



FORMULARIO ÚNICO DE SOI
PCT

ENTRADA EN FASE NACIONAL 28 Dic 2007

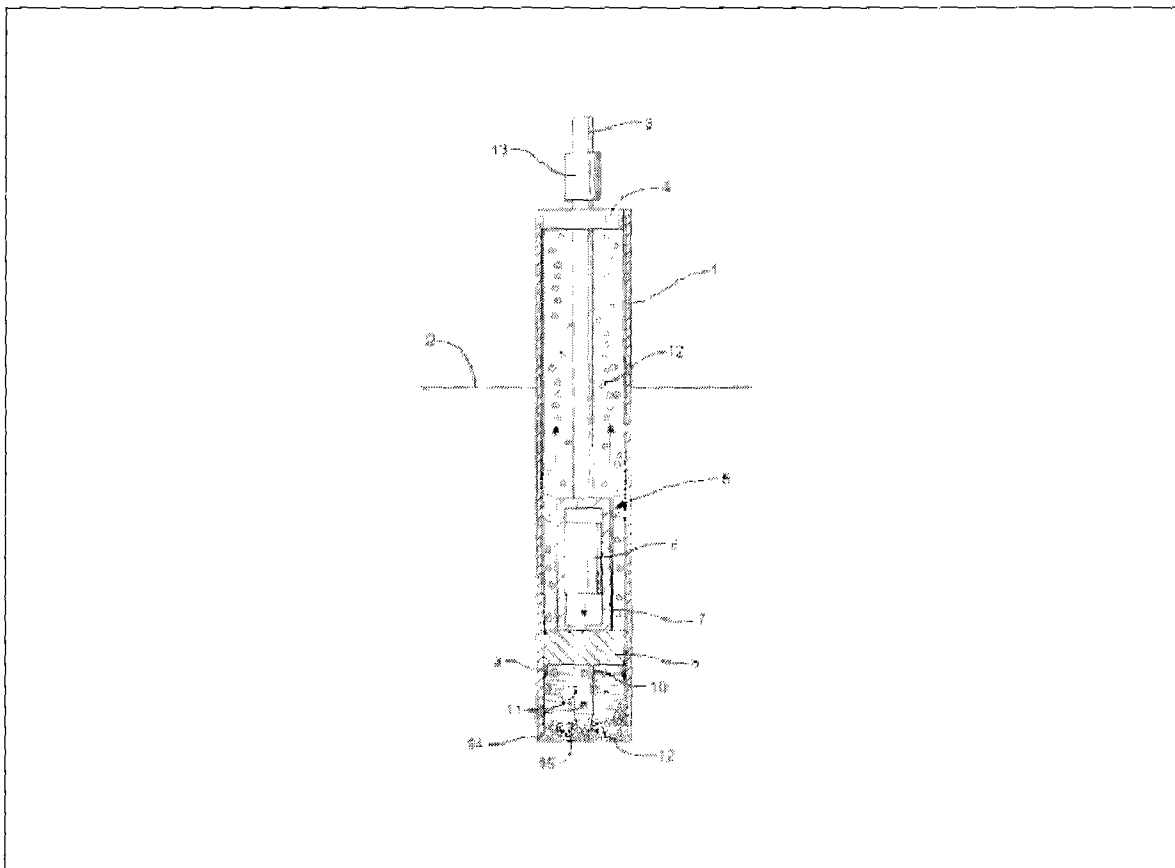
1) SOLICITUD DE:			
☒ Patente de invención		☐ Patente de Modelo de Utilidad	
☐ Capítulo I.		☒ Capítulo II.	
2) SOLICITANTE (71)	Nombre: BP EXPLORATION OPERATING COMPANY LIMITED		IDENTIFICACIÓN C.C. ☐ NIT: ☐ C.E. ☐ OTRO ☐ Cual _____ NÚMERO _____
	Dirección: Chertsey Road, Sun-on- Thames, Middlesex TW 16 7 BP. Gran Bretaña Nacionalidad o domicilio: Thames, Middlesex, Gran Bretaña Lugar de constitución: Gran Bretaña		
	Teléfono: _____ Fax: _____ E. Mail: _____		
3) REPRESENTANTE O APODERADO	Nombre: DILIA MARÍA RODRÍGUEZ D'ALEMAN		IDENTIFICACIÓN C.C. ☒ NIT: ☐ C.E. ☐ OTRO ☐ NÚMERO: 41.654.882 TP: 20824 CSJ
	Dirección: Carrera 11 N°. 86-53 Piso 6 Bogotá D.C. Teléfono: 6181088 Fax: 6350824 E. Mail: info@clarkemodet.com.co		
4) INVENTOR (ES) (72)	Nombre: LUO, Yuejin Dirección: 99 River Meads Avenue, Twickenham, Middlesex TW2 5JF, Gran Bretaña Nacionalidad o Domicilio: Inglés		
5) PCT (86) Solicitud Internacional No. PCT/GB2006/001692 Fecha: Mayo 9 de 2006 Publicación Internacional No. WO2006/125948 A1 Fecha: Nov. 30, 2006			
6) Título (54) APARATO Y MÉTODO PARA COLOCAR TUBERÍA DE REVESTIMIENTO O TUBO CONDUCTOR			
7) Clasificación Internacional: E21B 7/20 E21B 43/10 E21B 21/12 E21B 7/18			
8) PRIORIDAD		33) País de Origen	(32) Fecha
SI ☒ NO ☐		GRAN BRETAÑA	MAYO 25, 2005
			(31) Número de Solicitud 0510670.3
9) Comprobante de pago N°. 07-96,308 DE NOV. 26, 2007, 07-97,179 DE NOV. 28, 2007 07-97,180 DE NOV. 28, 2007			
Instrucciones para el diligenciamiento del presente formulario. Ver reverso de esta pagina			

10)

ANEXOS

- ☒ Comprobante de pago de la tasa de presentación de la solicitud
- ☐ Comprobante de pago por reivindicación de prioridad
- ☒ Documento que acredita la existencia y representación legal cuando el solicitante sea persona Jurídica
- ☒ Poderes, si fuera el caso
- ☐ Documento de cesión del inventor al solicitante o a su causante
- ☐ Declaraciones
- ☒ Copia de la solicitud Internacional. (Resumen, descripción, reivindicación, Dibujos).
- ☒ Traducción de la solicitud internacional al castellano. (Resumen, descripción, reivindicación, Dibujos)
- ☒ Copia del examen preliminar efectuado por la IPEA
- ☐ De ser el caso, copia del contrato de acceso
- ☐ De ser el caso, documento que acredite la licencia o autorización de uso de conocimientos tradicionales de las comunidades indígenas
- ☐ De ser el caso, certificado de depósito del material biológico
- ☐ Arte final 12 x 12 y 6 x 6 cm
- ☐ De ser el caso, información sobre otras solicitudes de patente o títulos obtenidos en el extranjero por el mismo titular o su causante, relacionados parcial o totalmente con la invención de esta solicitud.
- ☒ Otros:
 1. Reporte internacional de búsqueda
 2. Documentos informe de búsqueda

11) FIGURA CARACTERÍSTICA:



12) Solicitud concesión de la patente,

NOMBRE: DILIA RODRÍGUEZ D'ALEMAN

FIRMA:

C.C. 41.654.882 de Bogotá TP 20824 CSJ

Instrucciones para el diligenciamiento del presente formulario. Ver reverso de esta pagina

P. 1060

h
3

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 07 - 96,308
FECHA : NOVIEMBRE 26 DE 2007

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



No. 07-127749- -00000-0000

Fecha: 2007-12-03 16:53:32 Dep. 2025 NUECREACIONE
Vol. 11 PATENTE IYI Lve. 379 FASE NACIONAL
Act. 411 PRESENTACION Folios 194

***** CONSIGNACION *****

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	No. PAGO	FECHA PAGO	Vr. PAGO
CLARKE MODET Y CD. COLOMBIA	CONSIGNACION	BANCO POPULAR	050-00110-6	53267311	26/11/2007	22,480,000.00

***** CONCEPTO *****

CANT.	RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1	50005-01-01 SOLICITUDES	82 INVOCACION DE UNA PRIORIDAD EN NU	135,000.00
TOTAL :			\$ 135,000.00

SON: CIENTO TREINTA Y CINCO MIL PESOS

RESPONSABLE :

RECIBO DE CAJA APLICADO AL EXPEDIENTE No. _____

P1060
3

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 800176089-2

RECIBO OFICIAL DE CAJA : 07 - 97,179
FECHA : NOVIEMBRE 28 DE 2007

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



NOV 28 2007 14:40:00 0000

***** CONSIGNACION *****

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	Nº. PAGO	FECHA PGO	VT. PAGO
CLARKE MODET Y CO. COLOMBIA	CONSIGNACION	BANCO POPULAR	050-00110-0	72395998	28/11/2007	5,640,000.00

***** CONCEPTO *****

CANT.	RENTISTICO	CONCEPTO	TOTAL CONCEPTO
1	50005-01-01	SOLICITUDES	
32		INVOCACION DE UNA PRIORIDAD EN NU	135,000.00
TOTAL :			\$ 135,000.00

SON: CIENTO TREINTA Y CINCO MIL PESOS

RESPONSABLE :

RECIBO DE CAJA APLICADO AL EXPEDIENTE No. _____



CONSULADO GENERAL DE COLOMBIA

SUITE 14, 140 PARK LANE, LONDON W1Y 3AA
TELEPHONE 0171-495 4233 • TELEFAX: 0171-495 4441

El suscrito Cónsul General de Colombia en Londres, vistos los documentos presentados ante este Despacho,

CERTIFICA

Que, IAN RODERICK CAMPBELL, Notario Público de Londres, Inglaterra, Gran Bretaña, autenticó las firmas del Poder precedente y su firma se encuentra registrada en este Consulado General.

Que, **COLLAG LIMITED**, es una Sociedad que se encuentra debidamente establecida en Southampton, Inglaterra y cumple con su objeto social de acuerdo con las leyes de este país y que **BP EXPLORATION OPERATING COMPANY LIMITED**, es una Sociedad que se encuentra debidamente establecida en Londres, Inglaterra y cumple con su objeto social de acuerdo con las leyes de este país.

Que, JOHN MISSELBROOK en su calidad de Director de COLLAG LIMITED y MICHAEL JOHN WILSON, en su calidad de Apoderado de BP EXPLORATION OPERATING COMPANY LIMITED, debidamente autorizados, otorgan el Poder precedente y sus firmas se encuentran autenticadas por IAN RODERICK CAMPBELL, Notario Público de Londres, Inglaterra.

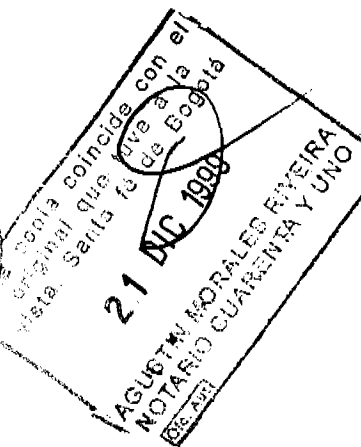
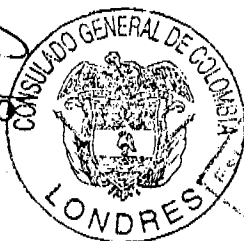
El Cónsul General no asume responsabilidad por el contenido del mencionado documento.

Dado en Londres, Inglaterra, Gran Bretaña, a los veintiocho (28) días del mes de Mayo de mil novecientos noventa y siete (1997).

Certificación No.05/0662

Derechos: US\$ 106,00 CANCELADOS

OSCAR LOPEZ PULECIO
Cónsul General



MINISTERIO DE RELACIONES
EXTERIORES

NO SE ASUME
RESPONSABILIDAD DEL TEXTO

27 JUL -8 1997

JEFE DE LEGALIZACIONES
SANTAFE DE BOGOTA

201510

CUYA FIRMA APARECE EN EL
DOCUMENTO DESEMPLEA
LAS FUNCIONES INDICADAS

SAVILLE & CO

NOTARIES PUBLIC

2 Throgmorton Avenue
London EC2N 2ER
Telephone: 0171-920 0000
Facsimile: 0171-920 0088
DX 33870 Finsbury Square

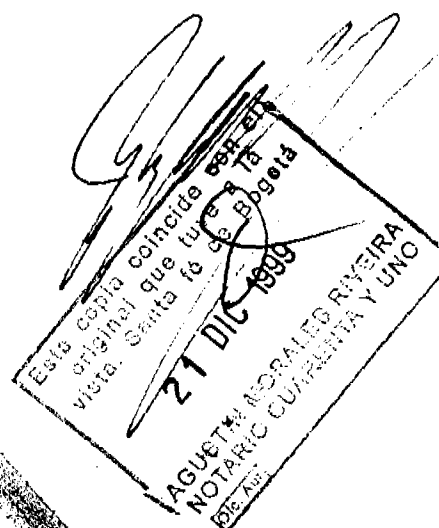
Richard Saville
Ian Campbell

Yo el infrascrito IAN RODERICK CAMPBELL Notario Público con vecindad y ejercicio en la Ciudad de Londres, Inglaterra, por Real Autoridad debidamente facultado y jurado CERTIFICO ser auténtica la firma de Don JOHN MISSELBROOK puesta al pie del documento anexo, por haber sido suscrita dicha firma ante mí en el día de hoy por el susodicho Señor John Misselbrook, director debidamente autorizado de la sociedad denominada COLLAG LIMITED, de Southampton, Inglaterra, y de cuya identidad doy fe;

Y ADEMÁS CERTIFICO ser auténtica la firma de Don MICHAEL JOHN WILSON, de cuya identidad asimismo doy fe, puesta al pie de dicho documento anexo, por haber sido suscrita dicha firma ante mí en el día de hoy por el susodicho Señor Michael John Wilson, apoderado debidamente autorizado de la sociedad denominada BP EXPLORATION OPERATING COMPANY LIMITED, de Londres, Inglaterra, en virtud de una escritura de poder con fecha 24 de abril de 1996 y exhibida ante mí, el notario.

Y TAMBIÉN CERTIFICO que COLLAG LIMITED está debidamente organizada y existente bajo las leyes de Inglaterra y Gales, y que su sede social está situada en Maidenston Heath, Blundell Lane, Bursledon, Southampton SO31 1AA, Inglaterra Y que BP EXPLORATION OPERATING COMPANY LIMITED, está asimismo debidamente organizada y existente bajo las leyes de Inglaterra y Gales, y que su sede social se encuentra en Britannic House, 1 Finsbury Circus, Londres EC2M 7BA, Inglaterra.

EN FE Y TESTIMONIO DE LO CUAL expido el presente que firmo y sello con el de mi oficio en Londres antedicho el día dieciséis de mayo de mil novecientos noventa y siete.



Clarke, Modet & Co. Colombia, Ltda.

Carrera 11, N° 93-53, Of. 404 - Santa Fé de Bogotá, Colombia

PODER

Yo (nosotros), abajo firmante(s)

Michael John WILSON
John MISSELBROOK
en mi (nuestro) caracter de representante(s) legales de
BP Exploration Operating Company Limited
& Collag Limited
una sociedad organizada y existente de acuerdo con las leyes de

Reino Unido

y en actual cumplimiento de su objeto social, con domicilio en
Britannic House, 1 Finsbury Circus, London EC2M 8BA
y Maidenston Heath, Blundell Lane, Bursledon, Southampton,
SO31 1AA, Reino Unido

por el presente instrumento confiamos (conferimos) poder especial a
favor de DILIA MARIA RODRIGUEZ D'ALEMAN, tp. 20824 y
CLAUDIA LUCIA CARO RAMIREZ, tp. 36448, con domicilio en
Santa Fé de Bogotá, Colombia, para que actuando en su orden en
nombre del (de la) otorgante le (la) representen ante cualquier
entidad, autoridad y/o persona, especialmente ante las del orden
Administrativo, Contencioso Administrativo, Judicial, Tribunales de
Arbitramento y/o cualquier otro en lo referente a los siguientes
asuntos:

- 1) Solicitar, tramitar, obtener y/o registrar cualquiera de las modalidades de Propiedad Industrial, tales como: patentes de invención, modelos de utilidad; diseños industriales, variedades vegetales; marcas, lemas, nombres y enseñanzas comerciales y denominaciones de origen; así como sus renovaciones, prórrogas, transferencias, cambios de nombre y/o domicilio, contratos y licencias.
- 2) Solicitar, tramitar, obtener y/o registrar derechos de autor, en cualquiera de sus presentaciones así como la protección de secretos industriales y know-how.
- 3) Solicitar, tramitar, obtener y/o registrar registros sanitarios, permisos y/o licencias de funcionamiento; así como sus renovaciones o prórrogas, transferencias, cambios de nombre y/o domicilio, contratos y licencias.
- 4) Ejercer acciones de oposición, observación, reclamos, reconsideración, reposición, apelación, cancelación administrativa o judicial, nulidad, protección al consumidor, concesión de licencias, protección de secretos industriales y demás acciones y recursos relacionados con derechos derivados de los asuntos arriba indicados y en contra de la competencia desleal, acciones derivadas de la obtención o explotación de licencias, acciones de indemnización de perjuicios. También podrá(n) intervenir en juicios civiles, comerciales, penales, contencioso-administrativos, tutelas y de policía; en acciones o juicios promovidos por el (la) mandante o en contra el (ella).
- 5) En el ejercicio de este mandato los mandatarios arriba mencionados quedan facultados para: conciliar, cancelar, transigir, comprometer en árbitros, desistir, recibir y tomar posesión de la cosa objeto de litigio y renunciar o desistir a derechos concedidos o en curso de concesión, admitir los hechos del proceso.
- 6) Ratificar o no la agencia oficiosa.
- 7) Así mismo faculto (facultamos) a los mencionados apoderados para recibir notificaciones y designar apoderados judiciales o extrajudiciales, sustituir el presente poder y revocar las sustituciones que hicieren.

Dado y firmado en Sunbury on Thames,
United Kingdom
a los 16th días de May
For Collag Limited

John MISSELBROOK
By Power of Attorney

POWER OF ATTORNEY

I (we), the undersigned

Michael John WILSON
John MISSELBROOK
legal representative(s) of
BP Exploration Operating Company Limited
& Collag Limited (Joint applicant)
an organization existing under the laws of
United Kingdom

and in present execution of its business activity, domiciled at
Britannic House, 1 Finsbury Circus, London EC2M 7BA and
Maidenston Heath, Blundell Lane, Bursledon, Southampton,
SO31 1AA, United Kingdom respectively

do hereby grant POWER OF ATTORNEY to DILIA MARIA
RODRIGUEZ D'ALEMAN, tp. 20824 and CLAUDIA LUCIA
CARO RAMIREZ, tp. 36448, residing in Santa Fé de Bogotá,
Colombia, to act in the order of their appointment in behalf of
grantor before any entity, authority and/or natural or juridical person,
specially before those Administrative, Administrative-Contentious,
Judicial, arbitration courts, and/or any other, in all matters
concerning the following:

- 1) To apply, process, obtain and/or register any of the modalities of Industrial Property, such as: Patents of Invention, Utility Models; Designs, vegetal varieties; Marks, Slogans, Trade Names and emblems and appellations of Origin; as well as their renewals, extensions, assignments, changes of name and/or domicile, agreements and licenses.
- 2) To apply, process, obtain and/or register copyrights of any kind as well as protection of industrial secrets or know-how.
- 3) To apply, process, obtain and/or register sanitary registrations, operating authorizations and/or licenses; as well as their renewals or extensions, assignments, changes of name and/or domicile, agreements and licenses.
- 4) To bring actions of opposition, observations, claims, reconsideration, appeal or legal remedies, cancellations, nullity, protection to the consumer, granting of licenses, protection of trade secrets and other actions related with rights derived from the above-mentioned matters and against the unfair competition, actions resulting from the obtention or exploitation of licenses, recovering damages actions. They can also intervene or participate in Civil, Commercial, Criminal or Contentious-Administrative Trials; the actions for writ mandamus, police actions; in actions, lawsuits or litigations instituted by the grantor or against him.
- 5) To the effect of this mandate the above-named proxy are empowered to: conciliate, cancel, settle, submit to arbitration, withdraw and to receive and take possession of the litigation related objet and waive or renounce the rights granted or in process of granting, admit the facts of the case.
- 6) To ratify or not the officious agency.
- 7) I (we) hereby appoint the afore mentioned attorneys with powers to receive notifications and to designate judicial and extrajudicial attorneys, substitute this Power of Attorney and to revoke such substitutions.

Granted and signed at Sunbury on Thames,
United Kingdom
on this 16th day of May of 1997
For BP Exploration Operating Company
Limited

M. J. Wilson

Michael John WILSON - By Power of Attorn

Firma signature

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
30 November 2006 (30.11.2006)

PCT

(10) International Publication Number
WO 2006/125948 A1

(51) International Patent Classification:

E21B 7/20 (2006.01) E21B 21/12 (2006.01)
E21B 43/10 (2006.01) E21B 7/18 (2006.01)

(21) International Application Number:

PCT/GB2006/001692

(22) International Filing Date: 9 May 2006 (09.05.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

0510670.3 25 May 2005 (25.05.2005) GB

(71) Applicant (for all designated States except US): **BP EXPLORATION OPERATING COMPANY LIMITED**

[GB/GB]: Chertsey Road, Sun-on-Thames, Middlesex TW16 7BP (GB).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **LUO, Yuejin**

[GB/GB]: 99 River Meads Avenue, Twickenham, Middlesex TW2 5JF (GB).

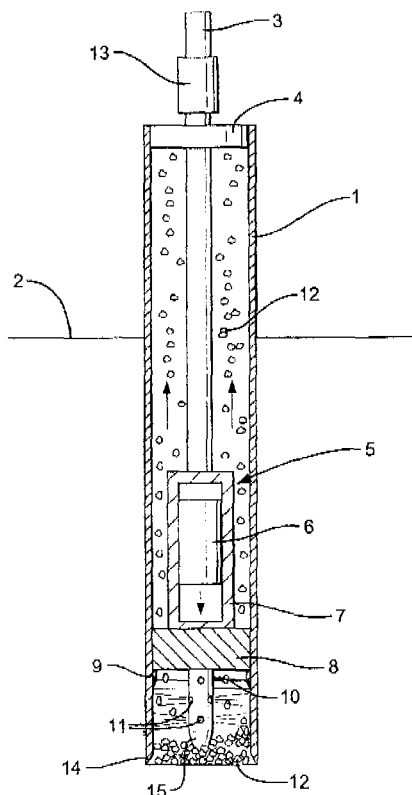
(74) Agent: **HYMERS, Ronald, Robson**; BP International Limited, Patents & Agreements, Chertsey Road, Sunbury-on-Thames, Middlesex TW16 7LN (GB).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SI, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,

[Continued on next page]

(54) Title: APPARATUS AND METHOD FOR DRIVING CASING OR CONDUCTOR PIPE:



(57) Abstract: A method for driving pipe (1) into the ground (2), which is particularly suitable for driving conductor pipes that are commonly installed in the hydrocarbon production industry during the construction of oil wells and gas wells, more particularly offshore wells comprises: (a) assembling at the lower end of a drill string (3), (i) means for supporting a conductor pipe on the drill string (4), (ii) a reciprocable impact driving means (5), (iii) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string, (iv) an anvil (8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe (1) and (v) means for jetting fluid (10), (b) positioning the assembly within a conductor (1) such that the assembly and conductor are supportable by the drill string and the means for jetting fluid (10) is at the lower end of the conductor (1), (c) positioning the lower end of the conductor pipe (1) on the ground (2) into which it is to be driven, (d) actuating the reciprocable impact driving means (5) to impact the anvil (8) and drive the conductor pipe (1) into the ground (2) and (e) simultaneously or sequentially jetting fluid into the lower part of the conductor pipe (1) such that it flows upwardly carrying with it particles (12) that have been forced into the conductor pipe the fluid and particles being removed from the upper part of the conductor pipe (1).

WO 2006/125948 A1



FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,
RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— of inventorship (Rule 4.17(iv))

Published:

with international search report

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a
patent (Rule 4.17(ii))

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

10

X
A
A**APPARATUS AND METHOD FOR DRIVING CASING OR CONDUCTOR PIPE**

The present invention relates to apparatus and method for driving casing, piles or conductor pipe. In particular, the invention relates to apparatus and method for driving
5 conductor pipes that are commonly installed in the hydrocarbon production industry during the construction of oil wells and gas wells, more particularly offshore wells.

It is well known in the hydrocarbon production industry to line wells with a number of concentric tubes to stabilise the bores and reduce the risk of fracture of the formation while drilling with weighted mud. The top section of the well casing is generally known as
10 the conductor pipe or conductor or sometimes as the structural casing. This conductor is essentially the well foundation and has different functions throughout its life. The main requirements of the conductor are to:

- (1) Stabilize and protect the near-surface sediments during the initial top-hole drilling operations by preventing well bore collapse and fracture of the formation
15 by mud pressures.
- (2) Temporarily support the weight of the next section of casing string, usually known as the surface casing.
- (3) Act together with the cemented surface casing to resist temporary axial tensile loads, shear loads and bending moments transmitted from the riser through the
20 Blowout Preventer (BOP) while drilling the remaining sections of well.
- (4) Act together with the surface casing to resist longer term operational loads from well trees, production risers and other production facilities.

Onshore, or in shallow water, the conductor may be driven into the ground using piling techniques. However, it can be difficult to pile drive a conductor through a
25 relatively thick or deep layer of sand. Installing conductor in deep water presents additional difficulties. One method that has been proposed uses "toe-driving" of the conductor. In this method, the casing is driven into the soil by the impact of a hammer acting at the bottom or toe of the pile compared to driving with a hammer striking at the top of the pile. In one example, a specially designed tip comprises an anvil and a conical
30 penetrating tip. The hydraulic hammer, arranged inside the casing, hits the anvil and drives the conical tip into the soil. The casing is attached to the tip not rigidly but by a shock absorbing element which acts to pull the casing into the soil after the tip. The toe

driving method has not been widely used for deep water applications as it can be difficult to achieve deep penetration.

The installation of conductors in deep water usually comprises forming an oversize hole by drilling and then cementing the conductor in place or by jetting, a procedure similar to wash boring in onshore geotechnical investigations. Although the drill and cement process is widely used in relatively shallow water, the soil in deepwater can be relatively weak. Consequently, there is a tendency for the drilled hole to be filled up by soil collapsing from the sides, not only while drilling is being carried out, but also when the drillstring is pulled out for running in casing. Therefore, jetting has been the more commonly used method for deep water. Jetting is often preferred as it may be quicker and, when performed properly, more reliable than drilling and cementing in normally consolidated clay sediments. However, if not properly planned and executed, jetting may result in excessive delays and even abandonment of a well. One of the greatest risks is excessive disturbance and wetting of the soil that results in low axial capacity and excessive settlement of the conductor when the surface casing is landed on it.

In a conventional jetting method a drill pipe is run inside a length of conductor and locked to the conductor by a drill-ahead running tool. The section of drill pipe inside the conductor, generally called the bottom hole assembly may typically comprise a drill bit positioned close to the lower end of the conductor, a mud motor, measurement-while-drilling directional sensors and a series of heavy drill collars with spacers. The assembly is lowered to the seabed and the conductor is washed into place with seawater and high viscosity mud sweeps injected through the drill bit. The pressurised fluid erodes the soil inside the conductor and around the lower edge and flushes the cuttings up the annular space between the conductor and bottom hole assembly. The resulting reduced soil resistance allows the jet assembly to penetrate the seabed under the combined weight of the conductor and bottom hole assembly. If this weight is insufficient to overcome the frictional resistance, the conductor may be worked up and down (reciprocated) by several metres to wet and remould the surface of the borehole.

As the outside surface of the conductor is in direct contact with the surrounding soil throughout the installation, there may be no need for a cementing operation with jetting. The installation of the conductor relies on the surrounding soil collapsing around the outside of the conductor to support the weight of the conductor and subsequent casing

X 3

strings. Often jetting is only possible to a relatively shallow depth, typically around 80 metres below mud line, as beyond this, the soil may not collapse around the conductor sufficiently to provide the required support or may take an unacceptably long time to do so. Another potential problem of the known jetting processes is that if the soil does not sufficiently consolidate around the conductor, it may not provide adequate formation isolation. This can be important when shallow formation is warmed up during subsequent drilling or production and hydrate gasifies and rises through the weak soil around the conductor to the seabed, possibly further weakening the soil and reducing its load bearing capacity.

10 The present invention overcomes or at least mitigates problems of the known techniques for driving open-ended casing, piles or conductor pipe. Although particularly useful for installing conductor pipe and more specifically for installing conductor pipe in deep water, the invention has wider application to driving tubular elements into the ground and the use in this specification of the terms "conductor" or "conductor pipe" is intended to
15 embrace such wider applications.

It is also anticipated that significant savings in time and cost are achievable by use of the process and apparatus according to the present invention as compared with the conventional method of drilling and cementing the string.

According to a first aspect of the present invention, apparatus for driving conductor
20 pipe into the ground comprises in combination:

- (a) a conductor pipe capable of being driven into the ground
- (b) a drill string
- (c) means for pumping fluid through the drill string
- (d) means for supporting the conductor pipe on the drill string
- 25 (e) a reciprocable impact driving means supportable by the drill string within the conductor pipe
- (f) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string
- (g) an anvil capable of transferring the percussive force of the reciprocable impact
30 driving means to the conductor pipe and
- (h) means for jetting fluid into the lower portion of the conductor pipe.

The means for pumping fluid through the drill string can conveniently be mud

13

14
14

pumps such as those conventionally present on drilling rigs which are used to circulate drilling muds down through the drill string and back through the annulus between the drill string and the well bore or vice versa. The use of the conventional drill string and mud pumps in the present invention simplifies the operation and minimises the disruption to rig activities.

The reciprocable impact driving means can be a hydraulic hammer similar to those already known for driving piles or hard rock drilling. A hammer suitable for use in relatively deep water would typically be able to provide an impact of about 100 to 250 kJ. For shallower water a less powerful hammer may be suitable, for example, a hammer capable of providing an impact of about 30 to 100kJ. The means for reciprocating the impact driving means is actuated by the fluid pumped through the drill string. The use of fluid pumped through the drill string obviates the need for separate hydraulic lines to drive the hammer.

