March 25, 1969 C. C. BROWN 3,434,293

FLOATABLE BASE FOR MARINE DRILLING PLATFORM AND METHOD OF OPERATION

Filed May 8, 1967 Sheet 1 of 3

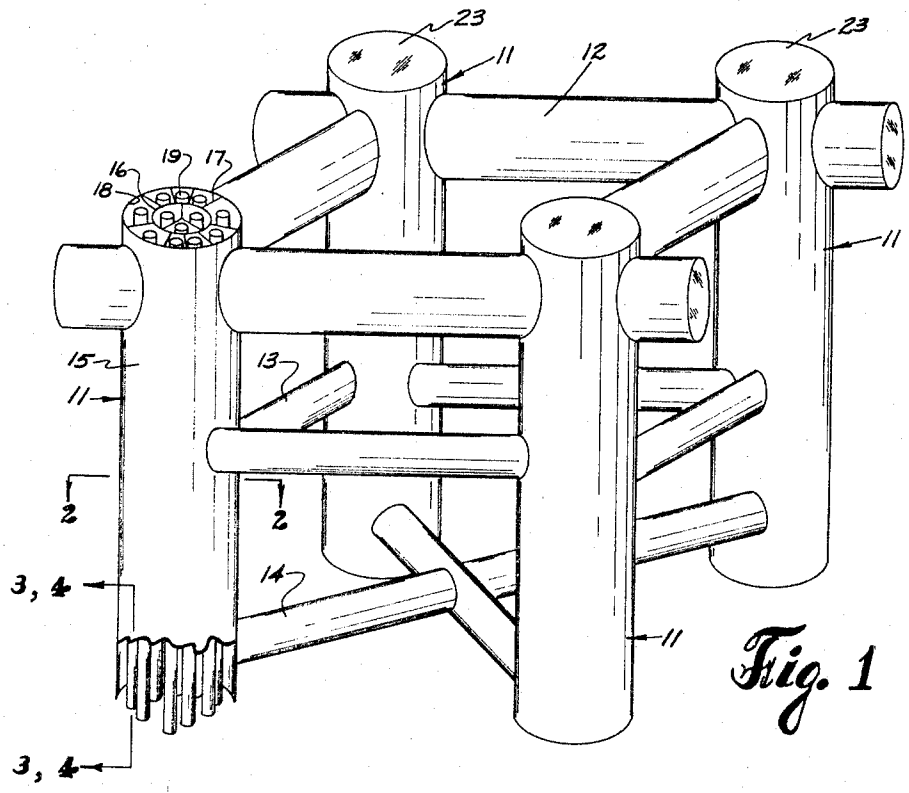


Fig. 1

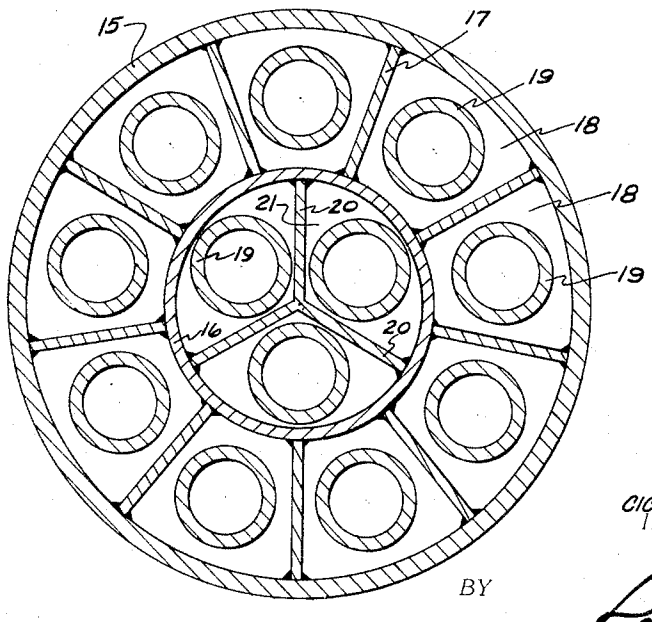


Fig. 2

