configuration and including a bottom wall that is substantially horizontal in the submerged position and that forms an extension of the bottom of said lower barge member, and a top wall that is inclined to the horizontal in the submerged position thereof, said inclined top wall extending outwardly and downwardly from the upper surface of said lower barge member to the upper surface of said water bed, said top wall defining a deflecting streamlined surface for causing adjacent currents to assume a streamlined flow, thereby reducing scouring and drag effect.

10. In a submersible barge for off-shore drilling adapted to rest upon the upper surface of a water bed, an upper barge member defining a work platform, a lower barge member spaced from said upper barge member having buoyant characteristics and adapted to be submerged during normal drilling operations, support means interconnecting said spaced upper and lower barge members, and at least one appendage removably secured to said lower barge member and forming an extension thereof, said appendage defining an enclosure having buoyant characteristics for providing reserve buoyancy for said barge thereby increasing stability of said barge under tow, and being adapted to be submerged with said lower barge member for anchoring said barge in the submerged position thereof, said enclosure being wedge-shaped in configuration and including a bottom wall that is substantially horizontal in the submerged position and that forms an extension of the bottom of said lower barge member, a top wall that is inclined to the horizontal in the submerged position thereof, said inclined top wall extending outwardly and downwardly from the upper surface of said lower barge member to the upper surface of said water bed, said top wall defining a deflecting streamlined surface for causing adjacent curents to assume a streamlined flow, thereby reducing scouring and drag effect, hinge pins extending inwardly from the top wall of said appendage and a plurality of spaced sockets formed in the body of said lower barge member and adapted to receive said hinge pins, said hinge pins selectively engaging one group of said sockets to secure said appendage in a lower position in the submerged position thereof, and engaging another group of said sockets to secure said appendage in an upper position thereof for

towing, whereby said bottom wall assumes an angle of rack with respect to the forward movement of said barge.

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