The reciprocable driving means impacts an anvil which is capable of transferring the percussive force of the reciprocable driving means to the conductor pipe. Suitably, the conductor pipe has an internal shoulder engageable with the anvil.

Suitable means for supporting the conductor pipe on the drill string and the means for supporting the reciprocable impact driving means are known. The conductor pipe and/or the reciprocable impact driving means can be directly or indirectly supported by the drill string.

Preferably, the apparatus further comprises shock absorbing means for reducing the percussive force transmitted between the conductor pipe and the drill string. For example, a shock absorber can be included in the drill string above the means for attaching the conductor pipe to the drill string. In this way the forces resulting from the impact of the driving means are not fully transmitted to the whole drill string.

The means for jetting fluid into the lower portion of the conductor pipe comprises a tubular element in fluid communication with either or both of the drill string and the reciprocal impact driving means; the tubular element having holes through which relatively high pressure fluid can pass into the lower portion of the conductor pipe. Preferably, the means for jetting fluid is arranged such that the jets are directed substantially wholly within the conductor. Thus, for example, the jets may be directed radially towards the inner wall of the conductor pipe and more preferable are directed substantially perpendicularly

14

X
15

towards the inner wall of the conductor, for example up to 20 degrees above or below the horizontal plane. Preferably the jets are directed up to 15 degrees below the horizontal plane.

Optionally, a means for breaking up the soil disturbed by the fluid jets may be provided, such as, for example, at least one rotatable blade. Preferably the means for breaking up the soil is positioned adjacent the means for jetting fluid into the lower portion of the conductor pipe. For example, the jetting sub may have at least one rotatable blade that can break up the soil as it is disturbed by the fluid jets. This will facilitate removal of the soil. The rotatable blades could be provided with a separate power source to rotate them, e.g. an electric or hydraulic motor. Preferably, the rotatable blades are driven by fluid flowing through the drill string.

Although the fluid jets are the primary method for removing the soil from within the conductor pipe, this may be supplemented by the use of another drilling device. For example, a conventional rotatable drill bit driven by a downhole motor may be used to drill into the soil to facilitate the action of the fluid jets.

According to a second aspect of the invention, a method for driving conductor pipe into the ground comprises:

- (a) assembling at the lower end of a drill string (i) means for supporting a conductor pipe on the drill string, (ii) a reciprocable impact driving means, (iii) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string, (iv) an anvil capable of transferring the percussive force of the reciprocable impact driving means to the conductor pipe and (v) means for jetting fluid
- (b) positioning the assembly within a conductor such that the assembly and conductor are supportable by the drill string and the means for jetting fluid is at the lower end of the conductor
- (c) positioning the lower end of the conductor pipe on the ground into which it is to be driven
- (d) actuating the reciprocable impact driving means to impact the anvil and drive the conductor pipe into the ground
- (e) simultaneously or sequentially jetting fluid into the lower part of the conductor pipe such that it flows upwardly carrying with it particles that have been forced into the

15

X
16

conductor pipe the fluid and particles being removed from the upper part of the conductor pipe.

According to a third aspect of the present invention, a downhole assembly for use in the present invention comprises, attached at the lower end of a drill string, (i) means for
5 supporting a conductor pipe on the drill string, (ii) a reciprocable impact driving means, (iii) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string, (iv) an anvil capable of transferring the percussive force of the reciprocable impact driving means to the conductor pipe and (v) means for jetting fluid.

The present invention will be described, by way of example, with respect to the
10 accompanying drawing which is a schematic sectional representation of apparatus according to the present invention.

The Figure shows an open-ended conductor pipe (1) partially driven into the seabed (2). The conductor pipe (1) is supported on a drill string (3) by means of a make-up tool (4). The lower edge (14) of the conductor pipe (1) is chamfered to assist penetration of the
15 conductor pipe (1) into the soil. A reciprocable impact driving means (5) is also supported on the drill string (3) within the conductor pipe (1). The reciprocable impact driving means (5) comprises a hydraulically actuated hammer element (6) which can be moved within a housing (7).

Fluid is pumped down the drill string (3) by means of mud pumps (not shown)
20 located on a drilling rig (not shown) to actuate the reciprocable impact driving means (5). The fluid lifts the hammer element (6) and then it is allowed to fall under the influence of gravity alone or assisted by the pumped fluid. The fluid used may conveniently be drilling mud and/or seawater. Suitable mechanisms to actuate and control the reciprocable impact driving means will be apparent to a person skilled in the art and may, for example, be
25 similar to the known hydraulic hammers for hard rock drilling. Optionally, the pumped fluids may be used to drive mud motors that can be used to mechanically actuate the hammer element (6).

The housing (7) of the reciprocable impact driving means (5) is positioned on an anvil (8) which in turn rests on an internal shoulder (9) within the conductor pipe (1).
30 When the hammer element (6) of the reciprocable impact driving means (5) falls, it strikes the bottom of the housing (7) transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe (1) via the anvil (8) and shoulder (9). The anvil

16

(8) can be separate from or integral with the housing (7). The anvil (8) may be fixed to the conductor pipe (1).

Below the anvil (8) and in fluid communication with the drill string (3) and/or the housing (7) of the reciprocable impact driving means (4), is a jetting sub (10). The jetting sub (10) comprises a tubular element with openings therein which allow pressurised fluid to be released into the bottom of the conductor tube (1) in the form of jets. The jets of fluid emerging from the openings (11) loosen the soil which has entered the bottom of the conductor pipe (1). The drilling cuttings (12) are entrained in the fluid and move upwardly through the annulus between the drill string and the conductor pipe (1) and are removed from the upper part of the conductor pipe (1). The equipment, including the makeup tool (4) and anvil (8) has passages which allow the fluid and drill cuttings to pass through.

A shock absorber means (13) is included in the drill string above the make-up tool (4). Suitable shock absorbing means are known. The shock absorbing means reduces the forces transmitted to the drill string from the impact of the impact driving means (5) on the conductor pipe (1).

The fluid and associated drilling cuttings may be lifted to the surface and passed over a screen to separate the solids from the fluid. The fluid may then be reused.

In an alternative, and preferred embodiment, the fluid may be water or another environmentally acceptable fluid and the fluid and associated drill cuttings are simply allowed to overflow the conductor pipe (1) such that the solids settle around the outside of the conductor pipe (1). This arrangement may assist in the consolidation of the soil around the conductor pipe (1).

The bottom of the jetting sub (10) shown in the figure has a conical end 15 which assists with the penetration of the jetting sub into the soil.

The impact driving means (5) and the jetting means (10) can be used simultaneously or sequentially. It may, for example, be convenient to drive the conductor into the soil a short distance using the impact driving means (5), stop the reciprocation of the impact driving means (5) and then use the jetting sub (10) to loosen and remove the soil that has entered the bottom of the conductor pipe (1) before stopping the jetting and recommencing the reciprocation of the impact driving means (5).

The apparatus and method according to the present invention is likely to cause less damage to the surrounding soil as the conductor pipe is driven into the seabed. The open-

ended conductor wall will cut into the seabed and, as the soil is removed from inside the conductor pipe, the disturbance to the surrounding soil is reduced as compared with known jetting techniques. This should result in the surrounding soil being able to provide immediate load bearing capacity, or at least significantly reducing the length of time that must be allowed to achieve sufficient consolidation of the surrounding soil.

The present invention can also provide the possibility of achieving greater setting depth. Since the soil within the conductor pipe is removed, the resistance to driving will only be the soil friction on the outside wall. This external wall friction can be further reduced by increasing surface smoothness, e.g. by the use of friction reducing paints or coatings. Where the conductor pipe comprises separate sections joined together, i.e. the conductor is a conductor string, they may conveniently be joined using external upset connectors. The use of external upset connectors or indeed external upsets which are not connectors on the external wall of the conductor can result in reduced soil friction, which can be particularly useful in relatively firm subterranean formations. Specially designed conductor connectors or other upsets which have a suitable external upset profile, e.g. a smooth profile, may also be used to reduce the soil friction around the conductor pipe body.

Modelling has shown that it will be possible to drive the conductor pipe to depths of at least 300m based on the conditions found in typical Gulf of Mexico and other oil producing regions. The greater depth can further mitigate the problems associated with shallow hazards such as shallow water flow regions, hydrate layers and weak soil layers. Furthermore, if an even greater depth is required, e.g. in excess of 300m, and the formation conditions allow, the apparatus and method of the present invention can be used in a multistage driving process in which a smaller diameter conductor pipe is lowered through an installed conductor pipe and the second is then driven in to the ground below the first. Thus, both a surface casing and an intermediate casing may be installed using the process of the present invention by driving a first surface conductor or conductor string into the ground and then installing through the first conductor or conductor string a second conductor or conductor string. The conductor pipe can comprise two or more lengths of pipe, each successive length being of a smaller diameter than the preceding pipe so that it can be passed through the preceding pipe to the location of installation. The lengths of pipe can be of the same or different wall thickness.

18

18

7/0
1/0

The greater load carrying capacity of the conductor pipe that can be achieved using the apparatus and method of the present invention may obviate the need for a conductor liner on some deepwater wells. This would provide a significant cost saving.

5

10

15

20

25

30

20
20Claims:

1. Apparatus for driving conductor pipe into the ground comprising in combination:
 - (a) a conductor pipe (1) capable of being driven into the ground (2),
 - (b) a drill string (3),
 - 5 (c) means for pumping fluid through the drill string,
 - (d) means (4) for supporting the conductor pipe on the drill string,
 - (e) a reciprocable impact driving means (5) supportable by the drill string (3) within the conductor pipe (1),
 - (f) means for reciprocating the reciprocable impact driving means using fluid pumped
 - 10 through the drill string (3),
 - (g) an anvil (8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe and
 - (h) means (10) for jetting fluid into the lower portion of the conductor pipe(1).
2. Apparatus as claimed in claim 1 which further comprises shock absorbing means
- 15 (13) for reducing the percussive force transmitted between the conductor pipe (1) and the drill string (3).
3. Apparatus as claimed in either claim 1 or claim 2 in which the conductor pipe (1) has an internal shoulder (9) engageable with the anvil (8).
4. Apparatus as claimed in any one of claims 1 to 3 in which the means (10) for
- 20 jetting fluid into the lower portion of the conductor pipe comprises a tubular element in fluid communication with either or both of the drill string (3) and the reciprocal impact driving means (5); the tubular element having openings (11) through which relatively high pressure fluid can pass into the lower portion of the conductor pipe (1).
5. Apparatus as claimed in any one of claims 1 to 4 in which means are provided for
- 25 breaking up the soil disturbed by the means (10) for jetting fluid.
6. Apparatus as claimed in claim 5 in which the means for breaking up the soil comprises at least one rotatable blade which can be driven by fluid pumped through the drill string (3).
7. Apparatus as claimed in any one of claims 1 to 6 in which the conductor pipe (1)
- 30 has external upsets.
8. Apparatus as claimed in any one of claims 1 to 7 in which the conductor pipe comprises two or more lengths of pipe, each successive length being of a smaller diameter

20

X
21

than the preceding pipe.

9. Apparatus as claimed in claim 8 in which the conductor pipes are of different wall thickness.

10. A method for driving conductor pipe into the ground comprising:

- 5 (a) assembling at the lower end of a drill string (3) (i) means (4) for supporting a conductor pipe (1) on the drill string (3), (ii) a reciprocable impact driving means (5), (iii) means for reciprocating the reciprocable impact driving means (5) using fluid pumped through the drill string (3), (iv) an anvil (8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor
10 pipe (1) and (v) means (10) for jetting fluid,
- (b) positioning the assembly within a conductor pipe (1) such that the assembly and conductor pipe (1) are supportable by the drill string and the means (10) for jetting fluid is at the lower end of the conductor pipe (1),
- (c) positioning the lower end of the conductor pipe (1) on the ground (2) into which it
15 is to be driven,
- (d) actuating the reciprocable impact driving means (5) to impact the anvil (8) and drive the conductor pipe (1) into the ground (2),
- (e) simultaneously or sequentially jetting fluid into the lower part of the conductor pipe (1) such that it flows upwardly carrying with it particles (12) that have been forced
20 into the conductor pipe (1) the fluid and particles being removed from the upper part of the conductor pipe (1).

11. A method as claimed in claim 10 in which the particles (12) removed from the upper part of the conductor pipe (1) overflow the conductor pipe (1) and settle around the outside of the conductor pipe (1).

25 12. A method as claimed in claim 10 or claim 11 in which a first surface conductor pipe is driven into the ground and subsequently a second conductor pipe of smaller diameter is lowered through the first conductor pipe and the second is then driven into the ground below the first conductor pipe.

13. A downhole assembly for use in the present invention comprising, attached at the
30 lower end of a drill string (3), (i) means (4) for supporting a conductor pipe on the drill string, (ii) a reciprocable impact driving means (5), (iii) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string, (iv) an anvil

21

(8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe (1) and (v) means for jetting fluid (10).

14. A downhole assembly as claimed in claim 13 which further comprises means for breaking up the soil disturbed by the means for jetting fluid (10), which comprises at least
5 one rotatable blade.

10

15

20

25

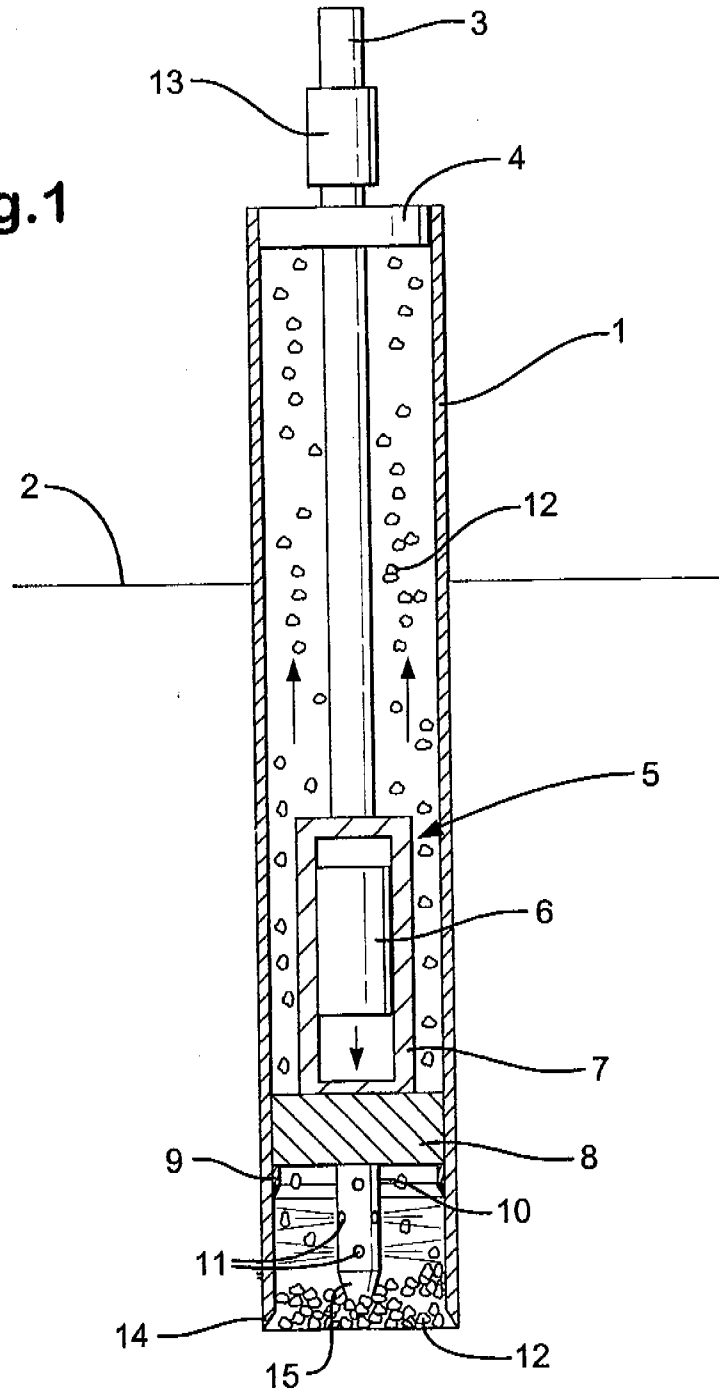
30

22

23

1/1

Fig.1



INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/001692

A. CLASSIFICATION OF SUBJECT MATTER

INV. E21B7/20 E21B43/10 E21B21/12 E21B7/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E21B E02D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004/051004 A (BJ SERVICES COMPANY; BELL, DOUGLAS, B; MUELLER, DAN, T; GRAY-STEPHENS,) 17 June 2004 (2004-06-17)	1, 10, 13
Y	page 3, line 6 - line 18; figures 1, 2, 11 page 5, line 10 - line 18 page 5, line 32 - page 6, line 9	2-6, 8, 9, 11, 12, 14
Y	US 4 702 325 A (HIPPE ET AL) 27 October 1987 (1987-10-27) column 2, line 21 - line 55; figures 6, 7	2, 5, 6, 11, 14
Y	GB 2 358 036 A (BILLY JAMES * ROBERTS; WILLIAM HAROLD * STRONG; * SMITH INTERNATIONAL,) 11 July 2001 (2001-07-11) page 13, line 18 - page 14, line 28; figures 12, 13	3
	----- --/--	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- *&* document member of the same patent family

Date of the actual completion of the international search

5 July 2006

Date of mailing of the international search report

13/07/2006

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Dantinne, P

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/001692

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3 376 922 A (JR. ERNST LEONHARDT,) 9 April 1968 (1968-04-09) column 3, line 7 - line 13; figure 2 -----	4
Y	WO 2004/001180 A (SAIPEM S.A; ANRES, STEPHANE; HOPPER, HANS, P) 31 December 2003 (2003-12-31) figures 1-4 -----	8,9,12
A	DE 42 17 293 A1 (KIPP, JENS-WERNER, 4800 BIELEFELD, DE; KIPP, JENS WERNER, 33659 BIELEF) 26 November 1992 (1992-11-26) abstract; figures 1,5 -----	1,10,13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2006/001692

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2004051004	A	17-06-2004	AU 2003295996 A1 EP 1567724 A2	23-06-2004 31-08-2005
US 4702325	A	27-10-1987	AU 4815285 A BR 8504890 A CA 1240310 A1 CN 85108013 A DK 230685 A GB 2165283 A IT 1182895 B NL 8501190 A NO 851464 A SE 8501718 A	10-04-1986 22-07-1986 09-08-1988 10-05-1986 05-04-1986 09-04-1986 05-10-1987 01-05-1986 07-04-1986 05-04-1986
GB 2358036	A	11-07-2001	NONE	
US 3376922	A	09-04-1968	GB 1162430 A	27-08-1969
WO 2004001180	A	31-12-2003	AU 2003260605 A1 BR 0311923 A EP 1525371 A1 FR 2841293 A1 US 2005152749 A1	06-01-2004 29-03-2005 27-04-2005 26-12-2003 14-07-2005
DE 4217293	A1	26-11-1992	NONE	

26

27

APARATO Y METODO PARA COLOCAR TUBERIA DE REVESTIMIENTO O

TUBO CONDUCTOR

CAMPO DE LA INVENCION

5 La presente invención se relaciona con un
aparato y método para colocar tubería de revestimiento,
pilotes o tubo conductor. En particular, la invención se
relaciona con un aparato y método para colocar tubos
conductores que son comúnmente instalados en la industria
10 de producción de hidrocarburos durante la construcción de
pozos de petróleo y pozos de gas, de manera más
particular pozos costeros.

ANTECEDENTES DE LA INVENCION

15 Es bien sabido en la industria productora de
hidrocarburos revestir pozos con un número de tubos
concéntricos para estabilizar las perforaciones y reducir
el riesgo de fractura de la formación mientras se perfora
con lodo pesado. La sección superior de la tubería de
20 revestimiento del pozo es generalmente conocida como tubo
conductor o conductor o algunas veces como la tubería de
revestimiento estructural. Este conductor es esencialmente
el cimientto del pozo y tiene diferentes funciones a través
de su vida. Los requerimientos principales del conductor son:

25 (1) Estabilizar y proteger los sedimentos cerca

de la superficie durante las operaciones de perforación en la parte superior evitando el colapso y la fractura de la formación del pozo de sondeo por presiones del lodo.

(2) Soportar temporalmente el peso de la siguiente sección de la tubería de revestimiento, usualmente conocida como tubería de revestimiento superficial.

(3) Actuar junto con la tubería de revestimiento superficial cementada para resistir cargas de tracción axial temporales, cargas cortantes y momentos de flexión transmitidos desde el elevador a través del Previsor de Explosión (BOP) mientras se perfora las secciones restantes del pozo.

(4) Actúa junto con la tubería de revestimiento superficial para resistir las cargas de operación a largo plazo de ramificaciones del pozo, elevadores de producción u otras instalaciones de producción.

En la costa o en agua poco profunda, el conductor puede ser colocado en el suelo usando técnicas de pilote. Sin embargo, puede ser difícil en el pilote colocar un conductor a través de una capa relativamente gruesa o profunda de arena. Instalar el conductor en aguas profundas presenta dificultades adicionales. Un método que ha sido propuesto usa una "colocación por el talón" del conductor. En este método, la tubería de

20
2

revestimiento es colocada en el suelo por el impacto de un martillo que actúa en el fondo o talón del pilote en comparación con la colocación con un martillo golpeando en la parte superior del pilote. En un ejemplo, una punta
5 especialmente diseñada comprende un yunque y una punta de penetración cónica. El martillo hidráulico, arrojado dentro de la tubería de revestimiento, golpea el yunque y lleva la punta cónica hacia el suelo. La tubería de revestimiento se une a la punta no rígidamente pero por
10 un elemento que absorbe choques el cual actúa para jalar la tubería de revestimiento hacia el suelo después de la punta. El método de colocación por el talón ha sido ampliamente usado para aplicaciones en aguas profundas puesto que puede ser difícil lograr una penetración
15 profunda.

La instalación de conductores en aguas profundas usualmente comprende formar un orificio sobredimensionado perforando y entonces cementando el conductor en su lugar o por chorro, un procedimiento
20 similar a la perforación de lavado en investigaciones geotécnicas en las costas. Aunque el proceso de perforación y cementado es ampliamente usado en agua relativamente poco profunda, el suelo en aguas profundas suele ser relativamente débil. En consecuencia, existe la
25 tendencia a que el orificio taladrado sea llenado o el

suelo que se colapsa desde los lados, no únicamente mientras se está llevando a cabo la perforación, sino también cuando la cadena de perforación es para jalar la tubería de revestimiento. Por lo tanto, el chorro ha sido
5 el método más comúnmente usado para aguas profundas. El chorro se prefiere con frecuencia, puesto que puede ser más rápido, y cuando se efectúa apropiadamente, más confiable que la perforación y cementado en sedimentos de arcilla normalmente consolidada. Sin embargo, sino se
10 planea y ejecuta apropiadamente, el chorro puede dar como resultado retrasos excesivos y aún el abandono de un pozo. Un riesgo mayor es la perturbación y humectación excesiva del suelo, lo que da como resultado una baja capacidad axial y sedimentación excesiva del conductor
15 cuando la tubería de revestimiento de la superficie se coloque encima de éste.

En un método de chorro convencional, un tubo de perforación se corre dentro de una longitud de un conductor y se traba al conductor por medio de una
20 herramienta de la perforadora. La sección del tubo de perforación dentro del conductor, generalmente conocida como el montaje del fondo del orificio puede comprender típicamente un trépano colocado cerca del extremo inferior del conductor, un motor de lodo, detectores
25 direccionales de perforación mientras se mide y una serie

30

24
33A

de collares de perforación pesados con separadores. El montaje es bajado al lecho marino y el conductor es lavado en su lugar con agua de mar y el lodo de alta viscosidad barre inyectado a través del trépano. El fluido presurizado erosiona el suelo dentro del conductor y alrededor del borde inferior y lava los cortes del espacio anular entre el conductor y el montaje en el fondo del orificio. La resistencia reducida al suelo resultante permite que el montaje de chorro penetre el lecho marino bajo el peso combinado del conductor y el montaje del fondo del orificio. Si este peso es insuficiente para superar la resistencia a la fricción, el conductor puede ser elevado y bajado (oscilar) varios metros para mojar y remodelar la superficie del orificio.

En la superficie externa del conductor está en contacto directo con el suelo circundante a través de la instalación, puede no ser necesaria una operación de cementado con chorro. La instalación del conductor depende del colapso del suelo circundante alrededor del exterior del conductor para soportar el peso del conductor y las cadenas de tubería de revestimiento posteriores. Con frecuencia, el chorro es únicamente posible a una profundidad relativamente poco profunda, típicamente de alrededor de 80 metros por debajo de la línea de lodo, más allá de esto, el suelo puede no

32
3

colapsarse alrededor del conductor lo suficiente para proporcionar el soporte requerido o puede tomar un tiempo inaceptablemente prolongado a ser esto. Otro problema potencial de los procesos de chorro conocidos es que si el suelo no está suficientemente consolidado alrededor del conductor, puede no proporcionar aislamiento de formación adecuado. Esto puede ser importante cuando la formación poco profunda se calienta durante la perforación o producción posterior y se gasifique hidrato y se eleva a través del suelo débil alrededor del conductor hacia el lecho marino, debilitando posiblemente aún más el suelo y reduciendo su capacidad de soporte de carga.

SUMARIO DE LA INVENCIÓN

La presente invención supera o al menos mitiga los problemas de las técnicas conocidas para construir tuberías de revestimiento de extremos abiertos, pilotes o tubo conductor. Aunque particularmente útil para instalar tubo conductor y más específicamente para instalar tubo conductor en aguas profundas, la invención tiene aplicación más amplia para construir elementos tubulares en la tierra y el uso en esta especificación de los términos "conductor" o "tubo conductor" se pretende abarcar esas aplicaciones más amplias.

También se anticipó que pueden ser logrados

2/3/3

ahorros significativos en el tiempo y costo mediante el uso del proceso y aparato de acuerdo a la presente invención en comparación con el método convencional de perforación y cementado de la cadena.

5 De acuerdo a un primer aspecto de la presente invención, el aparato para construir o colocar tubo conductor en el suelo comprende en combinación:

a) un tubo conductor que puede ser colocado en el suelo

10 (b) una cadena de perforación

(c) medios para bombear fluido a través de la cadena de perforación

(d) medios para soportar el tubo conductor sobre la cadena de perforación

15 (e) medios de accionamiento por impacto oscilante que pueden ser soportados por la cadena de perforación dentro del tubo conductor

(f) medios para hacer oscilar los medios de accionamiento de impacto oscilante usando el fluido
20 bombeado a través de la cadena de perforación

(g) un yunque que puede transferir la fuerza percusiva de los medios de accionamiento de impacto oscilantes al tubo conductor y

(h) medios para inyectar fluido en la porción
25 inferior del tubo conductor.

Los medios para bombear fluido a través de la cadena de perforación, pueden ser convenientemente las bombas de lodo, como aquéllos convencionalmente presentes en perforadoras las cuales son usadas para hacer circular lodos de perforación hacia abajo a través de la cadena de perforación y nuevamente a través del anillo entre la cadena de perforación y la cavidad del pozo o viceversa. El uso de la cadena de perforación convencional y las bombas de lodo en la presente invención simplifica la operación y minimiza la perturbación de las actividades de montaje.

El medio de accionamiento de impacto, oscilantes pueden ser un martillo hidráulico similar a aquéllos ya conocidos para colocar pilotes o perforar roca dura. Un martillo adecuado para usarse en aguas relativamente profundas típicamente sería capaz de proporcionar un impacto de aproximadamente 100 a 250 kJ. Para aguas poco profundas un martillo menos poderoso puede ser adecuado, por ejemplo, un martillo capaz de proporcionar un impacto de aproximadamente 30 a 100 kJ. Los medios para hacer oscilar los medios de accionamiento de impacto son accionados por el fluido bombeado a través de la cadena de perforación. El uso del fluido bombeado a través de la cadena de perforación obvia la necesidad de separar las líneas hidráulicas para accionar el martillo.

7/5

Los medios de accionamiento oscilantes hacen impacto sobre un yunque el cual es capaz de transferir la fuerza percusiva de los medios de accionamiento oscilantes al tubo conductor. De manera adecuada, el tubo conductor tiene un reborde interno acoplable con el yunque.

Los medios adecuados para soportar el tubo conductor sobre la cadena de perforación y los medios para soportar los medios de accionamiento de impacto oscilante son conocidos. El tubo conductor y/o los medios de accionamiento de impacto oscilantes pueden ser soportados directa o indirectamente por la cadena de perforación.

Preferiblemente, el aparato comprende además medios que absorben choques para reducir la fuerza percusiva transmitida entre el tubo conductor y la cadena de perforación. Por ejemplo, puede ser incluido un absorbente de choques en la cadena de perforación encima de los medios para unir el tubo conductor a la cadena de perforación. De esta manera las fuerzas resultantes del impacto de los medios de accionamiento no son completamente transmitidas a toda la cadena de perforación.

Los medios para inyectar fluido en la porción inferior del tubo conductor comprenden un elemento tubular en comunicación fluidica con cualquiera o ambas

de la cadena de perforación y los medios de accionamiento de impacto oscilantes; teniendo el elemento tubular orificios a través de los cuales puede hacerse pasar fluido a presión relativamente alta hacia la porción inferior del tubo conductor. Preferiblemente, los medios para inyectar fluido están arreglados de modo que los chorros son dirigidos de manera sustancial completamente dentro del conductor. De este modo, por ejemplo, los chorros pueden ser dirigidos radialmente hacia la pared interna del tubo conductor, y, de manera más preferible, son dirigidos de manera sustancialmente perpendicular hacia la pared interna del conductor, por ejemplo hasta 20 grados por encima o por debajo del plano horizontal. Preferiblemente los chorros son dirigidos hasta 15 grados por debajo del plano horizontal.