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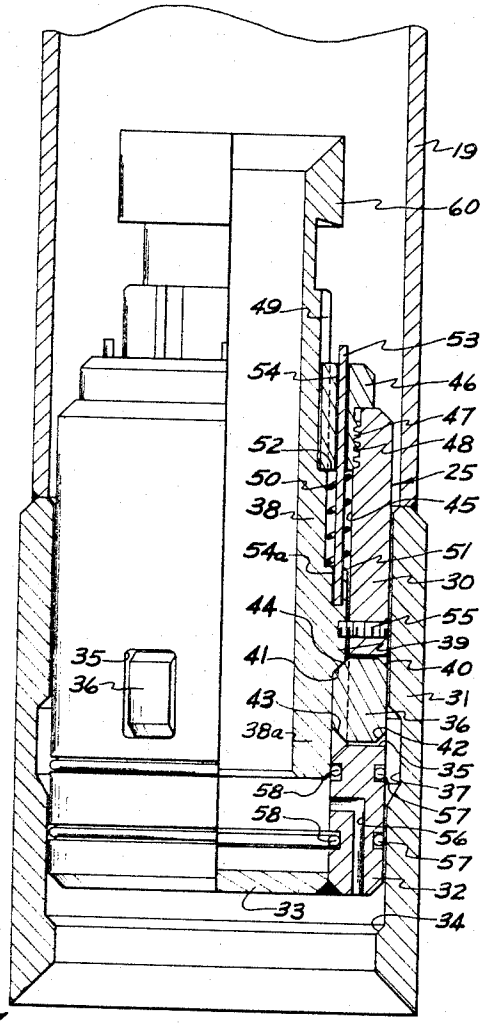


Fig. 3

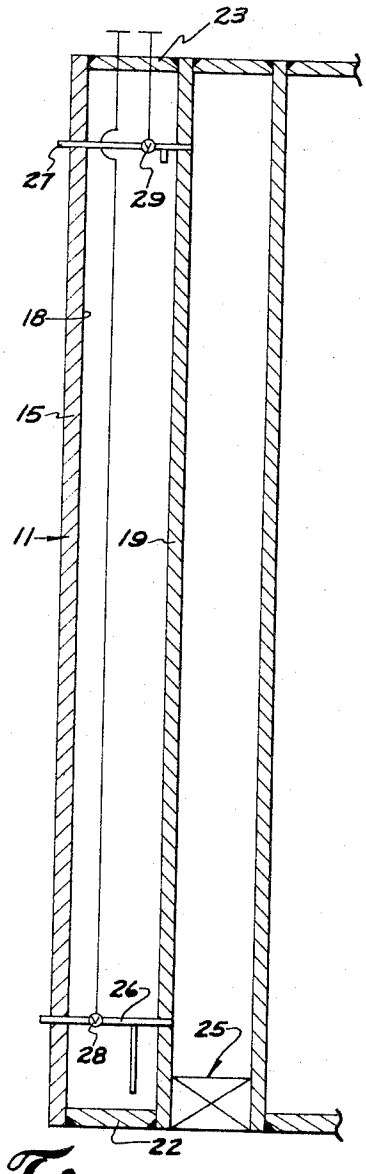


Fig. 6

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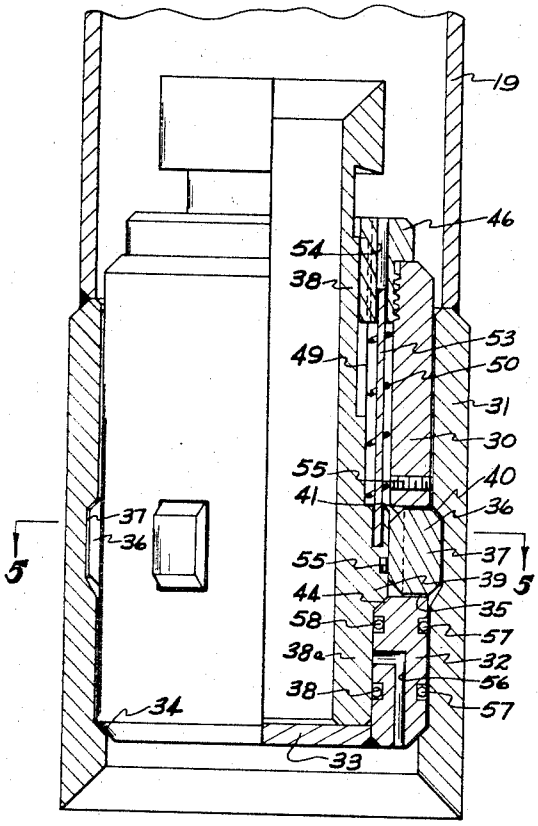
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Fig. 4