Opcionalmente, pueden ser proporcionados medios para romper el suelo, distribuidos por los chorros de fluido, como, por ejemplo, al menos una cuchilla giratoria. Preferiblemente los medios para romper el suelo se colocan adyacentes a los medios para inyectar fluido en la porción inferior del tubo conductor. Por ejemplo, el chorro submarino puede tener al menos una cuchilla giratoria que pueda romper el suelo, cuando es distribuido por los chorros de fluido. Esto facilitará la remoción del suelo. Las cuchillas giratorias podrían ser

12A
3

provistas con una fuente de energía separada para
hacerlas girar, por ejemplo, un motor eléctrico o
hidráulico. Preferiblemente, las cuchillas giratorias son
accionadas por el fluido que fluye a través de la cadena
5 de perforación.

Aunque los chorros de fluido son principalmente
un método para remover el suelo dentro del tubo
conductor, estos pueden ser suplementados por el uso de
otro dispositivo de perforación. Por ejemplo, podría ser
10 usado un trépano giratorio convencional accionado por un
motor en el fondo del pozo para perforar en el suelo para
facilitar la acción de los chorros de fluido.

De acuerdo a un segundo aspecto de la invención,
un método para colocar tubo conductor en el suelo
15 comprende:

(a) montar en el extremo inferior de una cadena
de perforación (i) medios para soportar un tubo conductor
sobre la cadena de perforación, (ii) medios de
accionamiento de impacto oscilantes, (iii) medios para
20 hacer oscilar los medios de accionamiento de impacto
oscilantes usando fluido bombeado a través de la cadena
de perforación, (iv) un yunque capaz de transferir la
fuerza percusiva de los medios de accionamiento de
impacto oscilantes al tubo conductor y (v) medios para
25 inyectar fluido

(b) colocar el montaje dentro de un conductor de modo que el montaje y el conductor puedan ser soportados por la cadena de perforación y los medios para inyectar fluido en el extremo inferior del conductor

5 (c) colocar el extremo inferior del tubo conductor sobre el suelo en el cual va a ser colocado

(d) accionar los medios de accionamiento de impacto oscilantes para hacer impacto sobre el yunque y conducir el tubo conductor hacia el suelo

10 (e) simultánea o secuencialmente inyectar fluido en la parte inferior del tubo conductor de modo que fluya hacia arriba llevando con éste las partículas que han sido forzadas hacia el tubo conductor, siendo removidos el fluido y las partículas de la parte superior del tubo
15 conductor.

De acuerdo a un tercer aspecto de la presente invención, un montaje en el fondo del pozo para usarse en la presente invención comprende, unido al extremo inferior de la cadena de perforación, (i) medios para
20 soportar un tubo conductor sobre la cadena de perforación, (ii) medios de accionamiento de impacto oscilantes, (iii) medios para hacer oscilar los medios de accionamiento de impacto oscilantes usando el fluido bombeado a través de la cadena de perforación, (iv) un
25 yunque capaz de transferir la fuerza percusiva de los

medios de accionamiento de impacto oscilantes al tubo conductor y (v) medios para inyectar fluido.

BREVE DESCRIPCION DE LA FIGURA

5 La presente invención será descrita, a manera de ejemplo, con respecto a la figura acompañante la cual es una representación en corte, esquemática, del aparato de acuerdo a la presente invención.

10 La Figura 1 muestra un tubo conductor de extremos abiertos (1) parcialmente colocado en el lecho marino (2). El tubo conductor (1) es soportado por una cadena de perforación (3) por medio de una herramienta de construcción (4). El borde inferior (14) del tubo conductor (1) está biselado para ayudar a la penetración
15 del tubo conductor (1) en el suelo. Los medios de accionamiento de impacto oscilantes (5) también son soportados sobre la cadena de perforación (3) dentro del tubo conductor (1). Los medios de accionamiento de impacto oscilantes (5) comprenden un elemento de martillo
20 accionado hidráulicamente (6) el cual puede moverse dentro de un alojamiento (7).

DESCRIPCION DETALLADA DE LAS MODALIDADES PREFERIDAS DE LA INVENCION

25 El fluido es bombeado hacia abajo de la cadena

40
40

de perforación (3) por medio de bombas de lodo (no mostradas) localizadas sobre la perforadora (no mostrada) para accionar los medios de accionamiento de impacto oscilantes (5). El fluido eleva el elemento de martillo (6) y entonces se deja caer bajo la influencia de la gravedad únicamente o ayudado por el fluido bombeado. El fluido usado puede ser convenientemente lodo de perforación y/o agua de mar. Los mecanismos adecuados para accionar y controlar los medios de accionamiento de impacto oscilante serán evidentes a un experto en la técnica y pueden, por ejemplo, ser similares a los martillos hidráulicos conocidos para perforar roca dura. Opcionalmente, los fluidos bombeados pueden ser usados para accionar los motores de lodo que pueden ser usados para accionar mecánicamente el elemento de martillo (6).

El alojamiento (7) de los medios de accionamiento de impacto oscilantes (5) se colocan sobre un yunque (8) el cual a su vez reposa sobre un reborde interno (9) dentro del tubo conductor (1). Cuando el elemento de martillo (6) de los medios de accionamiento de impacto oscilantes (5) cae, choca contra el fondo del alojamiento (7) transfiriendo la fuerza percusiva de los medios de accionamiento de impacto oscilantes (5) al tubo conductor (1) vía el yunque (8) y el reborde (9). El yunque (8) puede estar separado o integrado al alojamiento (7). El

40

44
47

yunque (8) puede ser fijado al tubo conductor (1).

Debajo del yunque (8) y en comunicación fluídica con la cadena de perforación (3) y/o el alojamiento (7) de los medios de accionamiento de impacto oscilantes (4), se encuentra un chorro auxiliar (10). El chorro auxiliar (10) comprende un elemento tubular con aberturas en él, el cual permite que sea liberado fluido presurizado hacia el fondo del tubo conductor (1) en forma de chorros. Los chorros del fluido que emergen de las aberturas (11) aflojan el suelo que ha entrado en el fondo del tubo conductor (1). Los cortes de perforación (12) son atrapados en el fluido y llevados hacia arriba a través del anillo entre la cadena de perforación y el tubo conductor (1) y son removidos de la parte superior del tubo conductor (1). El equipo, que incluye la herramienta de construcción (4) y el yunque (8) tiene pasajes los cuales permiten que el fluido y los cortes de perforación pasen a su través.

Los medios absorbentes de choques (13) están incluidos en la cadena de perforación encima de la herramienta de construcción (4). Los medios absorbentes de choques adecuados son conocidos. Los medios absorbentes de choques reducen las fuerzas transmitidas a la cadena de perforación del impacto de los medios de accionamiento del impacto (5) sobre el tubo conductor (1).

41

42
42

El fluido y los cortes de perforación asociados pueden ser elevados a la superficie y hacerse pasar sobre un tamiz para separar los sólidos del fluido. El fluido puede entonces ser reutilizado.

5 De manera alternativa, y en la modalidad preferida, el fluido puede ser agua u otro fluido ambientalmente aceptable y el fluido y los cortes de perforación asociados se dejan simplemente desbordar el tubo conductor (1), de modo que los sólidos se sedimenten
10 alrededor del exterior del tubo conductor (1). Este arreglo puede ayudar a la consolidación del suelo alrededor del tubo conductor (1).

El fondo del chorro auxiliar (10) mostrado en la figura tiene un extremo cónico 15 el cual ayuda a la penetración del chorro auxiliar en el suelo.

Los medios de accionamiento de impacto (5) y los medios de chorro (10) pueden ser usados de manera simultánea o secuencial. Puede, por ejemplo, ser conveniente colocar el conductor en el suelo a una
20 distancia corta usando los medios de accionamiento de impacto (5), detener la oscilación de los medios de accionamiento de impacto (5) y entonces usar el chorro auxiliar (10) para aflojar y remover el suelo que ha entrado al fondo del tubo conductor (1) antes de detener
25 el chorro y comenzar nuevamente la oscilación de los

42

medios de accionamiento de impacto (5).

El aparato y método de acuerdo a la presente invención igualmente produce menos daño al suelo circundante cuando el tubo conductor es colocado en el lecho marino. La pared del conductor de extremos abiertos cortará el lecho marino, y, a medida que el suelo sea removido del interior del tubo conductor, la perturbación del suelo circundante se reduce en comparación con las técnicas de chorro conocidas. Esto dará como resultado que el suelo circundante pueda proporcionar una capacidad de soporte de carga inmediata, o al menos reducir significativamente el periodo de tiempo que debe permitirse para lograr una consolidación suficiente del suelo circundante.

La presente invención puede proporcionar también, la posibilidad de lograr una mayor profundidad de sedimentación. Puesto que el suelo dentro del tubo conductor es removido, la resistencia a la colocación será únicamente por la fricción del suelo sobre la pared externa. Esta fricción de la pared externa puede reducirse además incrementando la lisura de la superficie, por ejemplo, por el uso de pinturas o recubrimientos que reduzcan la fricción. Donde el tubo conductor comprenda secciones separadas unidas juntas, es decir, el conductor sea una cadena conductora, ellas

43

43

H/4
1/4

5 pueden ser unidas convenientemente usando conectores
recalcados externos. El uso de los conectores recalcados
externos o en realidad dispositivos externos que no son
conectores sobre la pared externa del conductor puede dar
10 como resultado una fricción reducida del suelo, lo cual
puede ser particularmente útil en las formaciones
subterráneas relativamente firmes. Los conectores
conductores especialmente diseñados u otros aditamentos
que tengan un perfil de recalcado externo adecuado, por
15 ejemplo, un perfil liso, también pueden ser usados para
reducir la fricción del suelo alrededor del cuerpo del
tubo conductor.

El modelado ha mostrado que será posible
colocar el tubo conductor a profundidades de al menos
15 300m sobre la base de las condiciones encontradas en el
Golfo de México típico y otras regiones productoras de
petróleo. Una mayor profundidad puede mitigar aún más los
problemas asociados con los riesgos de poca profundidad
como regiones de flujo de agua poco profunda, capas de
20 hidrato y capas de suelo débil. Además, si se requiere
una profundidad aún mayor, por ejemplo, que exceda de
300m, y las condiciones de formación lo permitan, el
aparato y método de la presente invención pueden ser
usados en un proceso de colocación o construcción de
25 etapas múltiples en el cual un tubo conductor de diámetro

1/4

4/5
4/5

más pequeño se ha bajado a través de un tubo conductor instalado, y el segundo sea accionado hacia el fondo debajo del primero. De este modo, pueden ser instaladas una tubería de revestimiento superficial y una tubería de revestimiento intermedia usando el proceso de la presente invención colocando un primer conductor en la superficie o una cadena de conductores en el suelo y entonces instalarlo a través del primer conductor o cadena conductora, un segundo conductor o cadena conductora. El tubo conductor puede comprender dos o más longitudes de tubo, siendo cada longitud sucesiva de un diámetro más pequeño que el tubo precedente, de modo que pueda hacerse pasar a través del tubo precedente hacia el lugar de instalación. Las longitudes del tubo pueden ser del mismo o diferente espesor de pared.

La capacidad de soportar una carga mayor del tubo conductor que puede ser lograda usando el aparato y método de la presente invención puede obviar la necesidad de un revestimiento de conductor en algunos pozos de aguas más profundas. Esto proporcionará ahorro de costos significativos.

4/5

46
46**NOVEDAD DE LA INVENCION**

Habiéndose descrito la invención como antecede,
se reclama como propiedad lo contenido en las siguientes:

5

REIVINDICACIONES

1. Un aparato para colocar un tubo conductor en
el suelo, caracterizado porque comprende en combinación:

(a) un tubo conductor (1) que puede ser
colocado en el suelo (2),

10

(b) una cadena de perforación (3),

(c) medios para bombear fluidos a través de la
cadena de perforación,

(d) medios (4) para soportar el tubo conductor
sobre la cadena de perforación (3),

15

(e) medios de accionamiento de impacto
oscilantes (5) que pueden ser soportados por la cadena de
perforación (3) dentro del tubo conductor,

(f) medios para hacer oscilar los medios de
accionamiento de impacto oscilantes usando un fluido
bombeado a través de la cadena de perforación (3),

20

(g) un yunque (8) capaz de transferir la fuerza
percusiva de los medios de accionamiento de impacto (5)
oscilantes al tubo de conductor y

(h) medios (10) para inyectar fluido en la
porción inferior del tubo conductor (1).

25

46

2. El aparato de conformidad con la reivindicación 1, caracterizado porque comprende además medios que absorben choques (13) para reducir la fuerza percusiva transmitida entre el tubo conductor (1) y la
5 cadena de perforación (3).

3. El aparato de conformidad con cualquiera de la reivindicación 1 o la reivindicación 2, caracterizado porque el tubo conductor (1) tiene un reborde interno (9) acoplado con el yunque (8).

10 4. El aparato de conformidad con cualquiera de las reivindicaciones 1 a 3, caracterizado porque los medios (10) para inyectar fluido en la porción inferior del tubo conductor comprenden un elemento tubular en comunicación fluidica con cualquiera o ambos de la cadena
15 de perforación (3) y los medios de accionamiento de impacto oscilantes (5); teniendo el elemento tubular aberturas (11) a través de las cuales puede pasar fluido a presión relativamente alta hacia la porción inferior del tubo conductor (1).

20 5. El aparato de conformidad con cualquiera de las reivindicaciones 1 a 4, caracterizado porque se proporcionan medios para romper el suelo distribuido por los medios (10) para inyectar fluido.

25 6. El aparato de conformidad con la reivindicación 5, caracterizado porque los medios para

romper el suelo comprenden al menos una cuchilla giratoria la cual puede ser accionada por fluido bombeado a través de la cadena de perforación (3).

7. El aparato de conformidad con cualquiera de las reivindicaciones 1 a 6, caracterizado porque el tubo conductor (1) tiene recalcado externo.

8. El aparato de conformidad con cualquiera de las reivindicaciones 1 a 7, caracterizado porque el tubo conductor comprende dos o más longitudes de tubo, siendo cada longitud sucesiva de un diámetro más pequeño al del tubo precedente.

9. El aparato de conformidad con la reivindicación 8, caracterizado porque los tubos conductores son de diferente espesor de pared.

10. Un método para colocar un tubo conductor en el suelo, caracterizado porque comprende:

(a) montar al extremo inferior de una cadena de perforación (3) (i) medios (4) para soportar un tubo conductor (1) sobre la cadena de perforación (3), (ii) medios de accionamiento de impacto oscilantes (5), (iii) medios para hacer oscilar los medios de accionamiento de impacto oscilantes (5) usando fluido bombeado a través de la cadena de perforación (3), (iv) un yunque (8) capaz de transferir la fuerza percusiva de los medios de accionamiento de impacto oscilantes (5) al tubo conductor

(1) y (v) medios (10) para inyectar fluido,

(b) colocar el montaje dentro de un tubo conductor (1) de modo que el montaje y el tubo conductor (1) puedan ser soportados por la cadena de perforación y los medios (10) para inyectar fluido en el extremo inferior del tubo conductor (1),

(c) colocar el extremo inferior del tubo conductor (1) sobre el suelo (2) en el cual va a ser colocado,

(d) accionar los medios de accionamiento de impacto oscilantes (5) para impactar el yunque (8) y colocar el tubo conductor (1) en el suelo (2),

(e) simultánea o secuencialmente inyectar fluido en la parte inferior del tubo conductor (1), de modo que éste fluya hacia arriba transportando con éste las partículas (12) que han sido forzadas hacia el tubo conductor (1), siendo removidos el fluido y las partículas de la parte superior del tubo conductor (1).

11. El método de conformidad con la reivindicación 10, caracterizado porque las partículas (12) removidas de la parte superior del tubo conductor (1) desbordan el tubo conductor (1) y sedimentan alrededor del exterior del tubo conductor (1).

12. El método de conformidad con la reivindicación 10 o la reivindicación 11, caracterizado

86
50

porque el primer tubo conductor de la superficie es colocado en el suelo y posteriormente se baja un segundo tubo conductor de diámetro más pequeño a través del primer tubo conductor y el segundo es entonces colocado
5 en el suelo debajo del primer tubo conductor.

13. Un montaje en el fondo del pozo para usarse en la presente invención que comprende, unidos al extremo inferior de una cadena de perforación (3), (i) medios (4) para soportar un tubo conductor de extremos abiertos
10 sobre la cadena de perforación, (ii) medios de accionamiento de impacto oscilantes (5), (iii) medios para hacer oscilar los medios de accionamiento de impacto oscilantes usando fluido bombeado a través de la cadena de perforación, (iv) un yunque (8) capaz de transferir la
15 fuerza percusiva de los medios de accionamiento de impacto oscilantes (5) al tubo conductor (1) y (v) medios para inyectar fluido (10).

14. Un montaje en el fondo del pozo de conformidad con la reivindicación 13, caracterizado
20 porque comprende además, medios para romper el suelo distribuido por los medios para inyectar fluido (10), la cual comprende al menos una cuchilla giratoria.

50

RESUMEN DE LA INVENCION

Un método para colocar un tubo conductor (1) en el suelo (2), el cual es particularmente adecuado para construir tubos conductores que son comúnmente instalados en la industria de producción de hidrocarburos durante la construcción de pozos de petróleo y pozos de gas, de manera más particular pozos costeros que comprende: (a) montar el extremo inferior de una cadena de perforación (3), (i) medios para soportar un tubo conductor sobre la cadena de perforación (4), (ii) medios de accionamiento de impacto oscilantes (5), (iii) medios para hacer oscilar los medios de accionamiento de impacto oscilantes usando fluido bombeado a través de la cadena de perforación, (iv) un yunque (8) capaz de transferir la fuerza percusiva de los medios de accionamiento (5) de impacto oscilantes al tubo conductor (1) y (v) medios para inyectar fluido (10), (b) colocar el montaje dentro de un tubo conductor de modo que el montaje y el tubo conductor (1) puedan ser soportados por la cadena de perforación y los medios para inyectar fluido (10) en el extremo inferior del tubo conductor (1), (c) colocar el extremo inferior del tubo conductor (1) sobre el suelo (2) en el cual va a ser colocado, (d) accionar los medios de accionamiento (5) de impacto oscilantes para impactar el yunque (8) y colocar el tubo conductor (1) en el

4/2/7

suelo (2), y (e) simultánea o secuencialmente inyectar fluido en la parte inferior del tubo conductor (1), de modo que éste fluya hacia arriba transportando con éste las partículas (12) que han sido forzadas hacia el tubo conductor, siendo removidos el fluido y las partículas de la parte superior del tubo conductor (1).

PATENT COOPERATION TREATY

AMP
REC
16/3

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:	
BP INTERNATIONAL LIMITED Chertsey Road Sunbury-on-Thames Middlesex TW16 7LN GRANDE BRETAGNE	Received in PAT 10 JUL 2007

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(PCT Rule 71.1)

Applicant's or agent's file reference BPX 10259	IMPORTANT NOTIFICATION	
International application No. PCT/GB2006/001692	International filing date (day/month/year) 09.05.2006	Priority date (day/month/year) 25.05.2005
Applicant BP EXPLORATION OPERATING COMPANY LIMITED		

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international preliminary examining authority:	Authorized Officer
 European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Ter Haar, Heidi Tel. +31 70 340-3817



PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference BPX 10259	FOR FURTHER ACTION		See Form PCT/PEA/416
International application No. PCT/GB2006/001692	International filing date (day/month/year) 09.05.2006	Priority date (day/month/year) 25.05.2005	
International Patent Classification (IPC) or national classification and IPC INV. E21B7/20			
Applicant BP EXPLORATION OPERATING COMPANY LIMITED			
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of <u>5</u> sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. ☒ sent to the applicant and to the International Bureau a total of <u>3</u> sheets, as follows: ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).			
4. This report contains indications relating to the following items: ☒ Box No. I Basis of the report ☐ Box No. II Priority ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability ☐ Box No. IV Lack of unity of invention ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement ☐ Box No. VI Certain documents cited ☐ Box No. VII Certain defects in the international application ☐ Box No. VIII Certain observations on the international application			
Date of submission of the demand 2006-12-21		Date of completion of this report 25.06.2007	
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016		Authorized officer Dantine, Patrick Telephone No. +31 70 340-3396 	

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/GB2006/001692

Box No. I Basis of the report

1. With regard to the **language**, this report is based on

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
 - ☐ international search (under Rules 12.3(a) and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4(a))
 - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1-9 as originally filed

Claims, Numbers

1-14 filed with telefax on 02.03.2007

Drawings, Sheets

1/1 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/GB2006/001692

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or Industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	<u>2-9,11,12,14</u>
	No: Claims	<u>1,10,13</u>
Inventive step (IS)	Yes: Claims	
	No: Claims	<u>1-14</u>
Industrial applicability (IA)	Yes: Claims	<u>1-14</u>
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V.

1 Reference is made to the following documents:

- D1 : WO 2004/051004 A (BJ SERVICES COMPANY; BELL, DOUGLAS, B;
MUELLER, DAN, T; GRAY-STEPHENS,) 17 June 2004
D2: US-A-4 702 325 (HIPP ET AL) 27 October 1987
D3: GB-A-2 358 036 (BILLY JAMES ROBERTS; WILLIAM HAROLD STRONG;
SMITH INTERNATIONAL,) 11 July 2001
D4: US-A-3 376 922 (JR. ERNST LEONHARDT,) 9 April 1968
D5: WO 2004/001180 A (SAIPEM S.A; ANRES, STEPHANE; HOPPER, HANS, P)
31 December 2003

2 INDEPENDENT CLAIM 1

2.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.

Document D1 discloses (the references in parentheses applying to this document; see figure 1 and 2; page 3 line 15-17 and page 3 line 34- page 4 line 10):

Apparatus for driving open-ended conductor pipe into the ground comprising in combination:

- (a) an open-ended conductor pipe (103) capable of being driven into the ground (215),
- (b) a drill string (112),
- (c) means for pumping fluid through the drill string,
- (d) means (115) for supporting the conductor pipe on the drill string,
- (e) a reciprocable impact driving means (118) supportable by the drill string (112) within the conductor pipe (103),
- (f) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string (112),
- (g) an anvil (109) capable of transferring the percussive force of the reciprocable

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/GB2006/001692

impact driving means (118) to the conductor pipe and
(h) means (see page 5 line 32-37) for jetting fluid into the lower portion of the
conductor pipe(103).

3 DEPENDENT CLAIMS 2-9,11,12,14

Dependent claims 2-9,11,12,14 do not contain any features which, in combination
with the features of any claim to which they refer, meet the requirements of the PCT
in respect of novelty and/or inventive step (Article 33(2) and (3) PCT) for the following
reasons:

Claims 2,11: see D2 column 10 line 5 - 14.

Claim 3: see D3 figure 13.

Claim 4: see D4 figure 2.

Claims 5,6,14: see D2 figure 7.

Claim 7: obvious choice to reduce friction.

Claims 8,9,12: see D5.

- 4** Since the subject-matter of each of independent claims 10, 13 corresponds to the
subject matter of claim 1, the same reasoning as given for claim 1 will apply *mutatis
mutandis*.

Case No. 10259(2)

10

Claims:

1. Apparatus for driving open-ended conductor pipe into the ground comprising in combination:
 - (a) an open-ended conductor pipe (1) capable of being driven into the ground (2),
 - 5 (b) a drill string (3),
 - (c) means for pumping fluid through the drill string,
 - (d) means (4) for supporting the conductor pipe on the drill string,
 - (e) a reciprocable impact driving means (5) supportable by the drill string (3) within the conductor pipe (1),
 - 10 (f) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string (3),
 - (g) an anvil (8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe and
 - (h) means (10) for jetting fluid into the lower portion of the conductor pipe(1).
- 15 2. Apparatus as claimed in claim 1 which further comprises shock absorbing means (13) for reducing the percussive force transmitted between the conductor pipe (1) and the drill string (3).
3. Apparatus as claimed in either claim 1 or claim 2 in which the conductor pipe (1) has an internal shoulder (9) engageable with the anvil (8).
- 20 4. Apparatus as claimed in any one of claims 1 to 3 in which the means (10) for jetting fluid into the lower portion of the conductor pipe comprises a tubular element in fluid communication with either or both of the drill string (3) and the reciprocal impact driving means (5); the tubular element having openings (11) through which relatively high pressure fluid can pass into the lower portion of the conductor pipe (1).
- 25 5. Apparatus as claimed in any one of claims 1 to 4 in which means are provided for breaking up the soil disturbed by the means (10) for jetting fluid.
6. Apparatus as claimed in claim 5 in which the means for breaking up the soil comprises at least one rotatable blade which can be driven by fluid pumped through the drill string (3).
- 30 7. Apparatus as claimed in any one of claims 1 to 6 in which the conductor pipe (1) has external upsets.

Case No. 10259(2)

11

8. Apparatus as claimed in any one of claims 1 to 7 in which the conductor pipe comprises two or more lengths of pipe, each successive length being of a smaller diameter than the preceding pipe.
9. Apparatus as claimed in claim 8 in which the conductor pipes are of different wall thickness.
10. A method for driving open-ended conductor pipe into the ground comprising:
- (a) assembling at the lower end of a drill string (3) (i) means (4) for supporting an open-ended conductor pipe (1) on the drill string (3), (ii) a reciprocable impact driving means (5), (iii) means for reciprocating the reciprocable impact driving means (5) using fluid pumped through the drill string (3), (iv) an anvil (8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe (1) and (v) means (10) for jetting fluid,
 - (b) positioning the assembly within a conductor pipe (1) such that the assembly and conductor pipe (1) are supportable by the drill string and the means (10) for jetting fluid is at the lower end of the conductor pipe (1),
 - (c) positioning the lower end of the conductor pipe (1) on the ground (2) into which it is to be driven,
 - (d) actuating the reciprocable impact driving means (5) to impact the anvil (8) and drive the conductor pipe (1) into the ground (2),
 - (e) simultaneously or sequentially jetting fluid into the lower part of the conductor pipe (1) such that it flows upwardly carrying with it particles (12) that have been forced into the conductor pipe (1) the fluid and particles being removed from the upper part of the conductor pipe (1).
11. A method as claimed in claim 10 in which the particles (12) removed from the upper part of the conductor pipe (1) overflow the conductor pipe (1) and settle around the outside of the conductor pipe (1).
12. A method as claimed in claim 10 or claim 11 in which a first surface conductor pipe is driven into the ground and subsequently a second conductor pipe of smaller diameter is lowered through the first conductor pipe and the second is then driven into the ground below the first conductor pipe.
13. A downhole assembly for use in the present invention comprising, attached at the lower end of a drill string (3), (i) means (4) for supporting an open-ended conductor pipe

60

Case No. 10259(2)

12

on the drill string, (ii) a reciprocable impact driving means (5), (iii) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string, (iv) an anvil (8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe (1) and (v) means for jetting fluid (10).

- 5 14. A downhole assembly as claimed in claim 13 which further comprises means for breaking up the soil disturbed by the means for jetting fluid (10), which comprises at least one rotatable blade.

10

15

20

25

30

62
62

REIVINDICACIONES

1. Un aparato para colocar un tubo conductor de extremos abiertos en el suelo, caracterizado porque comprende en combinación:

(a) un tubo conductor de extremos abiertos (1) que puede ser colocado en el suelo (2),

(b) una cadena de perforación (3),

(c) medios para bombear fluidos a través de la cadena de perforación,

(d) medios (4) para soportar el tubo conductor sobre la cadena de perforación,

(e) medios de accionamiento de impacto oscilantes (5) que pueden ser soportados por la cadena de perforación (3) dentro del tubo conductor (1),

(f) medios para hacer oscilar los medios de accionamiento de impacto oscilantes usando un fluido bombeado a través de la cadena de perforación (3),

(g) un yunque (8) capaz de transferir la fuerza percusiva de los medios de accionamiento de impacto oscilantes (5) al tubo de conductor y

(h) medios (10) para inyectar fluido en la porción inferior del tubo conductor (1).

2. El aparato de conformidad con la reivindicación 1, caracterizado porque comprende además medios que absorben

63

choques (13) para reducir la fuerza percusiva transmitida entre el tubo conductor (1) y la cadena de perforación (3).

3. El aparato de conformidad con cualquiera de la reivindicación 1 o la reivindicación 2, caracterizado porque el tubo conductor (1) tiene un reborde interno (9) acoplado con el yunque (8).

4. El aparato de conformidad con cualquiera de las reivindicaciones 1 a 3, caracterizado porque los medios (10) para inyectar fluido en la porción inferior del tubo conductor comprenden un elemento tubular en comunicación fluidica con cualquiera o ambos de la cadena de perforación (3) y los medios de accionamiento de impacto oscilantes (5); teniendo el elemento tubular aberturas (11) a través de las cuales puede pasar fluido a presión relativamente alta hacia la porción inferior del tubo conductor (1).

5. El aparato de conformidad con cualquiera de las reivindicaciones 1 a 4, caracterizado porque se proporcionan medios para romper el suelo distribuido por los medios (10) para inyectar fluido.

6. El aparato de conformidad con la reivindicación 5, caracterizado porque los medios para romper el suelo comprenden al menos una cuchilla giratoria la cual puede ser accionada por fluido bombeado a través de la cadena de perforación (3).

63

64
04

7. El aparato de conformidad con cualquiera de las reivindicaciones 1 a 6, caracterizado porque el tubo conductor (1) tiene recalcado externo.

8. El aparato de conformidad con cualquiera de las reivindicaciones 1 a 7, caracterizado porque el tubo conductor comprende dos o más longitudes de tubo, siendo cada longitud sucesiva de un diámetro más pequeño al del tubo precedente.

9. El aparato de conformidad con la reivindicación 8, caracterizado porque los tubos conductores son de diferente espesor de pared.

10. Un método para colocar un tubo conductor de extremos abiertos en el suelo, caracterizado porque comprende:

(a) montar al extremo inferior de una cadena de perforación (3) (i) medios (4) para soportar un tubo conductor de extremos abiertos (1) sobre la cadena de perforación (3), (ii) medios de accionamiento de impacto oscilantes (5), (iii) medios para hacer oscilar los medios de accionamiento de impacto oscilantes (5) usando fluido bombeado a través de la cadena de perforación (3), (iv) un yunque (8) capaz de transferir la fuerza percusiva de los medios de accionamiento de impacto oscilantes (5) al tubo conductor (5) y (v) medios (10) para inyectar fluido,

65
65

(b) colocar el montaje dentro de un tubo conductor (1) de modo que el montaje y el tubo conductor (1) puedan ser soportados por la cadena de perforación y los medios (10) para inyectar fluido en el extremo inferior del tubo conductor (1),

(c) colocar el extremo inferior del tubo conductor (1) sobre el suelo (2) en el cual va a ser colocado,

(d) accionar los medios de accionamiento de impacto oscilantes (5) para impactar el yunque (8) y colocar el tubo conductor (1) en el suelo (2),

(e) simultánea o secuencialmente inyectar fluido en la parte inferior del tubo conductor (1), de modo que éste fluya hacia arriba transportando con éste las partículas (12) que han sido forzadas hacia el tubo conductor (1), siendo removidos el fluido y las partículas de la parte superior del tubo conductor (1).

11. El método de conformidad con la reivindicación 10, caracterizado porque las partículas (12) removidas de la parte superior del tubo conductor (1) desbordan el tubo conductor (1) y sedimentan alrededor del exterior del tubo conductor (1).

12. El método de conformidad con la reivindicación 10 o la reivindicación 11, caracterizado porque el primer tubo conductor de la superficie es colocado en el suelo y

65

posteriormente se baja un segundo tubo conductor de diámetro más pequeño a través del primer tubo conductor y el segundo es entonces colocado en el suelo debajo del primer tubo conductor.

13. Un montaje en el fondo del pozo para usarse en la presente invención que comprende, unidos al extremo inferior de una cadena de perforación (3), (i) medios (4) para soportar un tubo conductor de extremos abiertos sobre la cadena de perforación, (ii) medios de accionamiento de impacto oscilantes (5), (iii) medios para hacer oscilar los medios de accionamiento de impacto oscilantes usando fluido bombeado a través de la cadena de perforación, (iv) un yunque (8) capaz de transferir la fuerza percusiva de los medios de accionamiento de impacto oscilantes (5) al tubo conductor (1) y (v) medios para inyectar fluido (10).

14. Un montaje en el fondo del pozo de conformidad con la reivindicación 13, caracterizado porque comprende además, medios para romper el suelo distribuido por los medios para inyectar fluido (10), la cual comprende al menos una cuchilla giratoria.

4 AUG 2006

Box No. VIII (iv) DECLARATION: INVENTORSHIP (only for the purposes of the designation of the United States of America)
The declaration must conform to the following standardized wording provided for in Section 214; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (iv). If this Box is not used, this sheet should not be included in the request.

**Declaration of inventorship (Rules 4.17(iv) and 51bis.1(a)(iv))
 for the purposes of the designation of the United States of America:**

I hereby declare that I believe I am the original, first and sole (if only one inventor is listed below) or joint (if more than one inventor is listed below) inventor of the subject matter which is claimed and for which a patent is sought.

This declaration is directed to the international application of which it forms a part (if filing declaration with application).

This declaration is directed to international application No. PCT/..... (if furnishing declaration pursuant to Rule 26ter).

I hereby declare that my residence, mailing address, and citizenship are as stated next to my name.

I hereby state that I have reviewed and understand the contents of the above-identified international application, including the claims of said application. I have identified in the request of said application, in compliance with PCT Rule 4.10, any claim to foreign priority, and I have identified below, under the heading "Prior Applications," by application number, country or Member of the World Trade Organization, day, month and year of filing, any application for a patent or inventor's certificate filed in a country other than the United States of America, including any PCT international application designating at least one country other than the United States of America, having a filing date before that of the application on which foreign priority is claimed.

Prior Applications:

I hereby acknowledge the duty to disclose information that is known by me to be material to patentability as defined by 37 C.F.R. § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the PCT international filing date of the continuation-in-part application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name: LUO, Yuejin

Residence: Twickenham, Middlesex
 (city and either US state, if applicable, or country)

Mailing Address: 99 River Meads Avenue, Twickenham, Middlesex, TW2.5JF, United Kingdom

Citizenship: British

Inventor's Signature: *[Signature]* Date: 31-May-06
 (The signature must be that of the inventor, not that of the agent)

Name:

Residence: ..
 (city and either US state, if applicable, or country)

Mailing Address:

Citizenship:

Inventor's Signature: Date:
 (The signature must be that of the inventor, not that of the agent)

☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iv)".

Box No. VIII (ii) DECLARATION: ENTITLEMENT TO APPLY FOR AND BE GRANTED A PATENT

The declaration must conform to the standardized wording provided for in Section 212; see Notes to Boxes Nos. VIII, VIII (i) to (iv) (in general) and the specific Notes to Box No. VIII (ii). If this Box is not used, this sheet should not be included in the request.

Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent (Rules 4.17(ii) and 51bis.1(a)(ii)), in a case where the declaration under Rule 4.17(iv) is not appropriate:

In relation to this International Application, BP EXPLORATION OPERATING COMPANY LIMITED is entitled to apply for and be granted a patent by virtue of the following:

BP EXPLORATION OPERATING COMPANY LIMITED is entitled by virtue of a contract of employment with the inventor, LUO, Yuejin.

This declaration is made for the purposes of all designations (except the United States of America).

☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (ii)".

Sheet No. 4

Box No. VIII (iv) DECLARATION: INVENTORSHIP (only for the purposes of the designation of the United States of America)
The declaration must conform to the following standardized wording provided for in Section 214; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (iv). If this Box is not used, this sheet should not be included in the request.

**Declaration of inventorship (Rules 4.17(iv) and 51bis.1(a)(iv))
 for the purposes of the designation of the United States of America:**

I hereby declare that I believe I am the original, first and sole (if only one inventor is listed below) or joint (if more than one inventor is listed below) inventor of the subject matter which is claimed and for which a patent is sought.

This declaration is directed to the international application of which it forms a part (if filing declaration with application).

This declaration is directed to international application No. PCT/..... (if furnishing declaration pursuant to Rule 26ter).

I hereby declare that my residence, mailing address, and citizenship are as stated next to my name.

I hereby state that I have reviewed and understand the contents of the above-identified international application, including the claims of said application. I have identified in the request of said application, in compliance with PCT Rule 4.10, any claim to foreign priority, and I have identified below, under the heading "Prior Applications," by application number, country or Member of the World Trade Organization, day, month and year of filing, any application for a patent or inventor's certificate filed in a country other than the United States of America, including any PCT international application designating at least one country other than the United States of America, having a filing date before that of the application on which foreign priority is claimed.

Prior Applications:

I hereby acknowledge the duty to disclose information that is known by me to be material to patentability as defined by 37 C.F.R. § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the PCT international filing date of the continuation-in-part application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name: LUO, Yuejin

Residence: Twickenham, Middlesex
 (city and either US state, if applicable, or country)

Mailing Address: 99 River Meads Avenue, Twickenham, Middlesex, TW2.5JF, United Kingdom.

Citizenship: British

Inventor's Signature: Date:
 (The signature must be that of the inventor, not that of the agent)

Name:

Residence:
 (city and either US state, if applicable, or country)

Mailing Address:

Citizenship:

Inventor's Signature: Date:
 (The signature must be that of the inventor, not that of the agent)

☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iv)".

PATENT COOPERATION TREATY

AMP
100
100

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:

HYMERS, Ronald Robson
BP INTERNATIONAL LIMITED
Patents & Agreements
Chertsey Road
Sunbury-on-Thames
Middlesex TW16 7LN
GRANDE BRETAGNE

Received in PAT

10 JAN 2007

NOTIFICATION OF RECEIPT OF DEMAND BY COMPETENT INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

(PCT Rules 59.3(e) and 61.1(b), first sentence
and Administrative Instructions, Section 601(a))

Date of mailing
(day/month/year) 08-01-2007

Applicant's or agent's file reference
BPX 10259

IMPORTANT NOTIFICATION

International application No.

PCT/GB2006/001692

International filing date (day/month/year)

09/05/2006

Priority date (day/month/year)

25/05/2005

Applicant

BP EXPLORATION OPERATING COMPANY LIMITED et al.

1. The applicant is hereby **notified** that this International Preliminary Examining Authority considers the following date as the date of receipt of the demand for international preliminary examination of the international application:

21/12/2006

2. This date of receipt is:

- ☒ the actual date of receipt of the demand by this Authority (Rule 61.1(b)).
☐ the actual date of receipt of the demand on behalf of this Authority (Rule 59.3(e)).
☐ the date on which this Authority has, in response to the invitation to correct defects in the demand (Form PCT/IPEA/404), received the required corrections.

3. ☐ **ATTENTION:** That date of receipt is **after** the expiration of 19 months from the priority date. Consequently, in respect of some Offices, the demand does not have the effect of postponing the entry into the national phase until 30 months from the priority date (or later in some Offices) (Article 39(1)) and the acts for entry into the national phase must therefore be performed within 20 months from the priority date (or later in some Offices). **However**, in respect of some other Offices, the time limit of 30 months (or later) may nevertheless apply. See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

- ☐ (If applicable) This notification confirms the information given by telephone, facsimile transmission or in person on:

Please see OJ 11/2003 and OJ 05/2004 about the PCT Reform

4. Only where paragraph 3 applies, a copy of this notification has been sent to the International Bureau.

Name and mailing address of the IPEA/

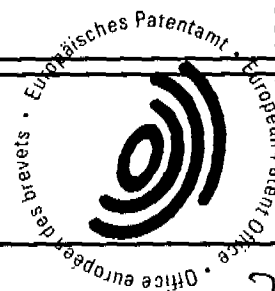


European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk - Netherlands
Tel.: (+31-70) 340-2040
Fax: (+31-70) 340-3016

Authorized officer

TSOGKA P

Tel. (+31-70) 340-3630



70

PATENT COOPERATION TREATY

PCT/GB2006/001692

19 JUL 2006

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

From the INTERNATIONAL BUREAU

To:

HYMERS, Ronald, Robson
BP International Limited
Patents & Agreements
Chertsey Road
Sunbury-on-Thames
Middlesex TW16 7LN
ROYAUME-UNI

(PCT Administrative Instructions, Section 411)

Date of mailing (day/month/year) 06 July 2006 (06.07.2006)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference BPX 10259	
International application No. PCT/GB2006/001692	International filing date (day/month/year) 09 May 2006 (09.05.2006)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 25 May 2005 (25.05.2005)
Applicant BP EXPLORATION OPERATING COMPANY LIMITED et al	

1. By means of this Form, which replaces any previously issued notification concerning submission or transmittal of priority documents, the applicant is hereby notified of the date of receipt by the International Bureau of the priority document(s) relating to all earlier application(s) whose priority is claimed. Unless otherwise indicated by the letters "NR", in the right-hand column or by an asterisk appearing next to a date of receipt, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).

2. (If applicable) The letters "NR" appearing in the right-hand column denote a priority document which, on the date of mailing of this Form, had not yet been received by the International Bureau under Rule 17.1(a) or (b). Where, under Rule 17.1(a), the priority document must be submitted by the applicant to the receiving Office or the International Bureau, but the applicant fails to submit the priority document within the applicable time limit under that Rule, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

3. (If applicable) An asterisk (*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b) (the priority document was received after the time limit prescribed in Rule 17.1(a) or the request to prepare and transmit the priority document was submitted to the receiving Office after the applicable time limit under Rule 17.1(b)). Even though the priority document was not furnished in compliance with Rule 17.1(a) or (b), the International Bureau will nevertheless transmit a copy of the document to the designated Offices, for their consideration. In case such a copy is not accepted by the designated Office as the priority document, Rule 17.1(c) provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
25 May 2005 (25.05.2005) ✓	0510670.3 ✓	GB	29 May 2006 (29.05.2006)

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer

Nora Lindner

Facsimile No. +41 22 338 82 70

Facsimile No. +41 22 338 89 65
Telephone No. +41 22 338 97 20



BP International Limited
Global Patents & Technology Law (Central)
Bldg 200, 1st Floor
Chertsey Road
Sunbury-on-Thames
Middlesex TW16 7LN
United Kingdom

Direct Telephone: +44 1932 763205
Direct Facsimile: +44 1932 762388
e-mail: formalities@uk.bp.com

European Patent Office
P.B.5818 Patentlaan 2
NL-2280 HV Rijswijk
Netherlands

2nd March 2007

PAT/RRH/kl/00/10259(2)

BY FACSIMILE

Dear Sirs

International Patent Application No. PCT/GB2006/001692
Applicant: BP Exploration Operating Company Limited
Our File: 10259

We refer to the Notification of the Transmittal of the International Search Report and the Written Opinion of the International Searching Authority dated 13 July 2006, issued in respect of the above-mentioned patent application.

The applicant wishes to amend the claims of the application and to respond to the Written Opinion.

An amended set of claims is enclosed, together with a set of claims showing the amendments made. Claims 1, 10 and 13 have been amended to specify that the conductor pipe is open-ended. This amendment is supported by the text of the application, as filed, at page 3, lines 10 to 11; page 6, lines 12 to 13 and the figure.

The written opinion states that the original claim 1 is anticipated by WO 2004/051004 (D1).

D1 relates to closed-end pile driving. The pile driving apparatus comprises a shoe tip coupled to the toe of the pile closing the toe end of the pile. A percussive hammer is deployed within the pile to transmit a force to the shoe tip.

Continued/....

During the pile-driving process, hydraulic fluid, used for driving the percussive hammer, or other fluids, such as lubricants, can be discharged from the shoe tip which closes the end of the pile.

The present invention overcomes or at least mitigates problems of known techniques for driving open-ended casing, piles or conductor pipe. The invention utilises both the reciprocable impact driving means and the simultaneous or sequential jetting into the lower part of the conductor pipe to drive the conductor into the ground. The jetting removes from the lower part of the conductor pipe the particles that have been forced into the open end of the conductor pipe. The apparatus and method disclosed in D1 does not use jetting fluid for this purpose because particles are not forced into the pile of D1 due to the shoe tip closing the lower end of the pile.

The Applicant believes that the amendments to the claims render moot the objections based on document D1.

Yours faithfully



R R Hymers
General Authorisation No. 36478

Encs.

74
74Claims:

1. Apparatus for driving open-ended conductor pipe into the ground comprising in combination:
 - (a) an open-ended conductor pipe (1) capable of being driven into the ground (2),
 - 5 (b) a drill string (3),
 - (c) means for pumping fluid through the drill string,
 - (d) means (4) for supporting the conductor pipe on the drill string,
 - (e) a reciprocable impact driving means (5) supportable by the drill string (3) within the conductor pipe (1),
 - 10 (f) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string (3),
 - (g) an anvil (8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe and
 - (h) means (10) for jetting fluid into the lower portion of the conductor pipe(1).
- 15 2. Apparatus as claimed in claim 1 which further comprises shock absorbing means (13) for reducing the percussive force transmitted between the conductor pipe (1) and the drill string (3).
3. Apparatus as claimed in either claim 1 or claim 2 in which the conductor pipe (1) has an internal shoulder (9) engageable with the anvil (8).
- 20 4. Apparatus as claimed in any one of claims 1 to 3 in which the means (10) for jetting fluid into the lower portion of the conductor pipe comprises a tubular element in fluid communication with either or both of the drill string (3) and the reciprocal impact driving means (5); the tubular element having openings (11) through which relatively high pressure fluid can pass into the lower portion of the conductor pipe (1).
- 25 5. Apparatus as claimed in any one of claims 1 to 4 in which means are provided for breaking up the soil disturbed by the means (10) for jetting fluid.
6. Apparatus as claimed in claim 5 in which the means for breaking up the soil comprises at least one rotatable blade which can be driven by fluid pumped through the drill string (3).
- 30 7. Apparatus as claimed in any one of claims 1 to 6 in which the conductor pipe (1) has external upsets.

74

95
95

8. Apparatus as claimed in any one of claims 1 to 7 in which the conductor pipe comprises two or more lengths of pipe, each successive length being of a smaller diameter than the preceding pipe.
9. Apparatus as claimed in claim 8 in which the conductor pipes are of different wall thickness.
10. A method for driving open-ended conductor pipe into the ground comprising:
- (a) assembling at the lower end of a drill string (3) (i) means (4) for supporting an open-ended conductor pipe (1) on the drill string (3), (ii) a reciprocable impact driving means (5), (iii) means for reciprocating the reciprocable impact driving means (5) using fluid pumped through the drill string (3), (iv) an anvil (8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe (1) and (v) means (10) for jetting fluid,
 - (b) positioning the assembly within a conductor pipe (1) such that the assembly and conductor pipe (1) are supportable by the drill string and the means (10) for jetting fluid is at the lower end of the conductor pipe (1),
 - (c) positioning the lower end of the conductor pipe (1) on the ground (2) into which it is to be driven,
 - (d) actuating the reciprocable impact driving means (5) to impact the anvil (8) and drive the conductor pipe (1) into the ground (2),
 - (e) simultaneously or sequentially jetting fluid into the lower part of the conductor pipe (1) such that it flows upwardly carrying with it particles (12) that have been forced into the conductor pipe (1) the fluid and particles being removed from the upper part of the conductor pipe (1).
11. A method as claimed in claim 10 in which the particles (12) removed from the upper part of the conductor pipe (1) overflow the conductor pipe (1) and settle around the outside of the conductor pipe (1).
12. A method as claimed in claim 10 or claim 11 in which a first surface conductor pipe is driven into the ground and subsequently a second conductor pipe of smaller diameter is lowered through the first conductor pipe and the second is then driven into the ground below the first conductor pipe.
13. A downhole assembly for use in the present invention comprising, attached at the lower end of a drill string (3), (i) means (4) for supporting an open-ended conductor pipe

75

~~76~~
76

on the drill string, (ii) a reciprocable impact driving means (5), (iii) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string, (iv) an anvil (8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe (1) and (v) means for jetting fluid (10).

- 5 14. A downhole assembly as claimed in claim 13 which further comprises means for breaking up the soil disturbed by the means for jetting fluid (10), which comprises at least one rotatable blade.

10

15

20

25

30

76

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/_____

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty.

For International Preliminary Examining Authority use only	
Identification of IPEA	Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION	
Applicant's or agent's file reference BPX 10259	
International application No. PCT/GB2006/001692	International filing date (day/month/year) 9th May 2006
(Earliest) Priority date (day/month/year) 25th May 2005	
Title of invention APPARATUS AND METHOD FOR DRIVING CASING OR CONDUCTOR PIPE	
Box No. II APPLICANT(S)	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) BP EXPLORATION OPERATING COMPANY LIMITED Chertsey Road Sunbury-on-Thames Middlesex, TW16 7BP United Kingdom	Telephone No. Facsimile No. Teleprinter No. Applicant's registration No. with the Office
State (that is, country) of nationality: GB	State (that is, country) of residence: GB
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) LUO, Yuejin 99 River Meads Avenue Twickenham Middlesex, TW2 5JF United Kingdom	
State (that is, country) of nationality: GB	State (that is, country) of residence: GB
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)	
State (that is, country) of nationality:	State (that is, country) of residence:
☐ Further applicants are indicated on a continuation sheet.	

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlierName and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

HYMERS, Ronald Robson
 BP INTERNATIONAL LIMITED
 Patents & Agreements
 Chertsey Road, Sunbury-on-Thames,
 Middlesex, TW16 7LN
 United kingdom

Telephone No.

01932 763205

Facsimile No.

01932 762388

Teleprinter No.

Agent's registration No. with the Office

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☐ the international application as originally filedthe description ☒ as originally filed☐ as amended under Article 34the claims ☒ as originally filed☐ as amended under Article 19 (together with any accompanying statement)☐ as amended under Article 34the drawings ☒ as originally filed☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ Where the IPEA wishes to start the international preliminary examination at the same time as the international search in accordance with Rule 69.1(b), the applicant requests the IPEA to postpone the start of the international preliminary examination until the expiration of the applicable time limit under Rule 69.1(d).4. ☐ The applicant expressly wishes the international preliminary examination to start earlier than at the expiration of the applicable time limit under Rule 54bis.1(a).

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

☒ which is the language in which the international application was filed☐ which is the language of a translation furnished for the purposes of international search☐ which is the language of publication of the international application☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination**Box No. V ELECTION OF STATES**

The filing of this demand constitutes the election of all Contracting States which are designated and are bound by Chapter II of the PCT.

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (specify) | : | sheets |

For International Preliminary Examining Authority use only

received not received

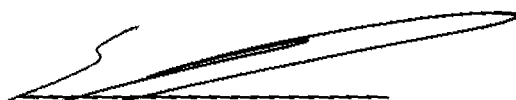
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐

The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. ☒ fee calculation sheet | 5. ☐ statement explaining lack of signature |
| 2. ☐ original separate power of attorney | 6. ☐ sequence listing in electronic form |
| 3. ☐ original general power of attorney | 7. ☐ tables in electronic form related to a sequence listing |
| 4. ☐ copy of general power of attorney; reference number, if any: | 8. ☐ other (specify): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).


DE KEZEL, Eric
Additional Representative

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the time limit of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

6. ☐ The date of receipt of the demand is AFTER the expiration of the time limit under Rule 54bis.1(a) and item 7 or 8, below, does not apply.

7. ☐ The date of receipt of the demand is WITHIN the time limit under Rule 54bis.1(a) as extended by virtue of Rule 80.5.

8. ☐ Although the date of receipt of the demand is after the expiration of the time limit under Rule 54bis.1(a), the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT

FEE CALCULATION SHEET

Annex to the Demand

International application No. Applicant's or agent's file reference BPX 10259 Applicant BP EXPLORATION OPERATING COMPANY LIMITED CALCULATION OF PRESCRIBED FEES 1. Preliminary examination fee EUR 1,595-00 P 2. Handling fee (<i>Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.</i>) EUR 129-00 H 3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box EUR 1,724-00 TOTAL	For International Preliminary Examining Authority use only Date stamp of the IPEA								
MODE OF PAYMENT (Not all modes of payment may be available at all IPEAs) <table style="width: 100%;"> <tr> <td>☒ authorization to charge deposit account with the IPEA (see below)</td> <td>☐ cash</td> </tr> <tr> <td>☐ cheque</td> <td>☐ revenue stamps</td> </tr> <tr> <td>☐ postal money order</td> <td>☐ coupons</td> </tr> <tr> <td>☐ bank draft</td> <td>☐ other (specify):</td> </tr> </table>		☒ authorization to charge deposit account with the IPEA (see below)	☐ cash	☐ cheque	☐ revenue stamps	☐ postal money order	☐ coupons	☐ bank draft	☐ other (specify):
☒ authorization to charge deposit account with the IPEA (see below)	☐ cash								
☐ cheque	☐ revenue stamps								
☐ postal money order	☐ coupons								
☐ bank draft	☐ other (specify):								
AUTHORIZATION TO CHARGE (OR CREDIT) DEPOSIT ACCOUNT (This mode of payment may not be available at all IPEAs) <table style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> ☒ Authorization to charge the total fees indicated above. ☐ (This check-box may be marked only if the conditions for deposit accounts of the IPEA so permit) Authorization to charge any deficiency or credit any overpayment in the total fees indicated above. </td> <td style="width: 50%; vertical-align: top;"> IPEA/ <u>EP</u> Deposit Account No.: <u>28050129 BP Int Ltd</u> Date: <u>20th December 2006</u> Name: <u>Anne Perry</u> Signature: <u>A.M. Perry</u> </td> </tr> </table>		☒ Authorization to charge the total fees indicated above. ☐ (This check-box may be marked only if the conditions for deposit accounts of the IPEA so permit) Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.	IPEA/ <u>EP</u> Deposit Account No.: <u>28050129 BP Int Ltd</u> Date: <u>20th December 2006</u> Name: <u>Anne Perry</u> Signature: <u>A.M. Perry</u>						
☒ Authorization to charge the total fees indicated above. ☐ (This check-box may be marked only if the conditions for deposit accounts of the IPEA so permit) Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.	IPEA/ <u>EP</u> Deposit Account No.: <u>28050129 BP Int Ltd</u> Date: <u>20th December 2006</u> Name: <u>Anne Perry</u> Signature: <u>A.M. Perry</u>								



Payment of fees and costs

European Patent Office
Directorate Cash and Accounts
D - 80298 München
Fax: (+49-89) 2399-2528

Please complete using a typewriter or a word processor

Name of payer

01 BP INTERNATIONAL LIMITED
PATENTS & AGREEMENTS DIVISION

Address

02 CHERTSEY ROAD, SUNBURY-ON-THAMES
MIDDLESEX, TW16 7LN
UNITED KINGDOM

Payer's reference

BPX 10259

Mode of payment

☐ Bank/Giro transfer¹

Bank/Giro Office

☐ Enclosed Cheque No.

☒ Debit from deposit
account with the
EPO is requested²

Deposit account No.

28050129

Patent application / Patent No. (A separate form is required for each application)

03

EP

PCT

PCT/GB2006/001692

03

	Code		Currency ³	Amount
04	001	Filing fee		
05	002	Search fee		
06	005	Designation fee(s) ⁴		
07	015	Claims fee(s) (Rule 31(1) EPC)		
08	055	Additional copy		
09	006	Examination fee		
10	007	Fee for grant including fee for printing (up to 35 pages)		
11	008	Additional fee for printing (more than 35 pages)		
12	033	Renewal fee for the 3rd year		
13	034	Renewal fee for the 4th year		
14	035	Renewal fee for the 5th year		
15		Extension fee(s) for ⁵ :		
16		Preliminary Exam Fee	EUR	1595-00
17		Handling Fee	EUR	129-00
18				
19				
20				
21				
22		Total	EUR	1,724-00

Signature

A. M. Perry

Sunbury, England 20th December 2006
Place, Date

From the INTERNATIONAL BUREAU

PCTNOTIFICATION CONCERNING
AVAILABILITY OF THE PUBLICATION
OF THE INTERNATIONAL APPLICATION

To:

HYMERS, Ronald, Robson
BP International Limited
Patents & Agreements
Chertsey Road
Sunbury-on-Thames
Middlesex TW16 7LN
ROYAUME-UNI

Received in PCT

- 5 DEC 2006

Date of mailing (day/month/year) 30 November 2006 (30.11.2006)		IMPORTANT NOTICE	
Applicant's or agent's file reference BPX 10259			
International application No. PCT/GB2006/001692	International filing date (day/month/year) 09 May 2006 (09.05.2006)	Priority date (day/month/year) 25 May 2005 (25.05.2005)	
Applicant BP EXPLORATION OPERATING COMPANY LIMITED et al			

The applicant is hereby **notified** that the International Bureau:☒ has **published** the above-indicated international application on 30 November 2006 (30.11.2006) under No. WO 2006/125948☐ has **republished** the above-indicated international application on under No. WOFor an explanation as to the reason for this republication of the international application, reference is made to INID codes (15), (48) or (88) (*as the case may be*) on the front page of the published international application.A copy of the international application is available for viewing and downloading on WIPO's website at the following address: <http://www.wipo.int/pctdb> (under "Query" enter the PCT or WO number).The applicant may also request a paper copy of the published international application from the International Bureau in writing from pct.eproducts@wipo.int or the contact details provided below.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Nora Lindner
Facsimile No. +41 22 338 82 70	e-mail: pt02@wipo.int

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
30 November 2006 (30.11.2006)

PCT

(10) International Publication Number
WO 2006/125948 A1

(51) International Patent Classification:

E21B 7/20 (2006.01) E21B 21/12 (2006.01)
E21B 43/10 (2006.01) E21B 7/18 (2006.01)

[GB/GB]; 99 River Meads Avenue, Twickenham, Middlesex TW2 5JF (GB).

(21) International Application Number:

PCT/GB2006/001692

(74) Agent: **HYMERS, Ronald, Robson**; BP International Limited, Patents & Agreements, Chertsey Road, Sunbury-on-Thames, Middlesex TW16 7LN (GB).

(22) International Filing Date: 9 May 2006 (09.05.2006)

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0510670.3 25 May 2005 (25.05.2005) GB

(71) Applicant (for all designated States except US): **BP EXPLORATION OPERATING COMPANY LIMITED**
[GB/GB]; Chertsey Road, Sun-on-Thames, Middlesex TW16 7BP (GB).

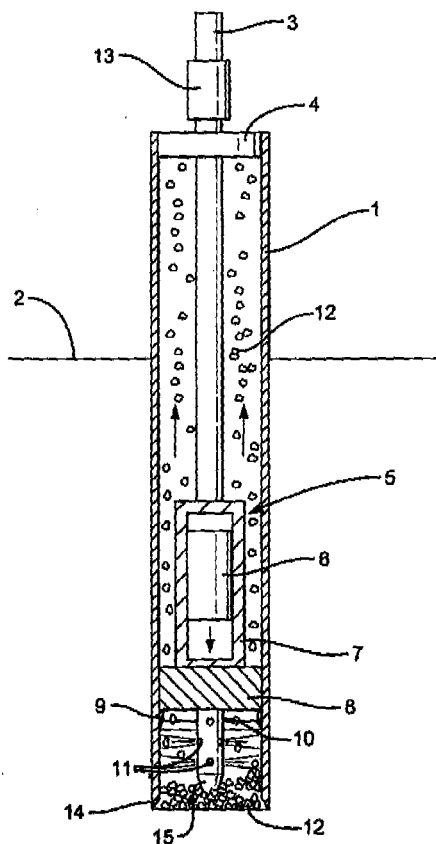
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,

(72) Inventor; and

(75) Inventor/Applicant (for US only): **LUO, Yuejin**

[Continued on next page]

(54) Title: APPARATUS AND METHOD FOR DRIVING CASING OR CONDUCTOR PIPE



(57) Abstract: A method for driving pipe (1) into the ground (2), which is particularly suitable for driving conductor pipes that are commonly installed in the hydrocarbon production industry during the construction of oil wells and gas wells, more particularly offshore wells comprises: (a) assembling at the lower end of a drill string (3), (i) means for supporting a conductor pipe on the drill string (4), (ii) a reciprocable impact driving means (5), (iii) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string, (iv) an anvil (8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe (1) and (v) means for jetting fluid (10), (b) positioning the assembly within a conductor (1) such that the assembly and conductor are supportable by the drill string and the means for jetting fluid (10) is at the lower end of the conductor (1), (c) positioning the lower end of the conductor pipe (1) on the ground (2) into which it is to be driven, (d) actuating the reciprocable impact driving means (5) to impact the anvil (8) and drive the conductor pipe (1) into the ground (2) and (e) simultaneously or sequentially jetting fluid into the lower part of the conductor pipe (1) such that it flows upwardly carrying with it particles (12) that have been forced into the conductor pipe the fluid and particles being removed from the upper part of the conductor pipe (1).