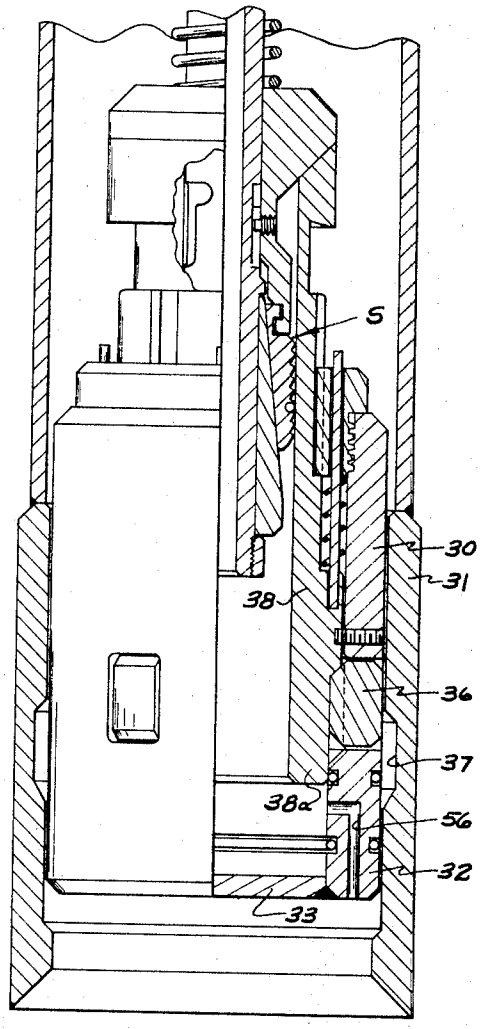


Fig. 7

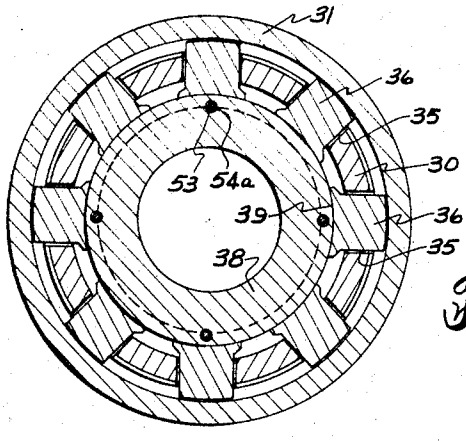


Fig. 5

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3,434,293

FLOATABLE BASE FOR MARINE DRILLING PLATFORM AND METHOD OF OPERATION

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Int. Cl. E02b *17/02*; E02d *21/00*
U.S. Cl. 61—46.5 8 Claims

ABSTRACT OF THE DISCLOSURE

A floatable base for a marine drilling platform and its method of operation, the main support members of the base comprising large diameter hollow column or leg elements which function as buoyancy chambers for floating the base on a water body and which enclose a plurality of drilling-through conduits, each equipped with removable plugging means adapted to seal-off the conduits against entry of water during flotation of the base and to be readily removable to clear the conduits for drilling therethrough.

This invention relates to a base for a marine drilling platform and its method of operation, and more particularly to a type of base which is adapted to be floated in horizontal position on a water body to a drilling location and to be then up-ended and submerged to rest upon the underlying land.

Such base structures commonly incorporate as the main support members, large diameter leg members which, when sealed, will function as buoyancy chambers to enable floating the structure and which, when suitably ballasted, can be up-ended to be sunk to rest in vertical position upon the underlying land. Moreover, such leg-type structures ordinarily are equipped with a plurality of drilling-through conduits enclosed within one or more of the legs to enable the drilling of a plurality of wells from the platform through the leg members.

In order to render such a base structure buoyant and floatable, the practice has been to seal-off the ends of the main leg members and the enclosed drilling-through conduits by welding heavy steel plates across the ends of the leg members. When the structure has reached the drilling location and has been suitably ballasted to up-end and set it on bottom, the further practice has been to cut-off the enclosing plates at the upper ends of the legs and to then drill through each of the conduits in order to drill out the plate portion closing the lower ends thereof. This latter operation frequently encounters considerable difficulty, particularly when the base is set on a bottom composed of hard rocky materials, as is often the case. Drilling out the individual segments of the enclosing end plate against the resistance of the underlying hard rock formations has proven to be a matter of considerable difficulty, entailing substantial loss of time in preparing the base, with consequent large expense.