904
20

FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT,
RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— of inventorship (Rule 4.17(iv))

Published:

— with international search report

Declarations under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a
patent (Rule 4.17(ii))

For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

APPARATUS AND METHOD FOR DRIVING CASING OR CONDUCTOR PIPE

The present invention relates to apparatus and method for driving casing, piles or conductor pipe. In particular, the invention relates to apparatus and method for driving
5 conductor pipes that are commonly installed in the hydrocarbon production industry during the construction of oil wells and gas wells, more particularly offshore wells.

It is well known in the hydrocarbon production industry to line wells with a number of concentric tubes to stabilise the bores and reduce the risk of fracture of the formation while drilling with weighted mud. The top section of the well casing is generally known as
10 the conductor pipe or conductor or sometimes as the structural casing. This conductor is essentially the well foundation and has different functions throughout its life. The main requirements of the conductor are to:

- (1) Stabilize and protect the near-surface sediments during the initial top-hole drilling operations by preventing well bore collapse and fracture of the formation
15 by mud pressures.
- (2) Temporarily support the weight of the next section of casing string, usually known as the surface casing.
- (3) Act together with the cemented surface casing to resist temporary axial tensile loads, shear loads and bending moments transmitted from the riser through the
20 Blowout Preventer (BOP) while drilling the remaining sections of well.
- (4) Act together with the surface casing to resist longer term operational loads from well trees, production risers and other production facilities.

Onshore, or in shallow water, the conductor may be driven into the ground using piling techniques. However, it can be difficult to pile drive a conductor through a
25 relatively thick or deep layer of sand. Installing conductor in deep water presents additional difficulties. One method that has been proposed uses "toe-driving" of the conductor. In this method, the casing is driven into the soil by the impact of a hammer acting at the bottom or toe of the pile compared to driving with a hammer striking at the top of the pile. In one example, a specially designed tip comprises an anvil and a conical penetrating tip. The hydraulic hammer, arranged inside the casing, hits the anvil and
30 drives the conical tip into the soil. The casing is attached to the tip not rigidly but by a shock absorbing element which acts to pull the casing into the soil after the tip. The toe

driving method has not been widely used for deep water applications as it can be difficult to achieve deep penetration.

The installation of conductors in deep water usually comprises forming an oversize hole by drilling and then cementing the conductor in place or by jetting, a procedure similar to wash boring in onshore geotechnical investigations. Although the drill and cement process is widely used in relatively shallow water, the soil in deepwater can be relatively weak. Consequently, there is a tendency for the drilled hole to be filled up by soil collapsing from the sides, not only while drilling is being carried out, but also when the drillstring is pulled out for running in casing. Therefore, jetting has been the more commonly used method for deep water. Jetting is often preferred as it may be quicker and, when performed properly, more reliable than drilling and cementing in normally consolidated clay sediments. However, if not properly planned and executed, jetting may result in excessive delays and even abandonment of a well. One of the greatest risks is excessive disturbance and wetting of the soil that results in low axial capacity and excessive settlement of the conductor when the surface casing is landed on it.

In a conventional jetting method a drill pipe is run inside a length of conductor and locked to the conductor by a drill-ahead running tool. The section of drill pipe inside the conductor, generally called the bottom hole assembly may typically comprise a drill bit positioned close to the lower end of the conductor, a mud motor, measurement-while-drilling directional sensors and a series of heavy drill collars with spacers. The assembly is lowered to the seabed and the conductor is washed into place with seawater and high viscosity mud sweeps injected through the drill bit. The pressurised fluid erodes the soil inside the conductor and around the lower edge and flushes the cuttings up the annular space between the conductor and bottom hole assembly. The resulting reduced soil resistance allows the jet assembly to penetrate the seabed under the combined weight of the conductor and bottom hole assembly. If this weight is insufficient to overcome the frictional resistance, the conductor may be worked up and down (reciprocated) by several metres to wet and remould the surface of the borehole.

As the outside surface of the conductor is in direct contact with the surrounding soil throughout the installation, there may be no need for a cementing operation with jetting. The installation of the conductor relies on the surrounding soil collapsing around the outside of the conductor to support the weight of the conductor and subsequent casing

strings. Often jetting is only possible to a relatively shallow depth, typically around 80 metres below mud line, as beyond this, the soil may not collapse around the conductor sufficiently to provide the required support or may take an unacceptably long time to do so. Another potential problem of the known jetting processes is that if the soil does not

5 sufficiently consolidate around the conductor, it may not provide adequate formation isolation. This can be important when shallow formation is warmed up during subsequent drilling or production and hydrate gasifies and rises through the weak soil around the conductor to the seabed, possibly further weakening the soil and reducing its load bearing capacity.

10 The present invention overcomes or at least mitigates problems of the known techniques for driving open-ended casing, piles or conductor pipe. Although particularly useful for installing conductor pipe and more specifically for installing conductor pipe in deep water, the invention has wider application to driving tubular elements into the ground and the use in this specification of the terms "conductor" or "conductor pipe" is intended to

15 embrace such wider applications.

It is also anticipated that significant savings in time and cost are achievable by use of the process and apparatus according to the present invention as compared with the conventional method of drilling and cementing the string.

According to a first aspect of the present invention, apparatus for driving conductor

20 pipe into the ground comprises in combination:

- (a) a conductor pipe capable of being driven into the ground
- (b) a drill string
- (c) means for pumping fluid through the drill string
- (d) means for supporting the conductor pipe on the drill string
- 25 (e) a reciprocable impact driving means supportable by the drill string within the conductor pipe
- (f) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string
- (g) an anvil capable of transferring the percussive force of the reciprocable impact
- 30 driving means to the conductor pipe and
- (h) means for jetting fluid into the lower portion of the conductor pipe.

The means for pumping fluid through the drill string can conveniently be mud

pumps such as those conventionally present on drilling rigs which are used to circulate drilling muds down through the drill string and back through the annulus between the drill string and the well bore or vice versa. The use of the conventional drill string and mud pumps in the present invention simplifies the operation and minimises the disruption to rig activities.

The reciprocable impact driving means can be a hydraulic hammer similar to those already known for driving piles or hard rock drilling. A hammer suitable for use in relatively deep water would typically be able to provide an impact of about 100 to 250 kJ. For shallower water a less powerful hammer may be suitable, for example, a hammer capable of providing an impact of about 30 to 100kJ. The means for reciprocating the impact driving means is actuated by the fluid pumped through the drill string. The use of fluid pumped through the drill string obviates the need for separate hydraulic lines to drive the hammer.

The reciprocable driving means impacts an anvil which is capable of transferring the percussive force of the reciprocable driving means to the conductor pipe. Suitably, the conductor pipe has an internal shoulder engageable with the anvil.

Suitable means for supporting the conductor pipe on the drill string and the means for supporting the reciprocable impact driving means are known. The conductor pipe and/or the reciprocable impact driving means can be directly or indirectly supported by the drill string.

Preferably, the apparatus further comprises shock absorbing means for reducing the percussive force transmitted between the conductor pipe and the drill string. For example, a shock absorber can be included in the drill string above the means for attaching the conductor pipe to the drill string. In this way the forces resulting from the impact of the driving means are not fully transmitted to the whole drill string.

The means for jetting fluid into the lower portion of the conductor pipe comprises a tubular element in fluid communication with either or both of the drill string and the reciprocal impact driving means; the tubular element having holes through which relatively high pressure fluid can pass into the lower portion of the conductor pipe. Preferably, the means for jetting fluid is arranged such that the jets are directed substantially wholly within the conductor. Thus, for example, the jets may be directed radially towards the inner wall of the conductor pipe and more preferable are directed substantially perpendicularly

88 89

towards the inner wall of the conductor, for example up to 20 degrees above or below the horizontal plane. Preferably the jets are directed up to 15 degrees below the horizontal plane.

Optionally, a means for breaking up the soil disturbed by the fluid jets may be provided, such as, for example, at least one rotatable blade. Preferably the means for breaking up the soil is positioned adjacent the means for jetting fluid into the lower portion of the conductor pipe. For example, the jetting sub may have at least one rotatable blade that can break up the soil as it is disturbed by the fluid jets. This will facilitate removal of the soil. The rotatable blades could be provided with a separate power source to rotate them, e.g. an electric or hydraulic motor. Preferably, the rotatable blades are driven by fluid flowing through the drill string.

Although the fluid jets are the primary method for removing the soil from within the conductor pipe, this may be supplemented by the use of another drilling device. For example, a conventional rotatable drill bit driven by a downhole motor may be used to drill into the soil to facilitate the action of the fluid jets.

According to a second aspect of the invention, a method for driving conductor pipe into the ground comprises:

- (a) assembling at the lower end of a drill string (i) means for supporting a conductor pipe on the drill string, (ii) a reciprocable impact driving means, (iii) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string, (iv) an anvil capable of transferring the percussive force of the reciprocable impact driving means to the conductor pipe and (v) means for jetting fluid
 - (b) positioning the assembly within a conductor such that the assembly and conductor are supportable by the drill string and the means for jetting fluid is at the lower end of the conductor
 - (c) positioning the lower end of the conductor pipe on the ground into which it is to be driven
 - (d) actuating the reciprocable impact driving means to impact the anvil and drive the conductor pipe into the ground
 - (e) simultaneously or sequentially jetting fluid into the lower part of the conductor pipe such that it flows upwardly carrying with it particles that have been forced into the
- 89

conductor pipe the fluid and particles being removed from the upper part of the conductor pipe.

According to a third aspect of the present invention, a downhole assembly for use in the present invention comprises, attached at the lower end of a drill string, (i) means for
5 supporting a conductor pipe on the drill string, (ii) a reciprocable impact driving means, (iii) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string, (iv) an anvil capable of transferring the percussive force of the reciprocable impact driving means to the conductor pipe and (v) means for jetting fluid.

The present invention will be described, by way of example, with respect to the
10 accompanying drawing which is a schematic sectional representation of apparatus according to the present invention.

The Figure shows an open-ended conductor pipe (1) partially driven into the seabed (2). The conductor pipe (1) is supported on a drill string (3) by means of a make-up tool (4). The lower edge (14) of the conductor pipe (1) is chamfered to assist penetration of the
15 conductor pipe (1) into the soil. A reciprocable impact driving means (5) is also supported on the drill string (3) within the conductor pipe (1). The reciprocable impact driving means (5) comprises a hydraulically actuated hammer element (6) which can be moved within a housing (7).

Fluid is pumped down the drill string (3) by means of mud pumps (not shown)
20 located on a drilling rig (not shown) to actuate the reciprocable impact driving means (5). The fluid lifts the hammer element (6) and then it is allowed to fall under the influence of gravity alone or assisted by the pumped fluid. The fluid used may conveniently be drilling mud and/or seawater. Suitable mechanisms to actuate and control the reciprocable impact driving means will be apparent to a person skilled in the art and may, for example, be
25 similar to the known hydraulic hammers for hard rock drilling. Optionally, the pumped fluids may be used to drive mud motors that can be used to mechanically actuate the hammer element (6).

The housing (7) of the reciprocable impact driving means (5) is positioned on an anvil (8) which in turn rests on an internal shoulder (9) within the conductor pipe (1).
30 When the hammer element (6) of the reciprocable impact driving means (5) falls, it strikes the bottom of the housing (7) transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe (1) via the anvil (8) and shoulder (9). The anvil

(8) can be separate from or integral with the housing (7). The anvil (8) may be fixed to the conductor pipe (1).

Below the anvil (8) and in fluid communication with the drill string (3) and/or the housing (7) of the reciprocable impact driving means (4), is a jetting sub (10). The jetting sub (10) comprises a tubular element with openings therein which allow pressurised fluid to be released into the bottom of the conductor tube (1) in the form of jets. The jets of fluid emerging from the openings (11) loosen the soil which has entered the bottom of the conductor pipe (1). The drilling cuttings (12) are entrained in the fluid and move upwardly through the annulus between the drill string and the conductor pipe (1) and are removed from the upper part of the conductor pipe (1). The equipment, including the makeup tool (4) and anvil (8) has passages which allow the fluid and drill cuttings to pass through.

A shock absorber means (13) is included in the drill string above the make-up tool (4). Suitable shock absorbing means are known. The shock absorbing means reduces the forces transmitted to the drill string from the impact of the impact driving means (5) on the conductor pipe (1).

The fluid and associated drilling cuttings may be lifted to the surface and passed over a screen to separate the solids from the fluid. The fluid may then be reused.

In an alternative, and preferred embodiment, the fluid may be water or another environmentally acceptable fluid and the fluid and associated drill cuttings are simply allowed to overflow the conductor pipe (1) such that the solids settle around the outside of the conductor pipe (1). This arrangement may assist in the consolidation of the soil around the conductor pipe (1).

The bottom of the jetting sub (10) shown in the figure has a conical end 15 which assists with the penetration of the jetting sub into the soil.

The impact driving means (5) and the jetting means (10) can be used simultaneously or sequentially. It may, for example, be convenient to drive the conductor into the soil a short distance using the impact driving means (5), stop the reciprocation of the impact driving means (5) and then use the jetting sub (10) to loosen and remove the soil that has entered the bottom of the conductor pipe (1) before stopping the jetting and recommencing the reciprocation of the impact driving means (5).

The apparatus and method according to the present invention is likely to cause less damage to the surrounding soil as the conductor pipe is driven into the seabed. The open-

ended conductor wall will cut into the seabed and, as the soil is removed from inside the conductor pipe, the disturbance to the surrounding soil is reduced as compared with known jetting techniques. This should result in the surrounding soil being able to provide immediate load bearing capacity, or at least significantly reducing the length of time that must be allowed to achieve sufficient consolidation of the surrounding soil.

The present invention can also provide the possibility of achieving greater setting depth. Since the soil within the conductor pipe is removed, the resistance to driving will only be the soil friction on the outside wall. This external wall friction can be further reduced by increasing surface smoothness, e.g. by the use of friction reducing paints or coatings. Where the conductor pipe comprises separate sections joined together, i.e. the conductor is a conductor string, they may conveniently be joined using external upset connectors. The use of external upset connectors or indeed external upsets which are not connectors on the external wall of the conductor can result in reduced soil friction, which can be particularly useful in relatively firm subterranean formations. Specially designed conductor connectors or other upsets which have a suitable external upset profile, e.g. a smooth profile, may also be used to reduce the soil friction around the conductor pipe body.

Modelling has shown that it will be possible to drive the conductor pipe to depths of at least 300m based on the conditions found in typical Gulf of Mexico and other oil producing regions. The greater depth can further mitigate the problems associated with shallow hazards such as shallow water flow regions, hydrate layers and weak soil layers. Furthermore, if an even greater depth is required, e.g. in excess of 300m, and the formation conditions allow, the apparatus and method of the present invention can be used in a multistage driving process in which a smaller diameter conductor pipe is lowered through an installed conductor pipe and the second is then driven in to the ground below the first. Thus, both a surface casing and an intermediate casing may be installed using the process of the present invention by driving a first surface conductor or conductor string into the ground and then installing through the first conductor or conductor string a second conductor or conductor string. The conductor pipe can comprise two or more lengths of pipe, each successive length being of a smaller diameter than the preceding pipe so that it can be passed through the preceding pipe to the location of installation. The lengths of pipe can be of the same or different wall thickness.

The greater load carrying capacity of the conductor pipe that can be achieved using the apparatus and method of the present invention may obviate the need for a conductor liner on some deepwater wells. This would provide a significant cost saving.

5

10

15

20

25

30

7/4
9/4Claims:

1. Apparatus for driving conductor pipe into the ground comprising in combination:
 - (a) a conductor pipe (1) capable of being driven into the ground (2),
 - (b) a drill string (3),
 - 5 (c) means for pumping fluid through the drill string,
 - (d) means (4) for supporting the conductor pipe on the drill string,
 - (e) a reciprocable impact driving means (5) supportable by the drill string (3) within the conductor pipe (1),
 - (f) means for reciprocating the reciprocable impact driving means using fluid pumped
 - 10 through the drill string (3),
 - (g) an anvil (8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe and
 - (h) means (10) for jetting fluid into the lower portion of the conductor pipe(1).
2. Apparatus as claimed in claim 1 which further comprises shock absorbing means
- 15 (13) for reducing the percussive force transmitted between the conductor pipe (1) and the drill string (3).
3. Apparatus as claimed in either claim 1 or claim 2 in which the conductor pipe (1) has an internal shoulder (9) engageable with the anvil (8).
4. Apparatus as claimed in any one of claims 1 to 3 in which the means (10) for
- 20 jetting fluid into the lower portion of the conductor pipe comprises a tubular element in fluid communication with either or both of the drill string (3) and the reciprocal impact driving means (5); the tubular element having openings (11) through which relatively high pressure fluid can pass into the lower portion of the conductor pipe (1).
5. Apparatus as claimed in any one of claims 1 to 4 in which means are provided for
- 25 breaking up the soil disturbed by the means (10) for jetting fluid.
6. Apparatus as claimed in claim 5 in which the means for breaking up the soil comprises at least one rotatable blade which can be driven by fluid pumped through the drill string (3).
7. Apparatus as claimed in any one of claims 1 to 6 in which the conductor pipe (1)
- 30 has external upsets.
8. Apparatus as claimed in any one of claims 1 to 7 in which the conductor pipe comprises two or more lengths of pipe, each successive length being of a smaller diameter

94

than the preceding pipe.

9. Apparatus as claimed in claim 8 in which the conductor pipes are of different wall thickness.

10. A method for driving conductor pipe into the ground comprising:

- 5 (a) assembling at the lower end of a drill string (3) (i) means (4) for supporting a conductor pipe (1) on the drill string (3), (ii) a reciprocable impact driving means (5), (iii) means for reciprocating the reciprocable impact driving means (5) using fluid pumped through the drill string (3), (iv) an anvil (8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor
- 10 pipe (1) and (v) means (10) for jetting fluid,
- (b) positioning the assembly within a conductor pipe(1) such that the assembly and conductor pipe (1) are supportable by the drill string and the means (10) for jetting fluid is at the lower end of the conductor pipe (1),
- (c) positioning the lower end of the conductor pipe (1) on the ground (2) into which it
- 15 is to be driven,
- (d) actuating the reciprocable impact driving means (5) to impact the anvil (8) and drive the conductor pipe (1) into the ground (2),
- (e) simultaneously or sequentially jetting fluid into the lower part of the conductor pipe (1) such that it flows upwardly carrying with it particles (12) that have been forced
- 20 into the conductor pipe (1) the fluid and particles being removed from the upper part of the conductor pipe (1).

11. A method as claimed in claim 10 in which the particles (12) removed from the upper part of the conductor pipe (1) overflow the conductor pipe (1) and settle around the outside of the conductor pipe (1).

25 12. A method as claimed in claim 10 or claim 11 in which a first surface conductor pipe is driven into the ground and subsequently a second conductor pipe of smaller diameter is lowered through the first conductor pipe and the second is then driven into the ground below the first conductor pipe.

13. A downhole assembly for use in the present invention comprising, attached at the

30 lower end of a drill string (3), (i) means (4) for supporting a conductor pipe on the drill string, (ii) a reciprocable impact driving means (5), (iii) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string, (iv) an anvil

96
96

(8) capable of transferring the percussive force of the reciprocable impact driving means (5) to the conductor pipe (1) and (v) means for jetting fluid (10).

14. A downhole assembly as claimed in claim 13 which further comprises means for breaking up the soil disturbed by the means for jetting fluid (10), which comprises at least
5 one rotatable blade.

10

15

20

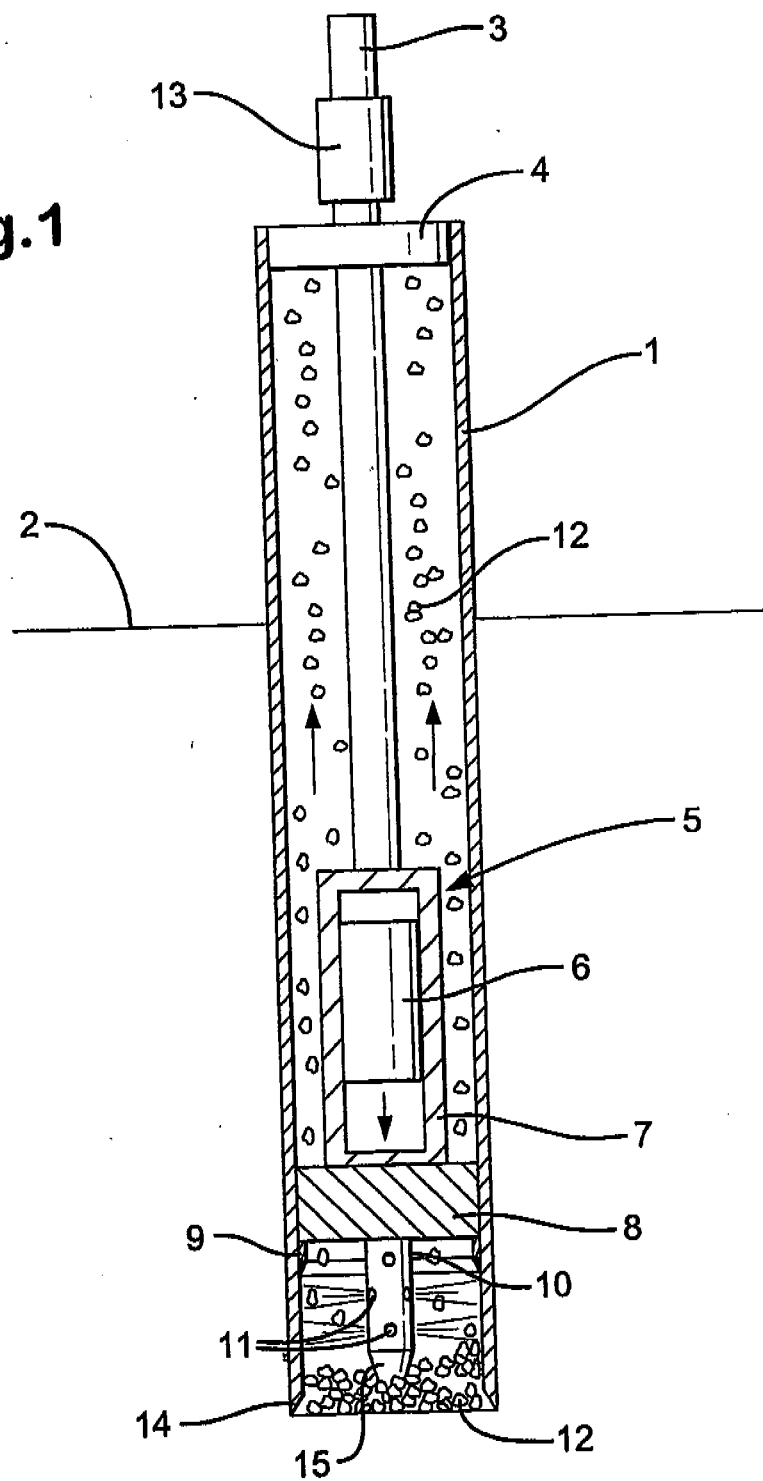
25

30

96

1/1

Fig.1



INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/001692

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B7/20 E21B43/10 E21B21/12 E21B7/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E21B E02D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004/051004 A (BJ SERVICES COMPANY; BELL, DOUGLAS, B; MUELLER, DAN, T; GRAY-STEPHENS,) 17 June 2004 (2004-06-17)	1, 10, 13
Y	page 3, line 6 - line 18; figures 1, 2, 11 page 5, line 10 - line 18 page 5, line 32 - page 6, line 9	2-6, 8, 9, 11, 12, 14
Y	US 4 702 325 A (HIPP ET AL) 27 October 1987 (1987-10-27) column 2, line 21 - line 55; figures 6, 7	2, 5, 6, 11, 14
Y	GB 2 358 036 A (BILLY JAMES * ROBERTS; WILLIAM HAROLD * STRONG; * SMITH INTERNATIONAL,) 11 July 2001 (2001-07-11) page 13, line 18 - page 14, line 28; figures 12, 13	3
	----- -/-	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

5 July 2006

Date of mailing of the international search report

13/07/2006

Name and mailing address of the ISA/
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Dantinne, P

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/001692

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3 376 922 A (JR. ERNST LEONHARDT,) 9 April 1968 (1968-04-09) column 3, line 7 - line 13; figure 2 -----	4
Y	WO 2004/001180 A (SAIPEM S.A; ANRES, STEPHANE; HOPPER, HANS, P) 31 December 2003 (2003-12-31) figures 1-4 -----	8,9,12
A	DE 42 17 293 A1 (KIPP, JENS-WERNER, 4800 BIELEFELD, DE; KIPP, JENS WERNER, 33659 BIELEF) 26 November 1992 (1992-11-26) abstract; figures 1,5 -----	1,10,13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2006/001692

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2004051004 A	17-06-2004	AU 2003295996 A1 EP 1567724 A2	23-06-2004 31-08-2005
US 4702325 A	27-10-1987	AU 4815285 A BR 8504890 A CA 1240310 A1 CN 85108013 A DK 230685 A GB 2165283 A IT 1182895 B NL 8501190 A NO 851464 A SE 8501718 A	10-04-1986 22-07-1986 09-08-1988 10-05-1986 05-04-1986 09-04-1986 05-10-1987 01-05-1986 07-04-1986 05-04-1986
GB 2358036 A	11-07-2001	NONE	
US 3376922 A	09-04-1968	GB 1162430 A	27-08-1969
WO 2004001180 A	31-12-2003	AU 2003260605 A1 BR 0311923 A EP 1525371 A1 FR 2841293 A1 US 2005152749 A1	06-01-2004 29-03-2005 27-04-2005 26-12-2003 14-07-2005
DE 4217293 A1	26-11-1992	NONE	

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference
(if desired) (12 characters maximum) BPX 10259

Box No. I TITLE OF INVENTION APPARATUS AND METHOD FOR DRIVING CASING OR CONDUCTOR PIPE	
Box No. II APPLICANT ☐ This person is also inventor	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) BP EXPLORATION OPERATING COMPANY LIMITED Chertsey Road Sunbury-on-Thames Middlesex, TW16 7BP United Kingdom	
Telephone No.	
Facsimile No.	
Teleprinter No.	
Applicant's registration No. with the Office	
State (that is, country) of nationality: GB	State (that is, country) of residence: GB
This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	
Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) LUO, Yuejin 99 River Meads Avenue Twickenham Middlesex, TW2 5JF United Kingdom	
This person is: ☐ applicant only ☒ applicant and inventor ☐ inventor only (If this check-box is marked, do not fill in below.)	
Applicant's registration No. with the Office	
State (that is, country) of nationality: GB	State (that is, country) of residence: GB
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box	
☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.	
Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE	
The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) HYMERS, Ronald Robson BP INTERNATIONAL LIMITED Patents & Agreements Chertsey Road, Sunbury-on-Thames, Middlesex, TW16 7LN United Kingdom	
Telephone No. 01932 763205	
Facsimile No. 01932 762388	
Teleprinter No.	
Agent's registration No. with the Office	
☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.	

Box No. V DESIGNATIONS

The filing of this request constitutes under Rule 4.9(a), the designation of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents. However,

- ☐ DE Germany is not designated for any kind of national protection
☐ JP Japan is not designated for any kind of national protection
☐ KR Republic of Korea is not designated for any kind of national protection
☐ RU Russian Federation is not designated for any kind of national protection

(The check-boxes above may only be used to exclude (irrevocably) the designations concerned if, at the time of filing, the international application contains in Box No. VI a priority claim to an earlier national application filed in the particular State concerned, in order to avoid the ceasing of the effect, under the national law, of this earlier national application. See the Notes to Box No. V as to the consequences of such national law provisions in these States).

Box No. VI PRIORITY CLAIM

The priority of the following earlier application(s) is hereby claimed:

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country or Member of WTO	regional application:* regional Office	international application: receiving Office
item (1) (25.05.05) 25th May 2005	0510670.3	GB		
item (2)				
item (3)				

☐ Further priority claims are indicated in the Supplemental Box.

The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of this international application is the receiving Office) identified above as:

☐ all items ☒ item (1) ☐ item (2) ☐ item (3) ☐ other, see Supplemental Box

* Where the earlier application is an ARIPO application, indicate at least one country party to the Paris Convention for the Protection of Industrial Property or one Member of the World Trade Organization for which that earlier application was filed (Rule 4.10(b)(ii)):

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

ISA / .EP

Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year) Number Country (or regional Office)

Box No. VIII DECLARATIONS

The following declarations are contained in Boxes Nos. VIII (i) to (v) (mark the applicable check-boxes below and indicate in the right column the number of each type of declaration):

		Number of declarations
☐ Box No. VIII (i)	Declaration as to the identity of the inventor	:
☒ Box No. VIII (ii)	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	: 1
☐ Box No. VIII (iii)	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	:
☒ Box No. VIII (iv)	Declaration of inventorship (only for the purposes of the designation of the United States of America)	: 1
☐ Box No. VIII (v)	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	:

Box No. VIII (ii) DECLARATION: ENTITLEMENT TO APPLY FOR AND BE GRANTED A PATENT

The declaration must conform to the standardized wording provided for in Section 212; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (ii). If this Box is not used, this sheet should not be included in the request.

Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent (Rules 4.17(ii) and 51 bis.1(a)(ii)), in a case where the declaration under Rule 4.17(iv) is not appropriate:

In relation to this International Application, BP EXPLORATION OPERATING COMPANY LIMITED is entitled to apply for and be granted a patent by virtue of the following:

BP EXPLORATION OPERATING COMPANY LIMITED is entitled by virtue of a contract of employment with the inventor, LUO, Yuejin.

This declaration is made for the purposes of all designations (except the United States of America).

☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (ii)".

Box No. VIII (iv) DECLARATION: INVENTORSHIP (only for the purposes of the designation of the United States of America)
The declaration must conform to the following standardized wording provided for in Section 214; see Notes to Boxes Nos. VIII, VIII (i) to (v) (in general) and the specific Notes to Box No. VIII (iv). If this Box is not used, this sheet should not be included in the request.

**Declaration of inventorship (Rules 4.17(iv) and 51bis.1(a)(iv))
for the purposes of the designation of the United States of America:**

I hereby declare that I believe I am the original, first and sole (if only one inventor is listed below) or joint (if more than one inventor is listed below) inventor of the subject matter which is claimed and for which a patent is sought.

This declaration is directed to the international application of which it forms a part (if filing declaration with application).

This declaration is directed to international application No. PCT/..... (if furnishing declaration pursuant to Rule 26ter).

I hereby declare that my residence, mailing address, and citizenship are as stated next to my name.

I hereby state that I have reviewed and understand the contents of the above-identified international application, including the claims of said application. I have identified in the request of said application, in compliance with PCT Rule 4.10, any claim to foreign priority, and I have identified below, under the heading "Prior Applications," by application number, country or Member of the World Trade Organization, day, month and year of filing, any application for a patent or inventor's certificate filed in a country other than the United States of America, including any PCT international application designating at least one country other than the United States of America, having a filing date before that of the application on which foreign priority is claimed.

Prior Applications:

I hereby acknowledge the duty to disclose information that is known by me to be material to patentability as defined by 37 C.F.R. § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the PCT international filing date of the continuation-in-part application.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name: LUO, Yuejin

Residence: Twickenham, Middlesex
(city and either US state, if applicable, or country)

Mailing Address: 99 River Meads Avenue, Twickenham, Middlesex, TW2.5JF, United Kingdom.

Citizenship: British

Inventor's Signature: *[Signature]* Date: 31-May-06
(The signature must be that of the inventor, not that of the agent)

Name:

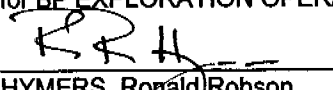
Residence:

Mailing Address:

Citizenship:

Inventor's Signature: Date:
(The signature must be that of the inventor, not that of the agent)

☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (iv)".

Box No. IX CHECK LIST; LANGUAGE OF FILING																																																					
This international application contains: (a) on paper, the following number of sheets: request (including declaration sheets) : 5 description (excluding sequence listing and/or tables related thereto) : 9 claims : 3 abstract : 1 drawings : 1 Sub-total number of sheets : 19 sequence listing : tables related thereto : <i>(for both, actual number of sheets if filed on paper, whether or not also filed in electronic form; see (c) below)</i> Total number of sheets : 19 (b) ☐ only in electronic form (Section 801(a)(i)) (i) ☐ sequence listing (ii) ☐ tables related thereto (c) ☐ also in electronic form (Section 801(a)(ii)) (i) ☐ sequence listing (ii) ☐ tables related thereto Type and number of carriers (diskette, CD-ROM, CD-R or other) on which are contained the ☐ sequence listing: ☐ tables related thereto: <i>(additional copies to be indicated under items 9(ii) and/or 10(ii), in right column)</i>	This international application is accompanied by the following item(s) <i>(mark the applicable check-boxes below and indicate in right column the number of each item)</i>: <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">1. ☒</td> <td style="width: 85%;">fee calculation sheet</td> <td style="width: 10%; text-align: right;">1</td> </tr> <tr> <td>2. ☒</td> <td>original separate power of attorney</td> <td style="text-align: right;">1</td> </tr> <tr> <td>3. ☐</td> <td>original general power of attorney</td> <td style="text-align: right;"></td> </tr> <tr> <td>4. ☒</td> <td>copy of general power of attorney; reference number, if any:</td> <td style="text-align: right;">1</td> </tr> <tr> <td>5. ☐</td> <td>statement explaining lack of signature</td> <td style="text-align: right;"></td> </tr> <tr> <td>6. ☐</td> <td>priority document(s) identified in Box No. VI as item(s):</td> <td style="text-align: right;"></td> </tr> <tr> <td>7. ☐</td> <td>translation of international application into (language):</td> <td style="text-align: right;"></td> </tr> <tr> <td>8. ☐</td> <td>separate indications concerning deposited microorganism or other biological material</td> <td style="text-align: right;"></td> </tr> <tr> <td>9. ☐</td> <td>sequence listing in electronic form <i>(indicate type and number of carriers)</i></td> <td style="text-align: right;"></td> </tr> <tr> <td style="padding-left: 15px;">(i) ☐</td> <td>copy submitted for the purposes of international search under Rule 13ter only (and not as part of the international application) :</td> <td style="text-align: right;"></td> </tr> <tr> <td style="padding-left: 15px;">(ii) ☐</td> <td><i>(only where check-box (b)(i) or (c)(i) is marked in left column)</i> additional copies including, where applicable, the copy for the purposes of international search under Rule 13ter :</td> <td style="text-align: right;"></td> </tr> <tr> <td style="padding-left: 15px;">(iii) ☐</td> <td>together with relevant statement as to the identity of the copy or copies with the sequence listing mentioned in left column :</td> <td style="text-align: right;"></td> </tr> <tr> <td>10. ☐</td> <td>tables in electronic form related to sequence listing <i>(indicate type and number of carriers)</i></td> <td style="text-align: right;"></td> </tr> <tr> <td style="padding-left: 15px;">(i) ☐</td> <td>copy submitted for the purposes of international search under Section 802(b-quater) only (and not as part of the international application) :</td> <td style="text-align: right;"></td> </tr> <tr> <td style="padding-left: 15px;">(ii) ☐</td> <td><i>(only where check-box (b)(ii) or (c)(ii) is marked in left column)</i> additional copies including, where applicable, the copy for the purposes of international search under Section 802(b-quater) :</td> <td style="text-align: right;"></td> </tr> <tr> <td style="padding-left: 15px;">(iii) ☐</td> <td>together with relevant statement as to the identity of the copy or copies with the tables mentioned in left column :</td> <td style="text-align: right;"></td> </tr> <tr> <td>11. ☒</td> <td>other <i>(specify)</i>: Form 23/77.....</td> <td style="text-align: right;"></td> </tr> </table>	1. ☒	fee calculation sheet	1	2. ☒	original separate power of attorney	1	3. ☐	original general power of attorney		4. ☒	copy of general power of attorney; reference number, if any:	1	5. ☐	statement explaining lack of signature		6. ☐	priority document(s) identified in Box No. VI as item(s):		7. ☐	translation of international application into (language):		8. ☐	separate indications concerning deposited microorganism or other biological material		9. ☐	sequence listing in electronic form <i>(indicate type and number of carriers)</i>		(i) ☐	copy submitted for the purposes of international search under Rule 13ter only (and not as part of the international application) :		(ii) ☐	<i>(only where check-box (b)(i) or (c)(i) is marked in left column)</i> additional copies including, where applicable, the copy for the purposes of international search under Rule 13ter :		(iii) ☐	together with relevant statement as to the identity of the copy or copies with the sequence listing mentioned in left column :		10. ☐	tables in electronic form related to sequence listing <i>(indicate type and number of carriers)</i>		(i) ☐	copy submitted for the purposes of international search under Section 802(b-quater) only (and not as part of the international application) :		(ii) ☐	<i>(only where check-box (b)(ii) or (c)(ii) is marked in left column)</i> additional copies including, where applicable, the copy for the purposes of international search under Section 802(b-quater) :		(iii) ☐	together with relevant statement as to the identity of the copy or copies with the tables mentioned in left column :		11. ☒	other <i>(specify)</i> : Form 23/77.....		Number of items
1. ☒	fee calculation sheet	1																																																			
2. ☒	original separate power of attorney	1																																																			
3. ☐	original general power of attorney																																																				
4. ☒	copy of general power of attorney; reference number, if any:	1																																																			
5. ☐	statement explaining lack of signature																																																				
6. ☐	priority document(s) identified in Box No. VI as item(s):																																																				
7. ☐	translation of international application into (language):																																																				
8. ☐	separate indications concerning deposited microorganism or other biological material																																																				
9. ☐	sequence listing in electronic form <i>(indicate type and number of carriers)</i>																																																				
(i) ☐	copy submitted for the purposes of international search under Rule 13ter only (and not as part of the international application) :																																																				
(ii) ☐	<i>(only where check-box (b)(i) or (c)(i) is marked in left column)</i> additional copies including, where applicable, the copy for the purposes of international search under Rule 13ter :																																																				
(iii) ☐	together with relevant statement as to the identity of the copy or copies with the sequence listing mentioned in left column :																																																				
10. ☐	tables in electronic form related to sequence listing <i>(indicate type and number of carriers)</i>																																																				
(i) ☐	copy submitted for the purposes of international search under Section 802(b-quater) only (and not as part of the international application) :																																																				
(ii) ☐	<i>(only where check-box (b)(ii) or (c)(ii) is marked in left column)</i> additional copies including, where applicable, the copy for the purposes of international search under Section 802(b-quater) :																																																				
(iii) ☐	together with relevant statement as to the identity of the copy or copies with the tables mentioned in left column :																																																				
11. ☒	other <i>(specify)</i> : Form 23/77.....																																																				
Figure of the drawings which should accompany the abstract: 1	Language of filing of the international application: English																																																				
Box No. X SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE <i>Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).</i> for BP EXPLORATION OPERATING COMPANY LIMITED  HYMERS, Ronald Robson Authorised Agent																																																					

For receiving Office use only	
1. Date of actual receipt of the purported international application:	2. Drawings: ☐ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	
5. International Searching Authority (if two or more are competent): ISA /	6. ☐ Transmittal of search copy delayed until search fee is paid
For International Bureau use only	
Date of receipt of the record copy by the International Bureau:	

PATENT COOPERATION TREATY

RR 106

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

BP INTERNATIONAL LIMITED
Patents & Agreements
Attn. Hymers, Ronald Robson
Chertsey Road, Sunbury-on-Thames
Middlesex, TW16 7LN
UNITED KINGDOM

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT AND
THE WRITTEN OPINION OF THE INTERNATIONAL
SEARCHING AUTHORITY, OR THE DECLARATION

13 JUL 2006

(PCT Rule 44.1)

Date of mailing
(day/month/year)

13/07/2006

Applicant's or agent's file reference

BPX 10259

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/GB2006/001692

International filing date
(day/month/year)

09/05/2006

Applicant

BP EXPLORATION OPERATING COMPANY LIMITED

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the International Search Report.

Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: (41-22) 338.82.70

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.
3. ☐ **With regard to the protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

- ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.
- ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. Reminders

Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. These comments would also be made available to the public but not before the expiration of 30 months from the priority date.

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the *PCT Applicant's Guide*, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Nathalie De Greef

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the *PCT Applicant's Guide*, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions, respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report and the written opinion of the International Searching Authority, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only (see *PCT Applicant's Guide*, Volume I/A, Annexes B1 and B2).

The attention of the applicant is drawn to the fact that amendments to the claims under Article 19 are not allowed where the International Searching Authority has declared, under Article 17(2), that no international search report would be established (see *PCT Applicant's Guide*, Volume I/A, paragraph 296).

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference BPX 10259	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/GB2006/001692	International filing date (day/month/year) 09/05/2006	(Earliest) Priority Date (day/month/year) 25/05/2005
Applicant BP EXPLORATION OPERATING COMPANY LIMITED		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:



the international application in the language in which it was filed



a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box No. II)

3. ☐ **Unity of invention is lacking** (see Box No. III)

4. With regard to the **title**,



the text is approved as submitted by the applicant



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,



the text is approved as submitted by the applicant



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings**,

a. the figure of the **drawings** to be published with the abstract is Figure No. 1



as suggested by the applicant



as selected by this Authority, because the applicant failed to suggest a figure



as selected by this Authority, because this figure better characterizes the invention

b. ☐ none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2006/001692

A. CLASSIFICATION OF SUBJECT MATTER

INV. E21B7/20 E21B43/10 E21B21/12 E21B7/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

E21B E02D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004/051004 A (BJ SERVICES COMPANY; BELL, DOUGLAS, B; MUELLER, DAN, T; GRAY-STEPHENS,) 17 June 2004 (2004-06-17)	1, 10, 13
Y	page 3, line 6 - line 18; figures 1, 2, 11 page 5, line 10 - line 18 page 5, line 32 - page 6, line 9	2-6, 8, 9, 11, 12, 14
Y	US 4 702 325 A (HIPPE ET AL) 27 October 1987 (1987-10-27) column 2, line 21 - line 55; figures 6, 7	2, 5, 6, 11, 14
Y	GB 2 358 036 A (BILLY JAMES * ROBERTS; WILLIAM HAROLD * STRONG; * SMITH INTERNATIONAL,) 11 July 2001 (2001-07-11) page 13, line 18 - page 14, line 28; figures 12, 13	3
	----- -/-	

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

5 July 2006

Date of mailing of the international search report

13/07/2006

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Dantinne, P

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2006/001692

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3 376 922 A (JR. ERNST LEONHARDT,) 9 April 1968 (1968-04-09) column 3, line 7 - line 13; figure 2 -----	4
Y	WO 2004/001180 A (SAIPEM S.A; ANRES, STEPHANE; HOPPER, HANS, P) 31 December 2003 (2003-12-31) figures 1-4 -----	8,9,12
A	DE 42 17 293 A1 (KIPP, JENS-WERNER, 4800 BIELEFELD, DE; KIPP, JENS WERNER, 33659 BIELEF) 26 November 1992 (1992-11-26) abstract; figures 1,5 -----	1,10,13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2006/001692

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2004051004	A	17-06-2004	AU 2003295996 A1 EP 1567724 A2	23-06-2004 31-08-2005
US 4702325	A	27-10-1987	AU 4815285 A BR 8504890 A CA 1240310 A1 CN 85108013 A DK 230685 A GB 2165283 A IT 1182895 B NL 8501190 A NO 851464 A SE 8501718 A	10-04-1986 22-07-1986 09-08-1988 10-05-1986 05-04-1986 09-04-1986 05-10-1987 01-05-1986 07-04-1986 05-04-1986
GB 2358036	A	11-07-2001	NONE	
US 3376922	A	09-04-1968	GB 1162430 A	27-08-1969
WO 2004001180	A	31-12-2003	AU 2003260605 A1 BR 0311923 A EP 1525371 A1 FR 2841293 A1 US 2005152749 A1	06-01-2004 29-03-2005 27-04-2005 26-12-2003 14-07-2005
DE 4217293	A1	26-11-1992	NONE	

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

see form PCT/ISA/220

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/GB2006/001692

International filing date (day/month/year)
09.05.2006

Priority date (day/month/year)
25.05.2005

International Patent Classification (IPC) or both national classification and IPC
INV. E21B7/20 E21B43/10 E21B21/12 E21B7/18

Applicant
BP EXPLORATION OPERATING COMPANY LIMITED

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



European Patent Office - P.B. 5818 Patentlaag 2
NL-2280 HV Rijswijk - Pays Bas
Tel. +31 70 340 - 2040 Tx: 31 651 epo nl
Fax: +31 70 340 - 3016

Date of completion of
this opinion

See form
PCT/ISA/210

Authorized Officer

Dantinne, P

Telephone No. +31 70 340-3396



**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/GB2006/001692

435
113

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ on paper
 - ☐ in electronic form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in electronic form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

113

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/GB2006/001692

**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or
industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	2-9,11,12,14
	No: Claims	1,10,13
Inventive step (IS)	Yes: Claims	
	No: Claims	1-14
Industrial applicability (IA)	Yes: Claims	1-14
	No: Claims	

2. Citations and explanations

see separate sheet

Re Item V.

1 Reference is made to the following documents:

- D1 : WO 2004/051004 A (BJ SERVICES COMPANY; BELL, DOUGLAS, B; MUELLER, DAN, T; GRAY-STEPHENS,) 17 June 2004
- D2: US-A-4 702 325 (HIPPE ET AL) 27 October 1987
- D3: GB-A-2 358 036 (BILLY JAMES ROBERTS; WILLIAM HAROLD STRONG; SMITH INTERNATIONAL,) 11 July 2001
- D4: US-A-3 376 922 (JR. ERNST LEONHARDT,) 9 April 1968
- D5: WO 2004/001180 A (SAIPEM S.A; ANRES, STEPHANE; HOPPER, HANS, P) 31 December 2003

2 INDEPENDENT CLAIM 1

2.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.

Document D1 discloses (the references in parentheses applying to this document; see figure 1 and 2):

Apparatus for driving conductor pipe into the ground comprising in combination:

- (a) a conductor pipe (103) capable of being driven into the ground (215),
- (b) a drill string (112),
- (c) means for pumping fluid through the drill string,
- (d) means (115) for supporting the conductor pipe on the drill string,
- (e) a reciprocable impact driving means (118) supportable by the drill string (112) within the conductor pipe (103),
- (f) means for reciprocating the reciprocable impact driving means using fluid pumped through the drill string (112),
- (g) an anvil (109) capable of transferring the percussive force of the reciprocable impact driving means (118) to the conductor pipe and
- (h) means (see page 5 line 32-37) for jetting fluid into the lower portion of the

conductor pipe(103).

3 DEPENDENT CLAIMS 2-9,11,12,14

Dependent claims 2-9,11,12,14 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT) for the following reasons:

Claims 2,11: see D2 column 10 line 5 - 14.

Claim 3: see D3 figure 13.

Claim 4: see D4 figure 2.

Claims 5,6,14: see D2 figure 7.

Claim 7: obvious choice to reduce friction.

Claims 8,9,12: see D5.

- 4** Since the subject-matter of each of independent claims 10, 13 corresponds to the subject matter of claim 1, the same reasoning as given for claim 1 will apply mutatis mutandis.

11/17

(12) **UK Patent Application** (19) **GB** (11) **2 358 036** (13) **A**

(43) Date of A Publication 11.07.2001

(21) Application No 0100338.3

(22) Date of Filing 08.01.2001

(30) Priority Data

(31) 60174861 (32) 07.01.2000 (33) US

(71) Applicant(s)

Billy James Roberts
5107 Forest Haven Drive, Houston, Texas 77066,
United States of America

William Harold Strong
3518 Richland Park Drive, Richmond, Texas 77066,
United States of America

(72) Inventor(s)

Billy James Roberts
William Harold Strong

(74) Agent and/or Address for Service

Barker Brettell
138 Hagley Road, Edgbaston, BIRMINGHAM,
B16 9PW, United Kingdom

(51) INT CL⁷

E21B 19/00

(52) UK CL (Edition S)

E1H HEA
E1F FGR FGR2

(56) Documents Cited

GB 2206628 A **US 4191494 A**

(58) Field of Search

UK CL (Edition S) E1F FGR, E1H HEA
INT CL⁷ E21B 19/00
Online EPODOC JAPIO WPI

(54) Abstract Title

Assembly and installation of a drive pipe to an offshore drilling site

(57) A process for assembling a drive pipe 5 for use at an offshore drill site comprises assembling the drive pipe onshore by fitting pipe sections (10, Fig 1) end to end, floating the drive pipe in a neutrally buoyant condition and towing it out to the offshore drill site, attaching the upper end of the floating drive pipe to a drilling vessel 40 at the offshore drill site and sinking the drive pipe until it is in a vertical orientation and its weight is fully supported by the drilling vessel and deploying the drive pipe to the ocean floor using a drill string (14, Fig 11). The drive pipe may be floated by attaching buoyancy elements 25 to it, or by sealing an interior gas filled cavity of the drive pipe. The drive pipe may be sunk by reducing the buoyancy of said elements or by breaching the gas filled interior cavity.