The magnitude of the problem and the attendant expense and time loss will be evident when it is considered that in one structure of the type described, each of the four main leg members is about 17 feet in diameter through which extend 12 drilling-through conduits, each about 38 inches in diameter. Thus, to clear these conduits requires the drilling-out of 48 heavy steel plate portions approximately 36 inches in diameter, which becomes an exceptionally difficult task when the end plates are backed directly by hard rock on which the structure is landed.

The present invention is directed to a platform-supporting base of the general character described, but in which each of the individual drilling-through conduits is provided with a removable plugging device, particularly

for plugging the ends thereof, which will be disposed adjacent the underlying land when the structure is in place. These plugging devices are constructed to seal each of the conduits against entrance of water to enable rendering them buoyant and are arranged to be easily removable by means of a suitable pulling tool, such as a conventional overshot or spear, to clear the conduits for subsequent well drilling operations, and thereby obviating the need for drilling out the end plate secitons as required on more conventional structures. Similar plugging means may be employed for the opposite ends of the conduits, although this is not particularly useful since these opposite ends will be above water when the base is in place and may, therefore, consist of the conventional welded cap or closure plate which will be readily removable by more conventional means.

Accordingly, it is a primary object of the present invention to provide a floatable base of the general character described, having readily removable plugging means for sealing the drilling-through conduits against entrance of water while the structure is in floating condition.

A further object is the provision of a floatable base of the general character described, in which the plugging means employed for the several drilling-through conduits include releasable latch means for anchoring the plugging members in the respective conduits.

An additional object is the provision of an improvement in the method of operating a floatable base of the general character described.

Other and more specific objects and advantages of this invention will become more readily apparent from the following description when read in conjunction with the accompanying drawing which illustrates a useful embodiment in accordance with this invention.

In the drawing,

FIG. 1 is a perspective elevational view, with portions broken away, showing a floatable base of the multiple leg type, the base being shown in erect position;

FIG. 2 is a cross-sectional view through one of the leg elements taken along line **2—2** of FIG. 1;

FIGS. 3 and 4 are longitudinal, sectional views, both taken along lines **3—3** of FIG. 1, showing two positions of a plugging member in one of the drilling-through conduits;

FIG. 5 is a cross-sectional view taken along line **5—5** of FIG. 4;

FIG. 6 is a longitudinal, sectional view of a portion of one of the leg members illustrating, schematically, a ballasting system for the leg member; and

FIG. 7 is a view generally similar to FIGS. 3 and 4, illustrating an arrangement for withdrawing a plugging member from a drilling-through conduit.

Referring to the drawing, there is shown a floatable base comprising, in the illustrative embodiment, four large diameter cylindrical hollow legs, each designated generally by the numeral **11**, interconnected by tubular cross-bracing elements **12**, **13** and **14** to form a rigid structure.

Each of the leg members **11** comprises outer and inner coaxial shells **15** and **16**, respectively. The annular space between shells **15** and **16** is divided by radial dividers **17** angularly spaced to provide a plurality of compartments **18** through each of which extends a tubular drilling-through conduit **19**.

Inner cylinder **16** is compartmented by means of radial dividers **20** to form three additional compartments **21**, each of which is similarly occupied by drilling-through conduit **19**. The upper and lower ends of leg members **11** are sealed-off about the several drilling-through conduits **19** by means of end plates **22** and **23**, respectively (see FIG. 6). Lower plate **22** corresponds to a tube sheet in that it is provided with openings for receiving the related

lower ends of the several drilling-through conduits, and is welded to the outer shell and about each of the drilling-through conduits to form a water-tight seal for the lower end of the leg member. Upper end plate **23** may be of the same form, but since it will be readily accessible when the base member is in the vertical position, it may be a continuous plate welded across the upper end of the leg member and the enclosed conduits.

Each of the drilling-through conduits is provided with a removable plugging member, designated generally by the numeral **25**, for closing the lower end of the conduit, and will be described in detail hereinafter.

Conduits **26** and **27**, fitted with valves **28** and **29**, respectively, are arranged in each of the leg members by means of which water ballast may be admitted into the interior of the shells **15** and **16**, as well as the interiors of the several conduits **19**, for purposes of up-ending and sinking the base when it has been transported to the drilling location. The ballasting arrangement is schematically illustrated since it will be obvious that any suitable and generally conventional system for destroying the buoyancy of the leg members may be employed in order to rotate the structure from the horizontal towing position to the vertical position, and for controllably sinking the up-ended base to rest on the underlying land. Should it become necessary or desirabe to move the base, the ballasting system may be employed for de-ballasting the legs and conduits, after the ends thereof have been closed off, to render the leg members buoyant for re-floating the base.