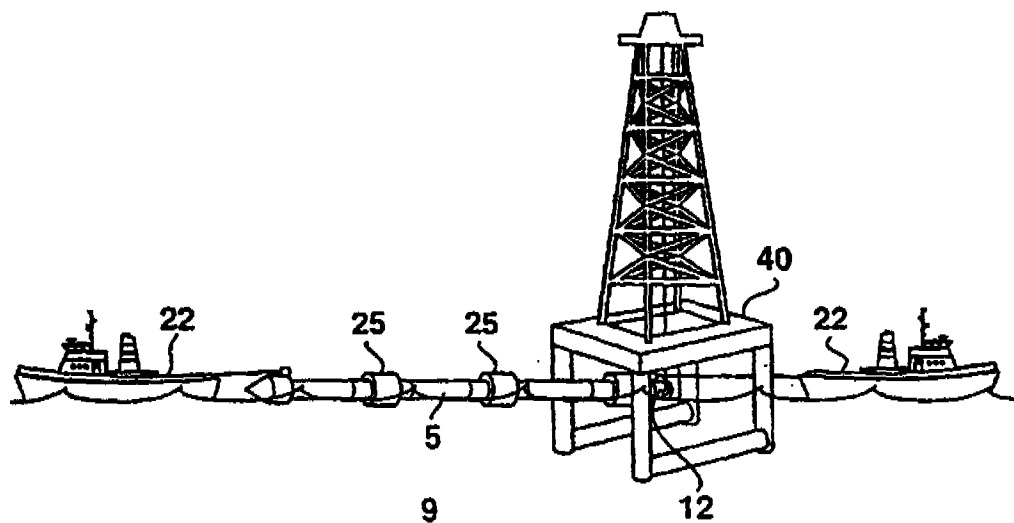


Fig. 5

GB 2 358 036 A

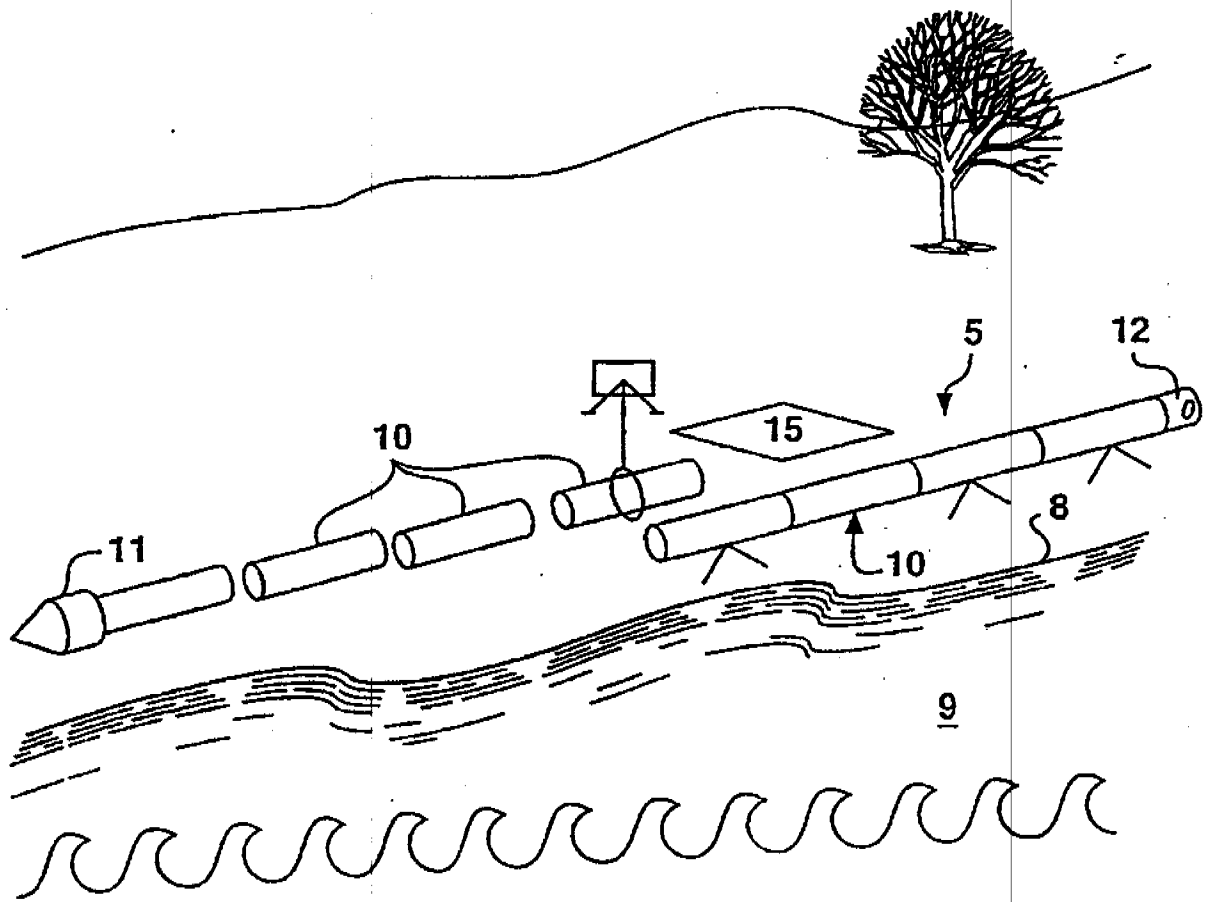


Fig. 1

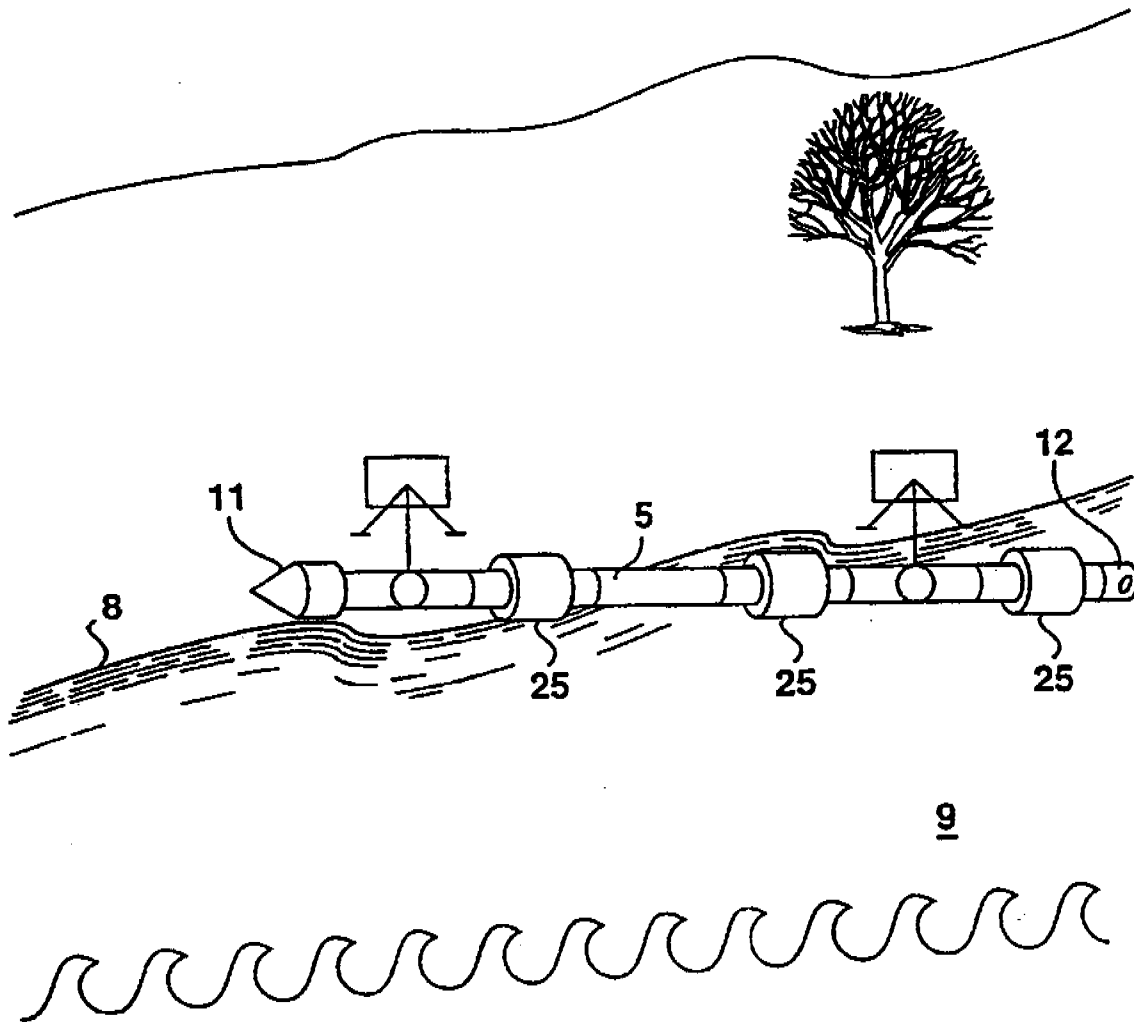


Fig. 2

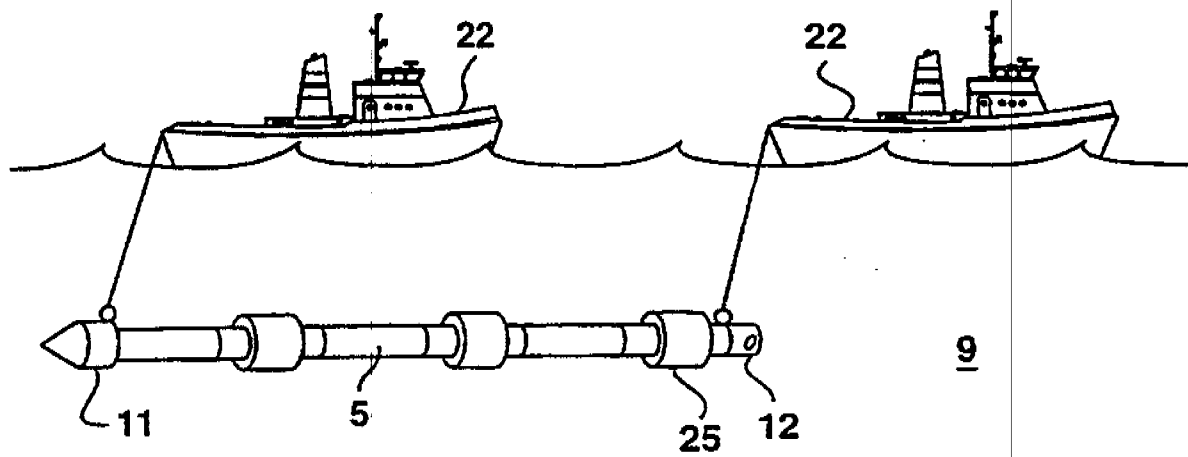


Fig. 3

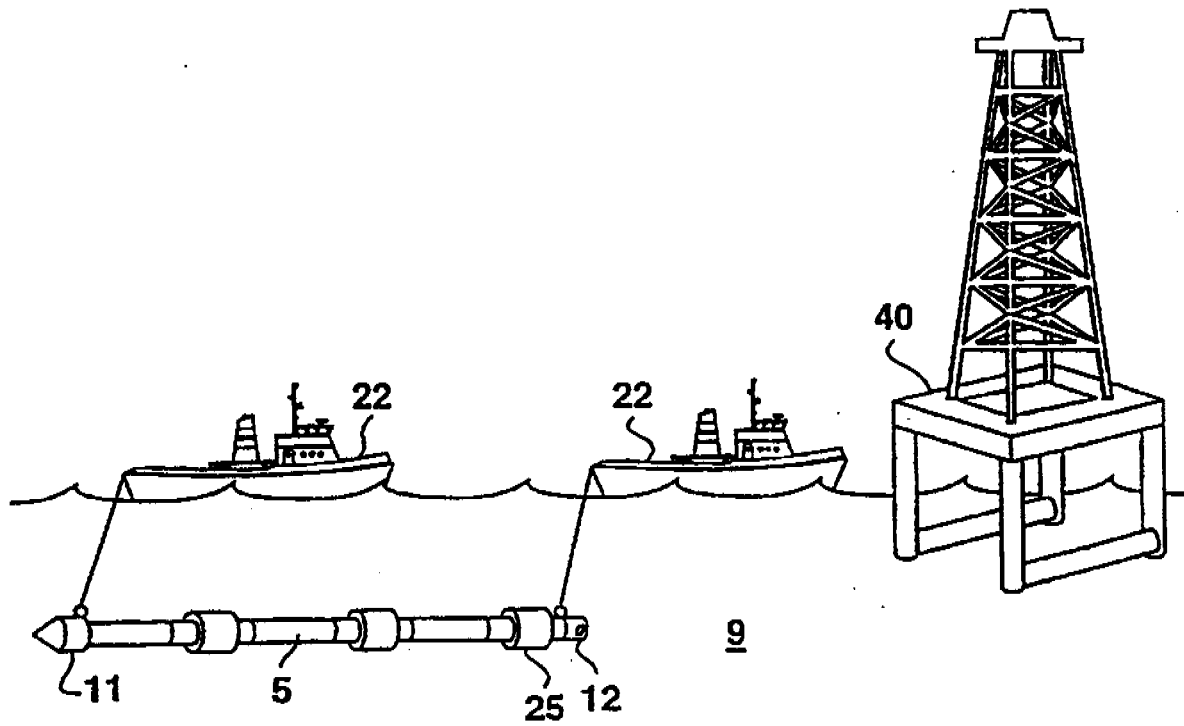


Fig. 4

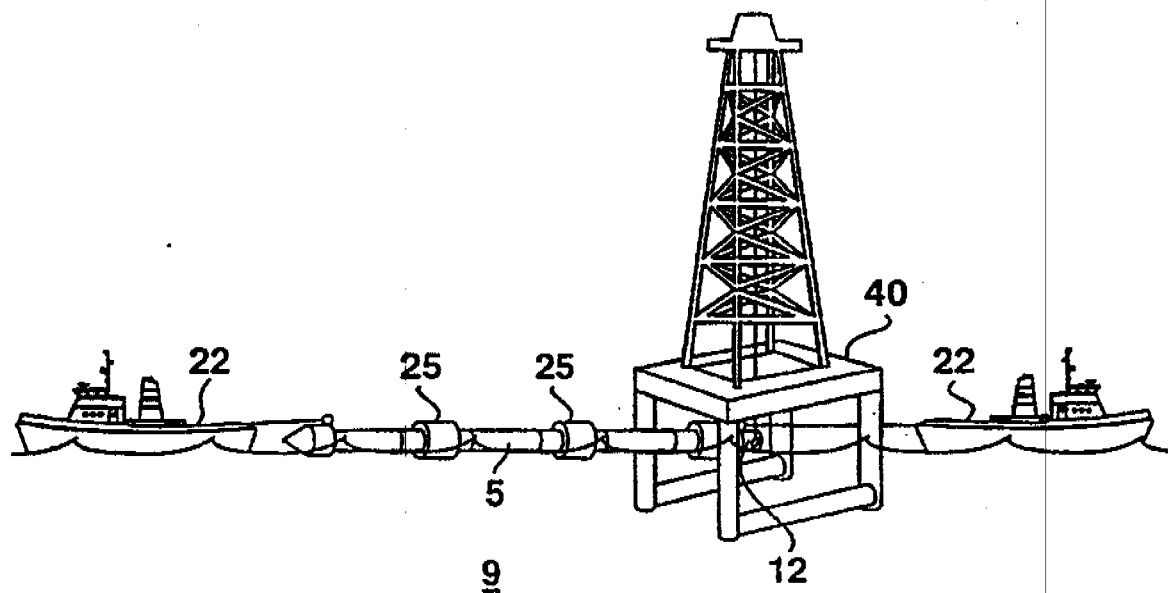


Fig. 5

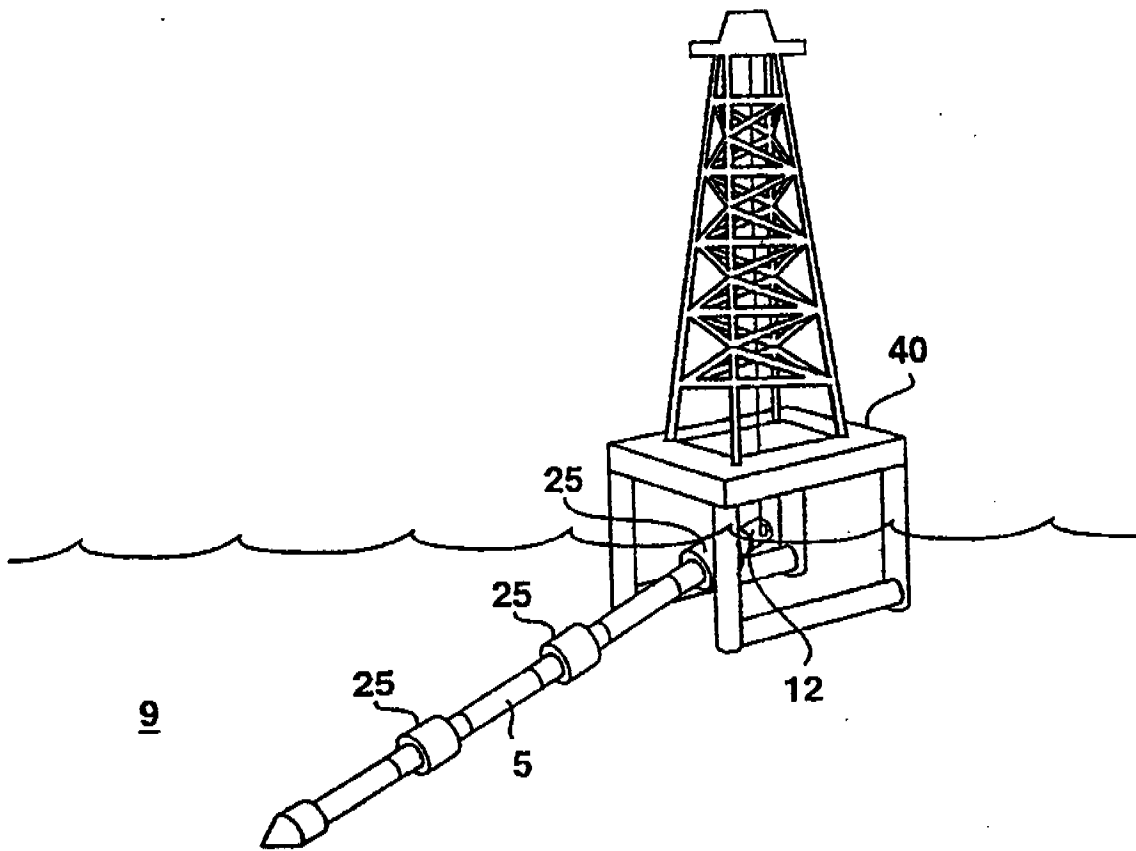


Fig. 6

120

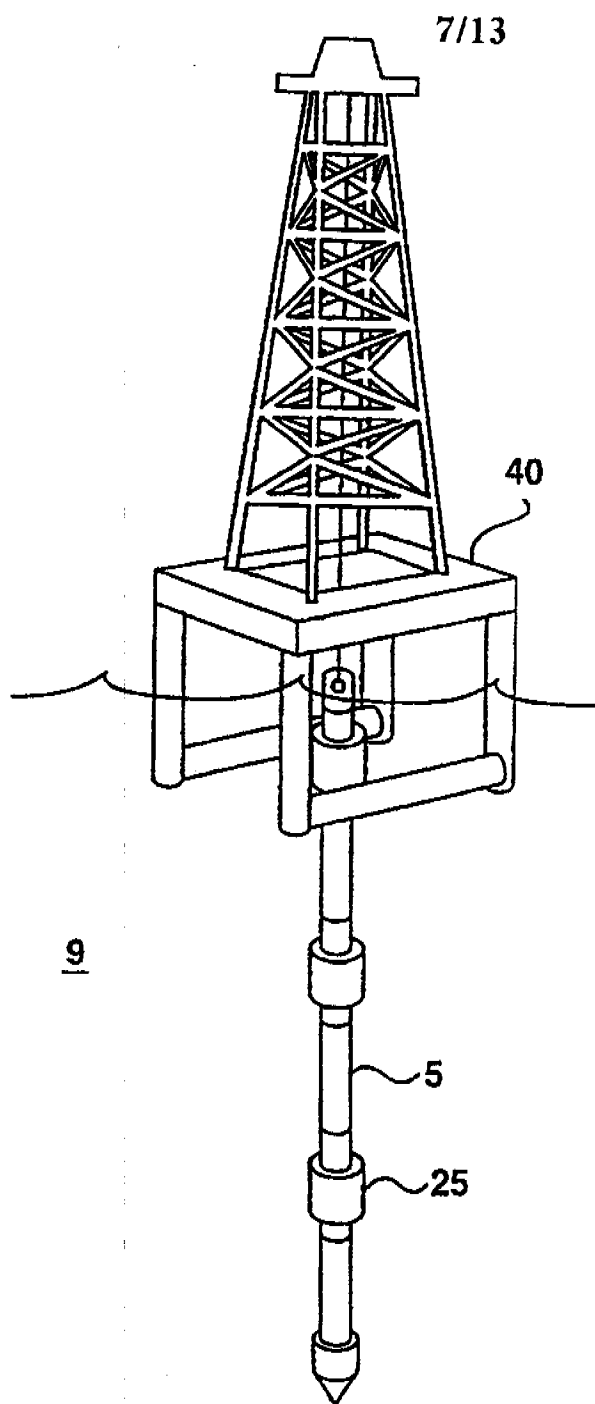


Fig. 7

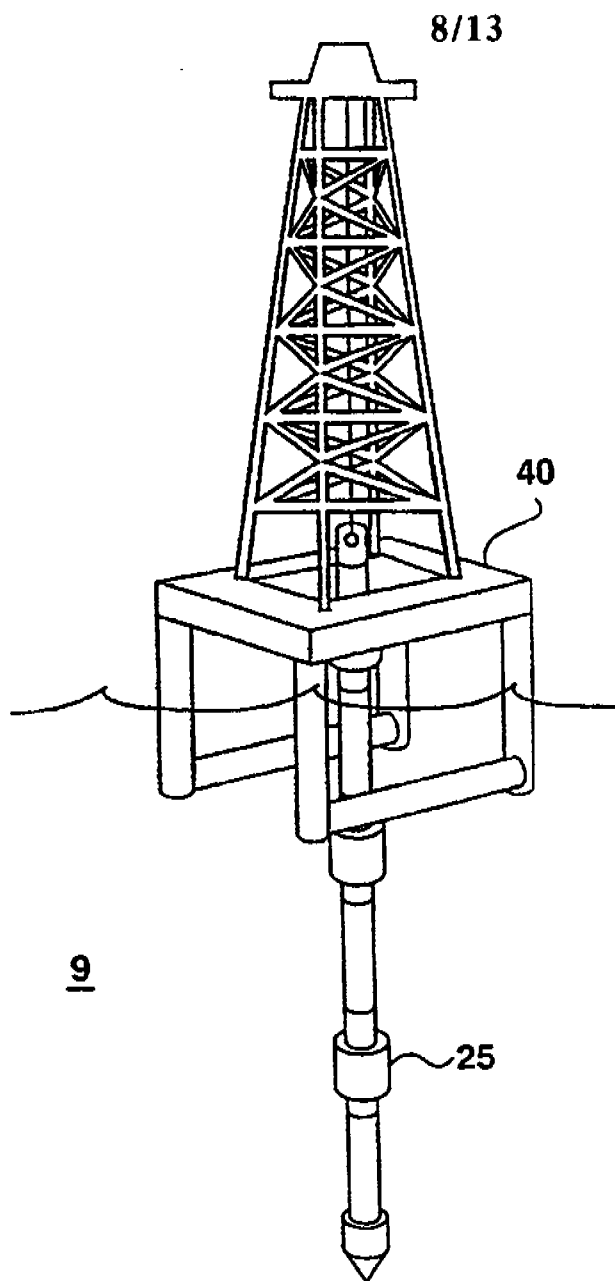


Fig. 8

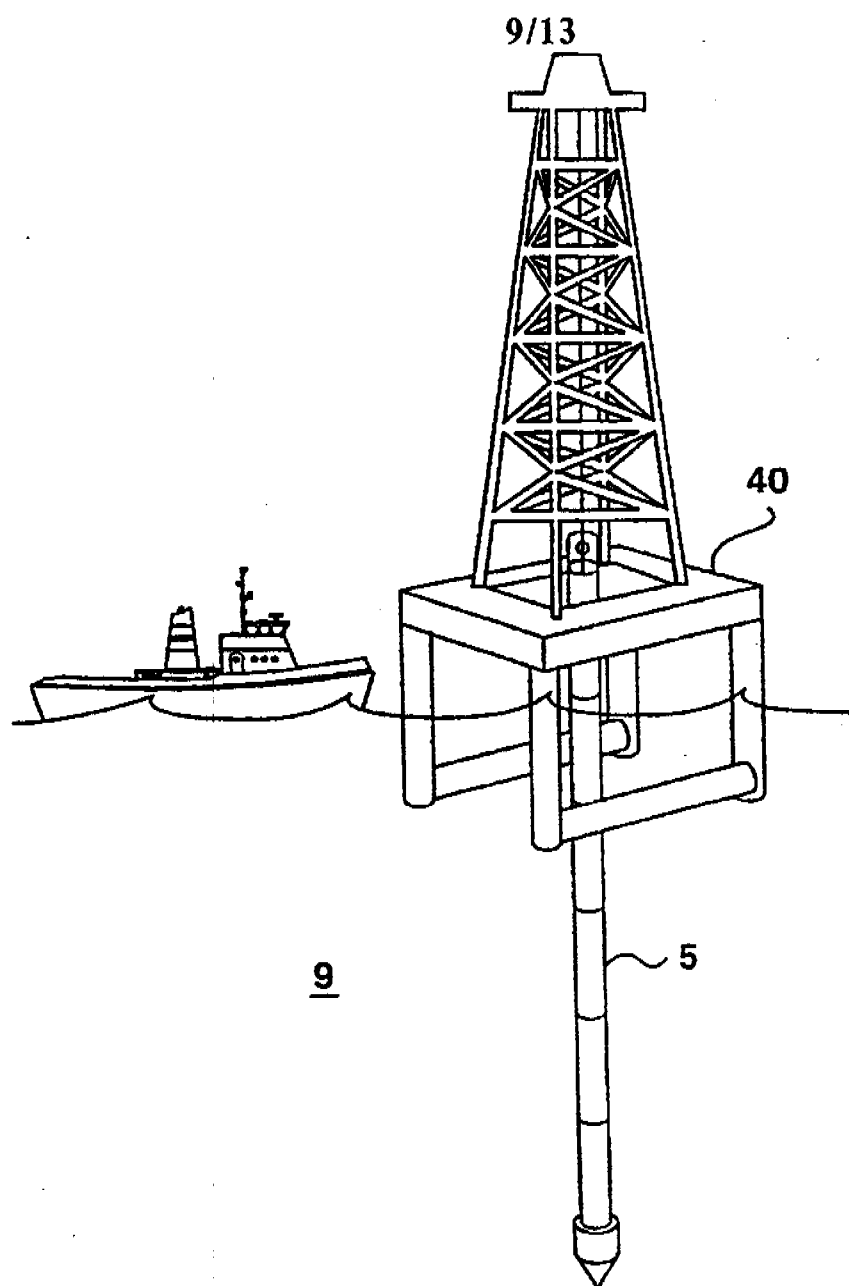


Fig. 9

122

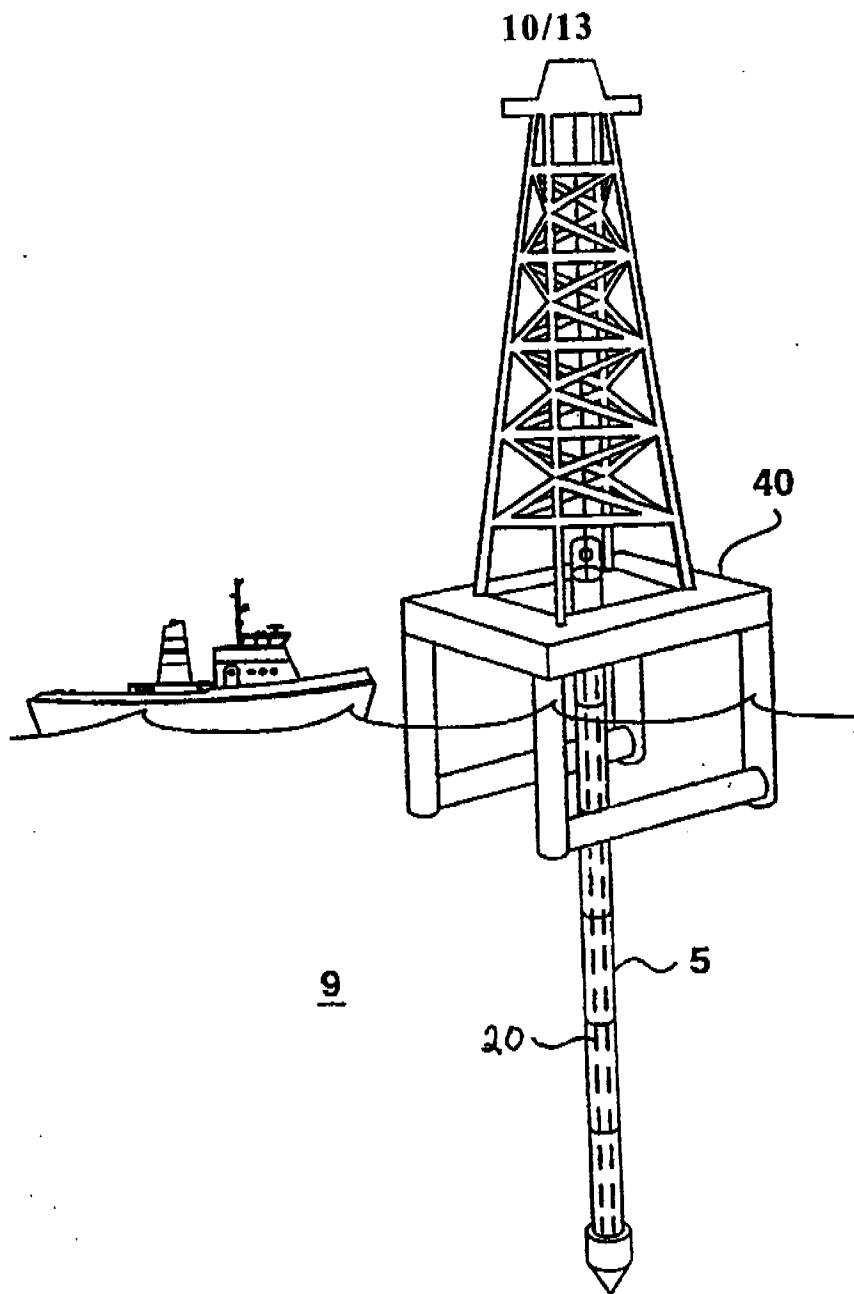


Fig. 10

122

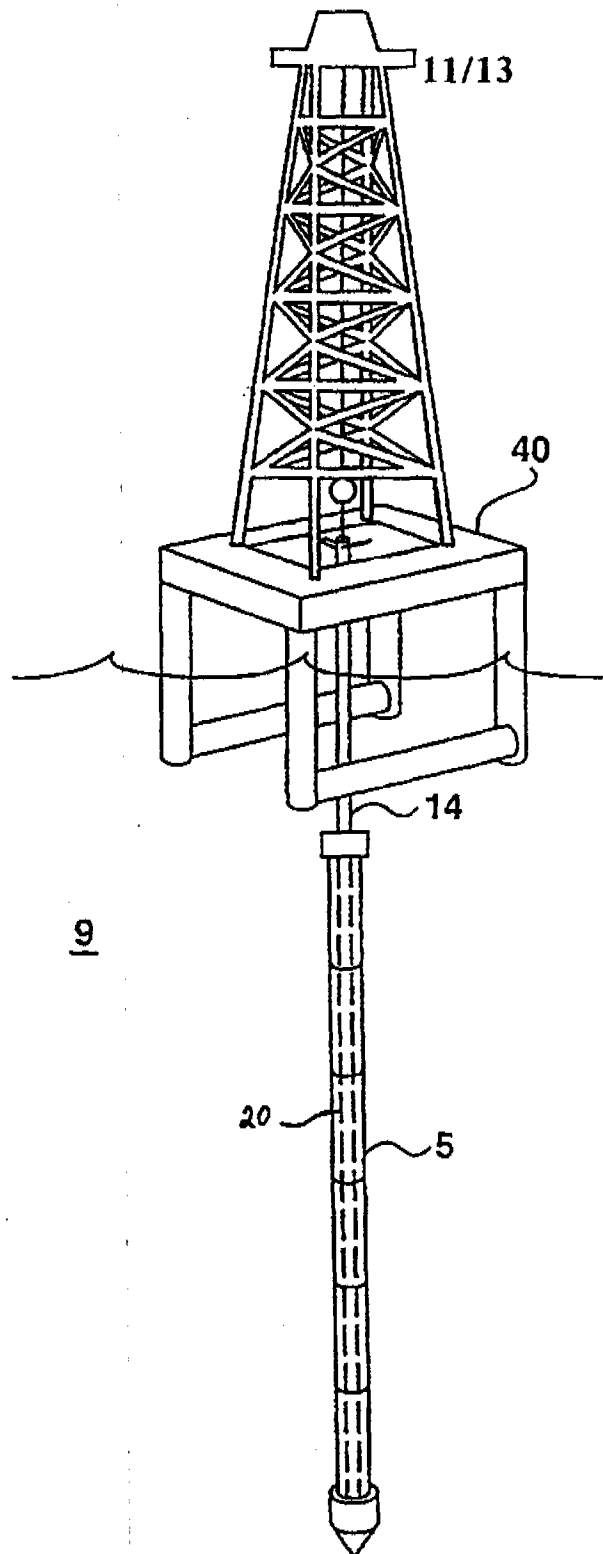


Fig. 11

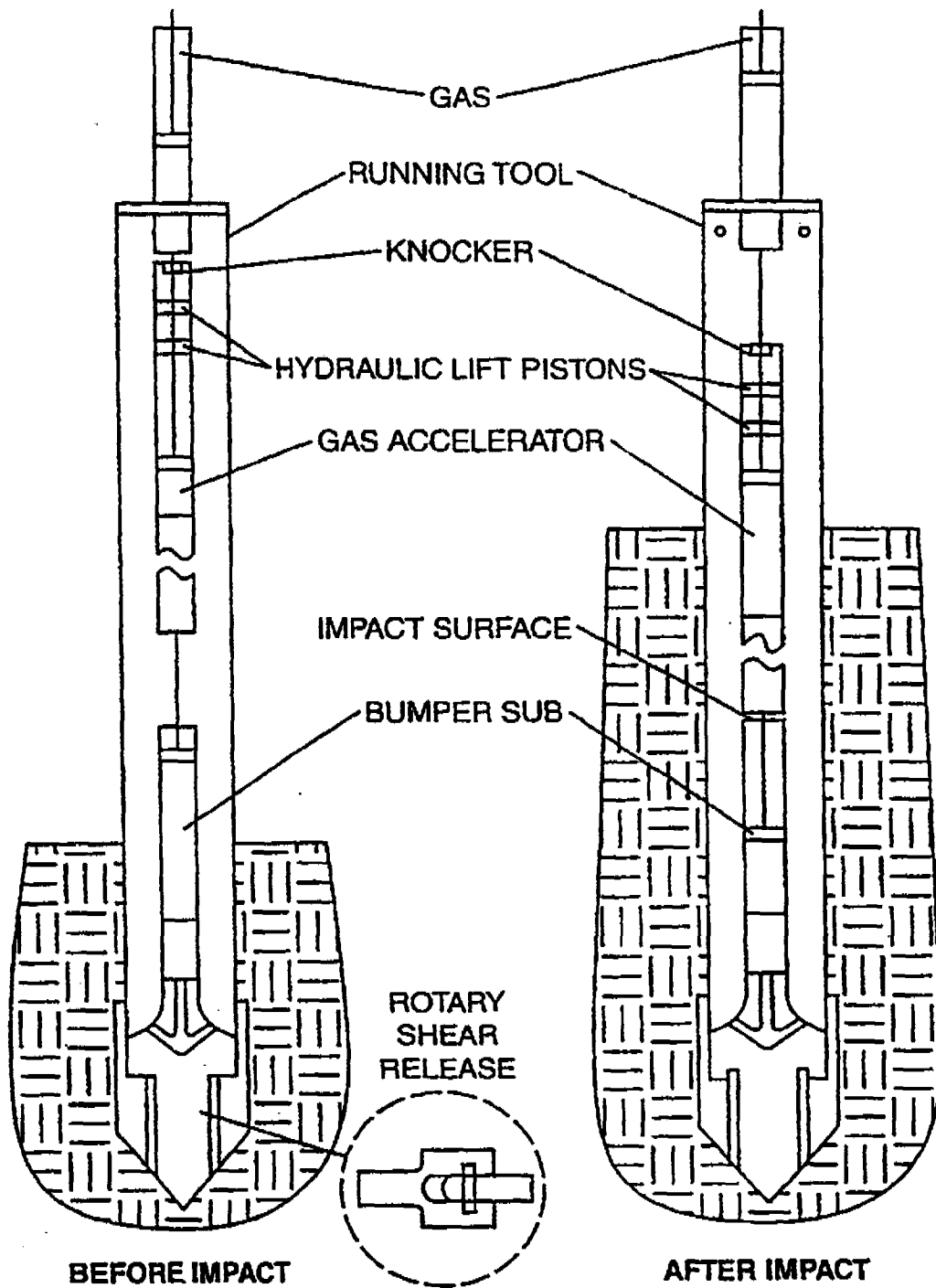


Fig. 12

13/13

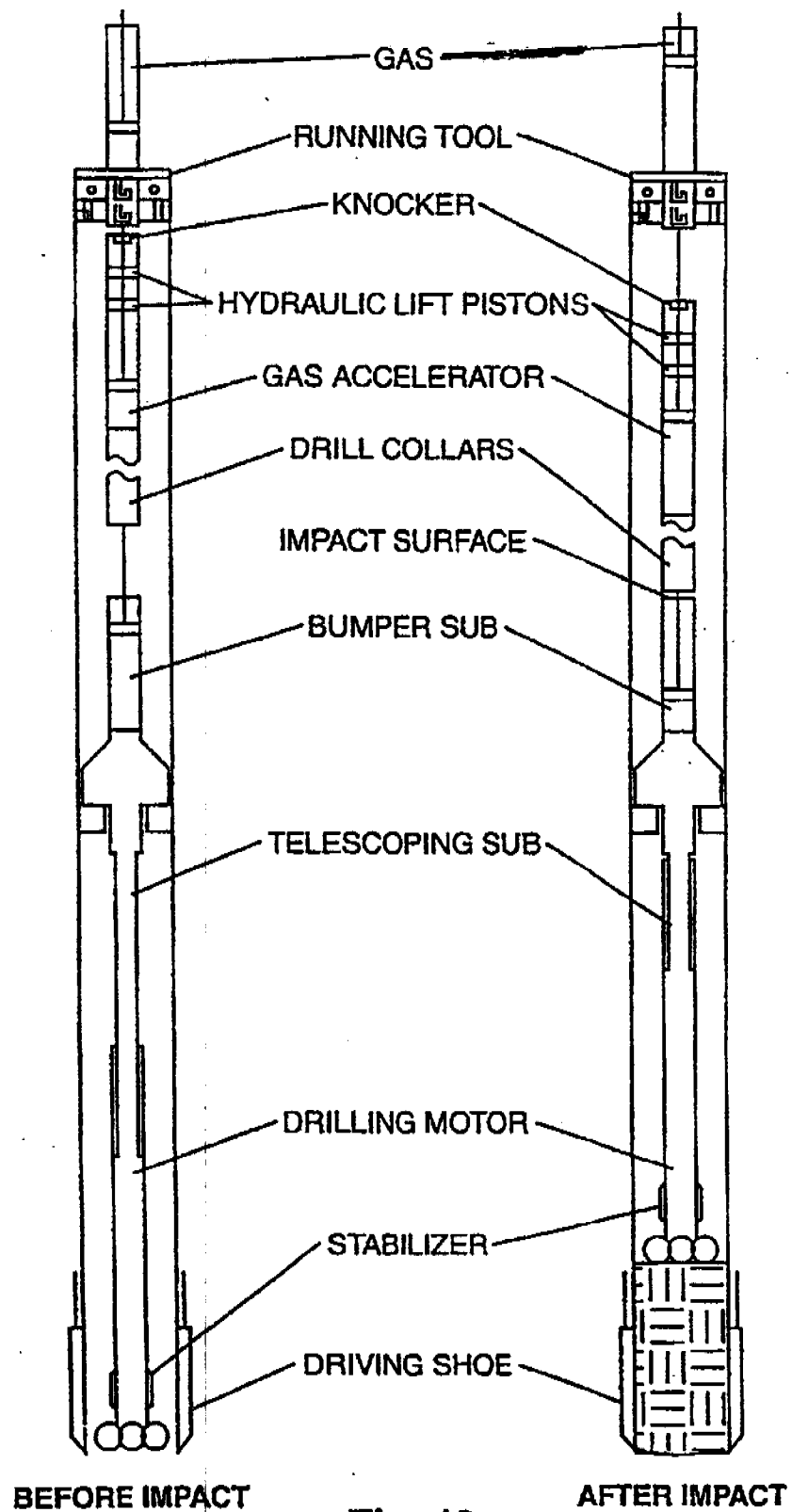


Fig. 13

124
124

ASSEMBLY AND FLOATATION METHOD FOR DRILLING DRIVEPIPE

TECHNICAL FIELD OF THE INVENTION

The present invention relates generally to deep water offshore drilling utilizing floating rigs, and more particularly, to a method for assembling, transporting and installing a drilling assembly, including a drivepipe.