Each of the plug members **25** includes a tubular latching body **30** dimensioned to slide freely through the bore of conduit **19** into a tubular housing **31**, which may be an extension of conduit **19**, and forms the lower end thereof when the structure is vertically disposed. The lower end portion **32** of latching body **30** is radially thickened and the bore thereof is closed at its outer (lower) end by means of a closure plate **33**. The lower end of housing **31** is provided with an internal shoulder **34** against which the lower end of the plug member **25** will seat when the plug member has been fully inserted in housing **31**, as seen in FIG. 4.

The wall of body **30**, immediately above section **32**, is provided with a plurality of radial windows **35**, in each of which is mounted for radial movement a latching dog **36**, the radial thickness of which is greater than the thickness of the wall of body **30**.

The inner wall of housing **31** is provided with an annular groove **37** positioned to register with latching dogs **36** when the plugging member is seated against shoulder **34**. In this position, dogs **36** may be moved radially outwardly into groove **37** for anchoring the plug member to the housing, in the manner to be hereinafter described.

A tubular expander mandrel **38** is mounted in the bore of body **30** for movement longitudinally thereof, and carries, intermediate the ends thereof, an outwardly projecting annular enlargement **39** adapted, when thrust behind dogs **36**, to urge the latter radially outwardly. Dogs **36** are provided with bevelled front and rear edges **40** and **41**, respectively, at their upper ends, and similarly bevelled front and rear edges **42** and **43**, respectively, at their lower ends. Enlargement **39** has a bevelled lower end surface **44** for engagement with bevelled edge **41** of the latching dogs. The exterior of mandrel **38**, above enlargement **39**, is reduced in diameter to define an annular space **45** between the mandrel and the inner wall of latching body **30**. An annular bushing **46** extends into annular space **45** and is provided with external threads **47** by means of which it is screwed into an internally threaded socket **48** provided at the upper end of body **30**. The bore of bushing **46** is longitudinally slotted to form a splined connection to the upper portion of mandrel **38** by engagement with the splines **49** mounted on the mandrel whereby to permit relative longitudinal, but non-rotative, movement between mandrel **38** and body **30**. A plurality of coil springs **50** are mounted at angularly spaced points in the annular space **45** in compression between a shoulder **51**, defining the upper end of enlargement **39**, and the inner end **52** of bushing **46**. Guide rods **53** extend slidably through vertical openings **54** in the bushing through the center of springs **50** into sockets **54***a* provided in enlargement **39**.

Coil springs **50** bias mandrel **38** downwardly so as to urge enlargement **39** downwardly behind dogs **36** and thereby urge dogs **36** outwardly of windows **35**. Initially, however, the mandrel is held in inactive relation to the dogs by means of shear pins **55** which connect body **30** to enlargement **39**, as best seen in FIG. 3. The upper end of mandrel **38** carries a conventional fishing neck **60** for attachment of conventional tools, such as an overshot, for pulling the plugging device out of conduit **19**, and may also serve as a seat for engagement by a conventional spear when the latter is used for either inserting or withdrawing the plugging device.

Section **32** of the latching body is provided with a drain passage **56** which opens to the lower end of the plug body at one end and to the interior thereof between plate **33** and windows **35**. Annular seals, such as O-rings **57—57**, are mounted about the exterior of section **32** to seal with the wall of housing **31**, and similar seals **58—58** are mounted in the bore wall of section **32** on opposite sides of the inner end of passage **56**, for purposes which will appear subsequently.

A plug member **25** may be inserted into a conduit **19** by sliding or pushing it from one end (the upper end) through the bore of the conduit until the lower end of section **32** seats on shoulder **34**. With shear pins **55** in place, it will be seen that mandrel **38** will be in the position shown in FIG. 3, at which no outward thrust will be applied to dogs **36**. Any suitable form of tool may be used to push the plug member home against seat **34**. At this point, dogs **36** will be directly opposite groove **37**, as seen in FIG. 4, whereupon, by a downward blow of sufficient force or application of sufficient weight against fishing neck **60**, sufficient downward force will be applied to mandrel **38** to break shear pins **55** and drive mandrel **38** downwarly, forcing enlargement **39** over the bevelled surfaces **41** of the dogs and urging the latter outwardly into groove **37**, thereby latching or anchoring the plug member to housing **31**. Springs **50** will maintain this latching engagement of the mandrel with the dogs, as seen in FIG. 4. The lower end portion **38***a* of mandrel **38** will have moved downwardly behind section **32**, so that the inner end of passage **56** will be sealed-off by engagement of seals **58—58** with the outer surface of mandrel **38**, as seen in FIG. 4, thereby functioning as a sleeve valve closing the passage against entrance of water to the conduit.

When the structure is in place at a well location and it then becomes desirable to clear the bores of conduits **19**, it is only necessary to run any sort of conventional fishing tool, such as a spear S (FIG. 7) or overshot, to grasp the upper end of mandrel **38** and apply an upward pull thereto sufficient to overcome the force of springs **50**, whereupon the continued upward force will pull mandrel **38** upwardly in the bore of body **30** sufficiently to raise enlargement **39** above dogs **36** sufficiently to free the latter for movement inwardly in response to the reaction between bevelled edges **40** and the corresponding bevelled upper end surface of groove **37**. Continued upward pull on mandrel **38** will thereupon be transmitted through bushing **46** to body **30**, and thereby permit the entire plugging device to be pulled out of the bore of conduit **19**. The initial upward movement of mandrel **38** releasing dogs **36** will raise end portion **38***a* above the inner end of passage **56** (FIG. 7, thereby opening the passage to permit drainage of water from the interior of conduit **19** above the plug member as the latter is drawn out of the conduit.

Although the floatable base of the illustrative embodiment comprises a structure employing four leg elements arranged at the corners of a square, the invention herein disclosed contemplates other leg-type structures, including a so-called "mono-pod" embodying a single very large diameter leg or pedestal through which extend a plurality of drilling-through conduits and which will ordinarily be made buoyant for transporting to a marine location and then ballasted to place it vertically on location.

It will be evident that the plug members may be re-inserted in the drilling-through conduits, should it become necessary or desirable to re-seal the lower ends of one or all of the conduits for any purpose, particularly if it should be desired to re-float the base structure.

It will be understood that various changes and modifications may be made in the details of the illustrative embodiment within the scope of the appended claims but without departing from the spirit of this invention.

What I claim and desire to secure by Letters Patent is:

1. A floatable base for a marine drilling platform, comprising,

(a) elongate hollow leg means adapted to be floated to a marine drilling location for positioning in an upright platform-supporting position on a submerged land bottom,

(b) a plurality of longitudinally extending tubular drilling conduits enclosed within said leg means,

(c) means for closing the bore of said leg means about said conduits,

(d) plug means insertible into and removable through the upper ends of the bores of said conduits for closing the ends of said conduits which will be disposed adjacent said land bottom when the leg means attain said upright position, said plug means including:

(i) a tubular body having a closed lower end,

(ii) annular seal means disposed about the body for sealing engagement with the bore wall of the related conduit, and

(iii) radially movable latch means engageable with shoulder means on the related conduit adjacent the submerged end thereof for releasably securing said plug means thereto.

2. A floatable base according to claim **1**, wherein said hollow leg means comprises a plurality of spaced apart tubular legs and interconnecting cross-bracing elements.

3. A floatable base according to claim **1** including means for introducing ballast into said leg means to attain said upright position.

4. A floatable base according to claim **1**, wherein said latch means comprises:

(a) latching dogs carried by said body for movement into and out of latching engagement with said shoulder means carried by said conduit, and

(b) a latching mandrel mounted on said body for movement between a first position holding said dogs in latching engagement with said shoulder means and a second position releasing said dogs from said shoulder means whereby to permit withdrawal of said plug means from said conduit.

5. In a floatable base according to claim **4**, resilient means biasing said mandrel toward said first position.

6. In a floatable base according to claim **4**, frangible means initially securing said mandrel to said body in said second position and releasable by end-wise force applied to said mandrel.

7. In the method of constructing a drilling platform at a marine location, wherein a platform base comprising a hollow leg means enclosing a plurality of drilling-through conduits is made buoyant for floating the same to the marine location and thereat submerged to rest in vertical position on a submerged land bottom, the improvement which comprises, inserting into the bores of said conduits adjacent the ends thereof which will be adjacent said land bottom removable sealing plug means whereby to seal said conduits during floatation of the base, and after the base is in vertical position on the land bottom withdrawing said plug means upwardly through said conduit bores to clear the same for drilling through operations.

8. In a method according to claim **7**, the further improvement which comprises re-inserting the plug means in the bores of said conduits to seal the same, to enable restoring the buoyancy of said base for refloating the same.

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JACOB SHAPIRO, *Primary Examiner.*

U.S. Cl. X.R.

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