BACKGROUND OF THE INVENTION

In deep water drilling operations, shallow water flow (SWF) hazards have become increasingly troublesome. SWF derives its name from the phenomena of a flow, emanating from a subsurface and overpressurized zone, back to the seafloor. An overpressurized subsurface zone is formed naturally when an impermeable seal is formed over sandy settlements by rapid deposition of silty material. As the silty material is deposited over the sealed, sandy aquifer, the trapped water in the sandy settlement is unable to escape. Over time, the pressure increases in the sandy aquifer until the pressure developed is equal to or greater than the hydrostatic pressure at the depth of water at the location of the sandy aquifer. A shallow water flow occurs when the impermeable seal of silty material is penetrated to release the overpressure within the sandy aquifer. In some cases, the pressures are high enough to cause powerful flows of water and sand into the well bore. Waterflows

124

destabilize the wellbore through erosion to collapse and in some cases damage the well bore and others adjacent thereto. Shallow waterflow hazards have been encountered in many areas of the world and continue to be a problem in
5 deepwater drilling operations.

One solution for avoiding shallow waterflow hazards is to use a drivepipe. The drivepipe is driven into the formation past the high pressure sandy aquifer. The drivepipe becomes the casing for the well bore through
10 which subsequent drilling operations may be conducted. Since the drivepipe is driven into the formation, the soil is compressed and compacted in the immediate vicinity of the drivepipe. Compacted soil seals the drivepipe in the formation to prevent shallow water flow around the
15 drivepipe.

Drivepipes are usually 30 to 36 inches in diameter, having a wall one inch thick, although in some instances, the drivepipe can be 42 inches, or larger, in diameter, with a two inch wall thickness. Drivepipes are typically
20 350 to 450 feet in length for shallow water drilling operations if driven from the surface. In drilling operations, it has been found that a drivepipe can not penetrate beyond a certain amount, usually around the 450 feet length, because at that length, the resistance caused
25 by skin friction becomes greater than the force of gravity and the force applied from the surface by conventional hammer means. The drivepipe will reach a point of refusal and any further force applied to the uppermost section of the drivepipe will cause yielding of the pipe material and
30 any further driving efforts must be discontinued.

In deep water drilling operations, drivepipes having lengths of 1000 feet or more are sometimes required to

mitigate shallow water flow hazards. Therefore, auxiliary means for driving drivepipes are necessary to augment the gravitational forces acting on the drivepipes to increase the depth of penetration of the drivepipes. Presently, drivepipes of this length are driven into the seafloor only by the force of gravity. At greater water depths, the application of force to the tops of the drivepipes is impractical due to the wasted energy absorption by the longer lengths. Although proven that any force applied is more effective if applied at the bottoms of the drivepipes, few methods exist for this application and are limited by the long umbilical required to supply electrical or hydraulic forces to the hammers. Some drivepipes are equipped with a drilling assembly and/or a drive assembly. The drill string continues below the running tool and extends down the entire length of the interior of the drivepipe. The lower end of the drill string assembly terminates with a jet sub or downhole motor connected to a stabilized drill bit. In alternative drivepipes, a drill bit is located at the mouth or lower opening of the drivepipe, and is driven by the motor to function as a jetting assembly to drill a hole approximately the size of the inner diameter of the drivepipe.

In an offshore deep water drilling installation, a drivepipe is typically installed by assembling the drivepipe one section at a time as the sections are hung from a floating drilling vessel. Drivepipes are assembled from various sections of pipe and fitted with the necessary driving mechanisms on the floating drilling vessel at the production site. Lengthy drivepipes having complicated driving mechanism require a good deal of time to assemble on the floating drilling vessel. Since the cost of a

drilling project is directly connected to the amount of time that a floating drilling vessel must be dedicated to the particular drilling project, cost reductions may be obtained by accelerating the drilling process. The time
5 required to assemble a drivepipe and fit the drivepipe with the necessary driving mechanisms has been identified as a significant portion of the overall project duration parameter. Therefore, there is a need for a method for assembling the drivepipe and fitting the drivepipe with the
10 necessary driving mechanisms in such a way that the time required for the floating drilling vessel to be at the drilling site is reduced.

SUMMARY OF THE INVENTION

15 The present invention is a method and apparatus which reduces the time required for a floating drilling vessel to be at the production site because the vessel is not required during drivepipe assembly. In particular, the present invention is a process for assembling a drivepipe
20 in its entirety at a shoreline assembly station and transporting the assembled drivepipe to the drilling vessel. Once delivered, the drivepipe is made up to a running string and lowered to the seabed. This invention obviates the requirement that the floating drilling vessel
25 be used during the assembly process.

According to one aspect of the invention, there is provided a method for assembling and delivering a drivepipe to a drill site, the method comprising: assembling the drivepipe at a shoreline assembly station; attaching
30 floatation devices to the drivepipe and floating the drivepipe in the ocean; towing the drivepipe with tow vessels to a drill site; delivering the drivepipe in a

horizontal orientation to a drilling vessel at the drill site; attaching a upper end of the drivepipe to the drilling vessel and detaching the tow vessels from the drivepipe; pivoting the drivepipe about its point of
 5 attachment to the drilling vessel until the drivepipe is vertically oriented; deactivating the buoyancy function of the floatation devices attached to the drivepipe; removing the floatation devices from the drivepipe; equipping the drivepipe with a driving mechanism; and lowering the
 10 drivepipe with a running string from the drilling vessel to the sea bed.

According to a further aspect of the invention, there is provided a process for assembling a drive pipe for use at an offshore drill site, the process comprising:
 15 assembling the drive pipe at a shoreline assembly station; floating the drive pipe in the ocean; transporting the floating drive pipe from the shoreline assembly station to the offshore drill site; suspending the floating drive pipe from a drilling vessel at the offshore drill site; and
 20 deploying the drive pipe to the ocean floor.

According to still another aspect of the invention, there is provided a process for assembling a drive pipe for use at an offshore drill site, the process comprising:
 assembling the drive pipe at a shoreline assembly station,
 25 wherein the assembling comprises fitting pipe sections end to end; floating the drive pipe in the ocean; transporting the floating drive pipe from the shoreline assembly station to the offshore drill site, wherein the transporting comprises towing the drive pipe through the ocean, wherein
 30 the drive pipe is submerged in the ocean in an approximately neutrally buoyant condition during the towing; suspending the floating drive pipe from a drilling

vessel at the offshore drill site, wherein the suspending comprises coupling an upper end of the drive pipe to the drilling vessel and sinking the drive pipe in the ocean, whereby a substantial portion of the weight of the drive pipe is supported by the drilling vessel; deploying the drive pipe to the ocean floor, wherein the deploying comprises attaching the upper end of the drive pipe to a drill string and lowering the drive pipe to the ocean floor with the drill string.

According to another aspect of the invention, there is provided a process for reducing the amount of time required for a drill vessel to assemble and deploy a drive pipe at an offshore drill site, the process comprising: delivering an assembled drive pipe to the drill vessel at the offshore drill site; suspending the drive pipe from the drilling vessel; and deploying the drive pipe to the ocean floor.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is better understood by reading the following description of non-limitative embodiments with reference to the attached drawings wherein like parts in each of the several figures are identified by the same reference characters, and which are briefly described as follows.

Fig. 1 is a perspective view of a drivepipe and being assembled at a shoreline assembly station.

Fig. 2 is a perspective view of an assembled drivepipe being equipped with floatation devices at a shoreline assembly station.

Fig. 3 is a perspective view of a drivepipe being towed from the shoreline assembly station to an offshore drilling site.

Fig. 4 is a perspective view of a drivepipe being delivered to an offshore semi-submersible platform.

Fig. 5 is a perspective view of a drivepipe being positioned with its upper end immediately beneath an offshore semi-submersible platform wherein the upper end of the drivepipe is being secured to the platform.

Fig. 6 is a perspective view of a drivepipe with its upper end attached to a semi-submersible platform and the remainder of the drivepipe being sunk into the ocean as the drivepipe pivots about its point of attachment to the platform.

Fig. 7 is a perspective view of a drivepipe with its upper end attached to a semi-submersible platform and the entire drivepipe suspended vertically beneath the platform.

Fig. 8 is a perspective view of a drivepipe suspended beneath a platform with deactivated floatation devices still attached.

Fig. 9 is a perspective view of a drivepipe suspended beneath a floatation platform with floatation devices removed.

Fig. 10 is a perspective view of a drivepipe suspended beneath a floatation platform with a driving mechanism installed in the drivepipe for driving the drivepipe into the sea bed.

Fig. 11 is a perspective view of a drivepipe suspended from a platform by a running string made up to the drivepipe.

Figure 12 is a side view of a drivepipe with a driving mechanism installed therein shown in before and after impact positions. The driving mechanism is configured to communicate momentum from the impact of the driving mechanism to the leading end of the drivepipe.

Figure 13 is a side view of a drivepipe with a driving mechanism installed therein shown in before and after impact positions. The driving mechanism is configured to communicate momentum from the impact to the drivepipe at a point of the drivepipe about 40 - 60 feet from the bottom of the drivepipe. The driving mechanism is further configured with a drill motor and bit or other device below the impact device.

It is to be noted, however, that the appended drawings illustrate only typical embodiments of this invention and are therefore not to be considered limiting of its scope, as the invention may admit to other equally effective embodiments.

15 DETAILED DESCRIPTION OF THE INVENTION

One aspect of the invention is to assemble the drivepipe in its entirety at a shoreline assembly station.

Such assembly may be done either parallel or perpendicular to the shoreline. Once assembled, the drivepipe is fitted with floatation devices and set afloat in the ocean. Boats then tow the drivepipe to the drilling site where it is attached at its upper end to the drilling vessel. The floatation devices then allow the drivepipe to sink into the ocean until it becomes vertically oriented beneath the floating drilling vessel. Once the drivepipe is vertically oriented, the floatation devices are removed from the drivepipe. The drivepipe is then made up to a running string that is used to lower the drivepipe to the ocean floor from the floating drilling vessel.

Referring to Fig. 1, a perspective view of a drivepipe assembly station at a shoreline is shown adjacent the ocean. The drivepipe 5 is assembled by attaching pipe

128

sections 10 end to end. The individual pipe sections 10 may be welded or pipe made-up with threaded connections at a make-up station 15 as is known in the art. A drive shoe 11 is attached to the leading end of the drivepipe 5 and a hinge coupling 12 is attached to the upper end of the drivepipe 5. Of course, heavy machinery and support devices are used to move and position the drivepipe 5 and pipe sections 10 as is known in the art during the assembly process.

10 As shown in Fig. 2, the assembled drivepipe 5 is fitted with floatation devices 25. In particular, floatation devices 25 are attached which are able to control the descent of the drivepipe in the ocean 9. Suitable buoyancy systems for the floatation devices 25 are disclosed in U.S. Patent Numbers 4,121,529; 4,191,494; 15 4,117,693; 4,048,686; and 4,040,264, all incorporated herein by reference. The floatation devices 25 are attached to the drivepipe 5 in sufficient number and at particular locations along the length of the drivepipe 5 so 20 that extreme bending moments are not induced in the drivepipe 5 due to the force of gravity acting against the buoyant force of the floatation devices 25. Depending on the floatation devices 25 used with the system, the drivepipe 5 may be sealed with a watertight seal to create 25 a gas filled chamber in its interior. In this embodiment, the gas filled chamber of the drivepipe 5 buoys the drivepipe 5 in the ocean 9 in addition to the buoyant forces imposed by the floatation devices 25. With the floatation devices 25 in place, the drivepipe 5 is floated 30 into the ocean 9 adjacent the shoreline 8. Further, the floatation devices 25 are adjusted to impart a buoyant force to the drivepipe 5 until the drivepipe 5 is

128

approximately neutrally buoyant and horizontally oriented in the water.

Referring to Fig. 3, a perspective view of the drivepipe 5 being transported from the shoreline assembly station to the production site is shown. The drivepipe 5 is shown at a neutrally buoyant position below the surface of the ocean 9. While the drivepipe may be towed on the surface of the ocean 9, in the embodiment of the invention shown, the drivepipe 5 is suspended at a neutrally buoyant position at a sufficient depth below the surface of the water to avoid wave action at the surface. It is preferable to tow the drivepipe 5 at a position below the wave action of the ocean so that the waves do not induce bending moments in the drivepipe 5 during transportation.

At this depth, the drivepipe 5 is towed by any number of tow vessels 22 from the shoreline assembly station to an offshore drilling site. The tow vessels 22 are attached to the drivepipe 5 by towlines as is known in the art

Referring to Fig. 4, the assembled drivepipe 5 is delivered to the offshore drilling site. A drilling vessel 40 is properly positioned relative to the drilling site.

In the embodiment shown in Fig. 4, the drilling vessel 40 is a semi-submersible platform. While a semi-submersible platform is shown, a drillship or any floating drilling vessel may be used with the present invention. The tow vessels 22 bring the upper end of the drivepipe 5 having the hinge coupling 12 into close proximity with the drilling vessel 40.

As shown in Fig. 5, a perspective view of the drivepipe 5 being delivered to a drilling vessel 40 is shown. The upper end of the drill pipe 5 having the hinge coupling 12 is positioned beneath the drilling vessel 40 by

the tow vessels 22. The floatation devices 25 then buoy the drivepipe 5 to the surface of the ocean 9 so that the hinge coupling 12 is accessible to the drilling vessel 40.

Once properly positioned, the hinge coupling 12 of the drivepipe 5 is attached to the drilling vessel 40. Upon attachment of the hinge coupling 12 to the drilling vessel 40, the tow vessels 22 release the drivepipe 5. Attachment to the drivepipe may be made using wire rope, a clevis, the tubular drilling string from the drilling vessel, or any device known to those of skill.

Referring to Fig. 6, a perspective view of the drivepipe 5 and the drilling vessel 40 is shown. At this stage of the process, the tow vessels 22 are removed from the drilling site and the drivepipe 5 is freely floating with the hinge coupling 12 attached to the drilling vessel 40. The floatation devices 25, which are attached to the drivepipe 5, are then made to sink in the ocean 9. The floatation devices 25 farthest from the hinge coupling 12 are made to descend faster than floatation devices 25 closer to the hinge coupling 12. Throughout this process, the upper end of the drivepipe 5 remains attached or secured to the drilling vessel 40 by the hinge coupling 12.

As the floatation devices 25 allow the drivepipe 5 to sink, the drivepipe 5 swings or rotates about its point of attachment to the floating drilling vessel 40 until the drivepipe is vertically oriented beneath the drilling vessel 40. Throughout the sinking process, the floatation devices 25 are regulated to maintain sufficient buoyant force on the drivepipe 5 to prevent bending moments from being generated in the drivepipe 5. This requires that each floatation device 25 be made to descend at a different rate depending on its point of attachment to the drivepipe

5. The floatation devices 25 provide a sufficient buoyant force so that the drivepipe 5 remains approximately neutrally buoyant as the drivepipe 5 is rotated from a horizontal orientation to a vertical orientation.

5 In embodiments of the invention where the drivepipe 5 is sealed with a water tight seal to create a gas filled chamber in its interior, it is preferable to maintain the integrity of the interior chamber until the drivepipe is vertically oriented. The allows the drivepipe 5 to remain
10 neutrally buoyant as the drivepipe 5 is vertically oriented.

As shown in Figure 7, the drivepipe 5 is vertically oriented under the drilling vessel 40. At this position, the floatation devices 25 continue to exert a buoyant force
15 on the drivepipe 5 so that the weight of the drivepipe has not yet been transferred to the drilling vessel 40. However, the hinge coupling 12 remains attached to the drilling vessel 40.

As shown in Figure 8, the weight of the drivepipe 5 is
20 transferred from the floatation devices 25 to the drilling vessel 40 by deactivating the buoyancy function of the floatation devices 25. In embodiments of the invention where the drivepipe 5 is sealed with a water tight seal to create a gas filled chamber in its interior, the buoyancy
25 function of the interior chamber is breached by flooding the inside of the drivepipe 5 with sea water. Of course, as weight is transferred to the drilling vessel 40, the drilling vessel 40 is pulled deeper into the ocean 9.

Referring to Figure 9, a perspective view of the
30 drilling vessel 40 and drivepipe 5 is shown, wherein the floatation devices 25 are removed from the drivepipe 5. The floatation devices 25 are removed from the drivepipe

according to processes known to persons of skill in this art.

Referring to Figure 10, a perspective view of the drilling vessel and drivepipe is shown, wherein the drivepipe has a driving mechanism installed therein. With the drivepipe 5 fully supported by the drilling vessel 40, a driving mechanism 20 is installed in the drivepipe 5 for driving the drivepipe 5 into subterranean layers. Many different driving mechanisms 20 are possible depending on the particular drivepipe and drilling conditions anticipated.

In a first driving mechanism configuration, the driving mechanism 20 is a hydraulic hammer attached to the drivepipe between the driving shoe 11 and the hinge coupling 12. Conventional hydraulic hammers require an umbilical cord that extends from the hammer to the drilling vessel at the ocean surface.

In a second configuration, the driving mechanism 20 is a drop weight system installed inside the drivepipe 5. For example, a drop weight system is shown in Figure 12. Drop weight systems have lift pistons that lift a set of weights off an impact surface and allow the set of weights to fall again to the impact surface. The momentum generated by the weights is transferred to the drivepipe through the impact surface. Alternative embodiments of this second configuration are possible where the drop weight system is positioned within the drivepipe either at the leading end near the driving shoe or at a position closer to the middle of the drivepipe. In the embodiment shown in Figure 12, the momentum of the impact is transferred to the leading end of the drivepipe.

In a third configuration, a drop weight system is equipped with a drill that operates within an open face of the drive shoe 11. An example of this type of system is shown in Figure 13. In this configuration, the drop weight system is attached within the drivepipe 5 at a midpoint location and the drill extends below the drop weight system. A mud motor below the drop weight system drives the drill bit.

Alternative driving mechanism configurations are also possible. Regardless of the configuration of the driving mechanism 20, to be used in the drivepipe 5, the driving mechanism 20 is installed in or attached to the drivepipe 5 while the drivepipe 5 is suspended from the drilling vessel 40. In this position, the driving mechanism 20 (shown in Figures 10, 12 and 13) for driving the drivepipe 5 into the seabed is made ready and tested.

Referring to Figure 11, a perspective view of the drivepipe 5 suspended by a running string 14 is shown. After the drivepipe 5 is equipped with a driving mechanism, the drivepipe 5 is then lowered from the drilling vessel 40 to the sea bed. In the embodiment shown, a running string 14 is made up to the upper end of the drivepipe 5 for suspending the drivepipe 5 from the drilling vessel 40. The hinge coupling 12 is removed from the drivepipe 5 and the running string 14 is made-up directly to the drivepipe 5. Additional sections of the running string 14 are made up as the drivepipe 5 is lowered from the drilling vessel 40 to the sea floor.

While the particular embodiments for drilling drivepipe assembly and floatation methods as herein shown and disclosed in detail are fully capable of obtaining the objects and advantages hereinbefore stated, it is to be

understood that they are merely illustrative of the preferred embodiments of the invention and that no limitations are intended by the details of construction or design herein shown other than as described in appended
5 claims.

CLAIMS

1. A process for assembling a drive pipe for use at an offshore drill site, said process comprising:

5 assembling the drive pipe at a shoreline assembly station;

floating the drive pipe in the ocean;

transporting the floating drive pipe from the shoreline assembly station to the offshore drill site;

10 suspending the floating drive pipe from a drilling vessel at the offshore drill site;

deploying the drive pipe to the ocean floor.

2. The process for assembling a drive pipe as claimed in claim 1, wherein said assembling comprises fitting pipe sections end to end.

3. The process for assembling a drive pipe as claimed in claim 1, wherein said floating comprises attaching at least one floatation device to the drive pipe and adjusting the buoyancy of the at least one floatation device until the drive pipe is approximately neutrally buoyant.

25 4. The process for assembling a drive pipe as claimed in claim 1, wherein said floating comprises sealing an interior cavity of said drive pipe, whereby a gas filled chamber is created within said drive pipe which buoys the drive pipe.

30

5. The process for assembling a drive pipe as claimed in claim 1, wherein said transporting comprises

towing the drive pipe through the ocean, wherein the drive pipe is submerged in the ocean in an approximately neutrally buoyant condition during said towing.

5 6. The process for assembling a drive pipe as claimed in claim 1, wherein said suspending comprises coupling an upper end of the drive pipe to the drilling vessel and sinking the drive pipe in the ocean, whereby a substantial portion of the weight of the drive pipe is
10 supported by the drilling vessel.

7. The process for assembling a drive pipe as claimed in claim 6, wherein said sinking comprises deactivating a buoyancy function of at least one floatation
15 device attached to the drive pipe.

8. The process for assembling a drive pipe as claimed in claim 6, wherein said sinking comprises breaching an interior cavity of said drive pipe, wherein
20 the interior cavity is initially a gas filled chamber, and whereby ocean water is allowed to enter the interior cavity.

9. The process for assembling a drive pipe as
25 claimed in claim 1, wherein said deploying comprises attaching the upper end of the drive pipe to a drill string and lowering the drive pipe to the ocean floor with the drill string.

30 10. The process for assembling a drive pipe as claimed in claim 1, further comprising assembling a drive mechanism to the drive pipe.

11. A process for assembling a drive pipe for use at an offshore drill site, said process comprising:

assembling the drive pipe at a shoreline assembly station, wherein said assembling comprises fitting pipe sections end to end;

floating the drive pipe in the ocean;

transporting the floating drive pipe from the shoreline assembly station to the offshore drill site, wherein said transporting comprises towing the drive pipe through the ocean, wherein the drive pipe is submerged in the ocean in an approximately neutrally buoyant condition during said towing;

suspending the floating drive pipe from a drilling vessel at the offshore drill site, wherein said suspending comprises coupling an upper end of the drive pipe to the drilling vessel and sinking the drive pipe in the ocean, whereby a substantial portion of the weight of the drive pipe is supported by the drilling vessel;

deploying the drive pipe to the ocean floor, wherein said deploying comprises attaching the upper end of the drive pipe to a drill string and lowering the drive pipe to the ocean floor with the drill string.

12. The process for assembling a drive pipe as claimed in claim 11, wherein said floating comprises attaching at least one floatation device to the drive pipe and adjusting the buoyancy of the at least one floatation device until the drive pipe is approximately neutrally buoyant, and wherein said sinking comprises deactivating a buoyancy function of the at least one floatation device attached to the drive pipe.

13. The process for assembling a drive pipe as claimed in claim 11, wherein said floating comprises sealing an interior cavity of said drive pipe, whereby a
 5 gas filled chamber is created within said drive pipe which buoys the drive pipe, and wherein said sinking comprises breaching an interior cavity of said drive pipe, wherein the interior cavity is initially a gas filled chamber, and whereby ocean water is allowed to enter the interior
 10 cavity.

14. The process for assembling a drive pipe as claimed in claim 11, further comprising assembling a drive mechanism to the drive pipe.

15

15. A process for reducing the amount of time required for a drill vessel to assemble and deploy a drive pipe at an offshore drill site, said process comprising:
 delivering an assembled drive pipe to the drill vessel
 20 at the offshore drill site;
 suspending the drive pipe from the drilling vessel;
 and
 deploying the drive pipe to the ocean floor.

25 16. The process as claimed in claim 15, wherein said suspending comprises coupling an upper end of the drive pipe to the drilling vessel and sinking the drive pipe in the ocean, whereby a substantial portion of the weight of the drive pipe is supported by the drilling vessel.

30

17. The process as claimed in claim 15, wherein said deploying comprises attaching the upper end of the drive

pipe to a drill string and lowering the drive pipe to the ocean floor with the drill string.

18. The process as claimed in claim 15, further
5 comprising assembling a drive mechanism to the drive pipe.

19. The process for assembling a drive pipe as
claimed in any preceding claim, wherein said assembling
comprises fitting pipe sections end to end.
10

20. The process for assembling a drive pipe as
claimed in any preceding claim, wherein said floating
comprises attaching at least one floatation device to the
drive pipe and adjusting the buoyancy of the at least one
15 floatation device until the drive pipe is approximately
neutrally buoyant.

21. The process for assembling a drive pipe as
claimed in any preceding claim, wherein said floating
20 comprises sealing an interior cavity of said drive pipe,
whereby a gas filled chamber is created within said drive
pipe which buoys the drive pipe.

22. The process for assembling a drive pipe as
25 claimed in any preceding claim, wherein said transporting
comprises towing the drive pipe through the ocean, wherein
the drive pipe is submerged in the ocean in an
approximately neutrally buoyant condition during said
towing.

30

23. The process for assembling a drive pipe as
claimed in any preceding claim, wherein said suspending

comprises coupling an upper end of the drive pipe to the drilling vessel and sinking the drive pipe in the ocean, whereby a substantial portion of the weight of the drive pipe is supported by the drilling vessel.

5

24. The process for assembling a drive pipe as claimed in claim 23, wherein said sinking comprises deactivating a buoyancy function of at least one floatation device attached to the drive pipe.

10

25. The process for assembling a drive pipe as claimed in claim 23, wherein said sinking comprises breaching an interior cavity of said drive pipe, wherein the interior cavity is initially a gas filled chamber, and
15 whereby ocean water is allowed to enter the interior cavity.

26. The process for assembling a drive pipe as claimed in any preceding claim, wherein said deploying
20 comprises attaching the upper end of the drive pipe to a drill string and lowering the drive pipe to the ocean floor with the drill string.

27. The process for assembling a drive pipe as
25 claimed in any preceding claim, further comprising assembling a drive mechanism to the drive pipe.

28. The process for assembling a drive pipe as
30 claimed in any preceding claim, wherein said floating comprises attaching at least one floatation device to the drive pipe and adjusting the buoyancy of the at least one floatation device until the drive pipe is approximately

134
134

134

neutrally buoyant, and wherein said sinking comprises deactivating a buoyancy function of the at least one floatation device attached to the drive pipe.

5 29. The process for assembling a drive pipe as claimed in any preceding claim, wherein said floating comprises sealing an interior cavity of said drive pipe, whereby a gas filled chamber is created within said drive
10 pipe which buoys the drive pipe, and wherein said sinking comprises breaching an interior cavity of said drive pipe, wherein the interior cavity is initially a gas filled chamber, and whereby ocean water is allowed to enter the interior cavity.

15 30. The process as claimed in any preceding claim, wherein said suspending comprises coupling an upper end of the drive pipe to the drilling vessel and sinking the drive pipe in the ocean, whereby a substantial portion of the weight of the drive pipe is supported by the drilling
20 vessel.

 31. The process as claimed in any preceding claim, wherein said deploying comprises attaching the upper end of the drive pipe to a drill string and lowering the drive
25 pipe to the ocean floor with the drill string.

 32. A process for assembling a drive pipe for use in an offshore drill site substantially as described herein with reference to and as illustrated in the accompanying
30 drawings.



INVESTOR IN PEOPLE

Application No: GB 0100338.3
Claims searched: 1 to 32

Examiner: Richard Collins
Date of search: 13 March 2001

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl (Ed.S): E1H HEA; E1F FGR.
Int Cl (Ed.7): E21B 19/00.
Other: Online EPODOC, JAPIO, WPI.

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2206628 A (CONOCO) figure 2 and related description.	-
A	US 4191494 A (NAKAMURA) figure 2 and related description.	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

United States Patent [19]
Hipp

[11] **Patent Number:** 4,702,325
[45] **Date of Patent:** Oct. 27, 1987

[54] **APPARATUS AND METHOD FOR DRIVING CASING OR CONDUCTOR PIPE**

[75] **Inventor:** James Hipp, 110 Leitmeyer, New Iberia, La. 70560

[73] **Assignee:** James Hipp, New Iberia, La.

[21] **Appl. No.:** 657,970

[22] **Filed:** Oct. 4, 1984

[51] **Int. Cl.⁴** B25D 17/14

[52] **U.S. Cl.** 173/64; 173/61;
175/215; 175/257

[58] **Field of Search** 173/73, 61, 62, 63,
173/64, 132; 175/77, 78, 215, 257

[56] **References Cited**

U.S. PATENT DOCUMENTS

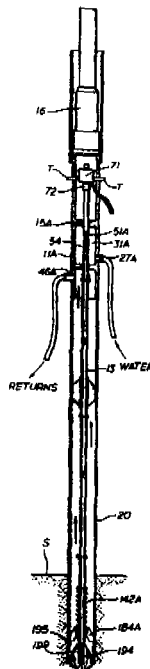
3,847,230 11/1974 Blomquist 405/232 X
3,871,486 3/1975 Curington et al. 175/215 X

Primary Examiner—E. R. Kazenske
Assistant Examiner—Willmon Fridie, Jr.
Attorney, Agent, or Firm—Bernard A. Reiter; Mark G. Bocchetti

[57] **ABSTRACT**

Apparatus for driving casing, piles, or conductor pipe into the ground comprises in combination; an external reciprocal impact driving means supported atop the conductor pipe, internal rotatable drilling means supported within the conductor pipe, and means associated therewith for introducing air and water under pressure for creating a pressure differential to evacuate the drilling debris and cuttings to the surface. The drilling means is supported within said conductor pipe at the bottom portion thereof near the point of least energy absorption and rebound. The driving and drilling operations may be performed simultaneously or sequentially.

17 Claims, 8 Drawing Figures



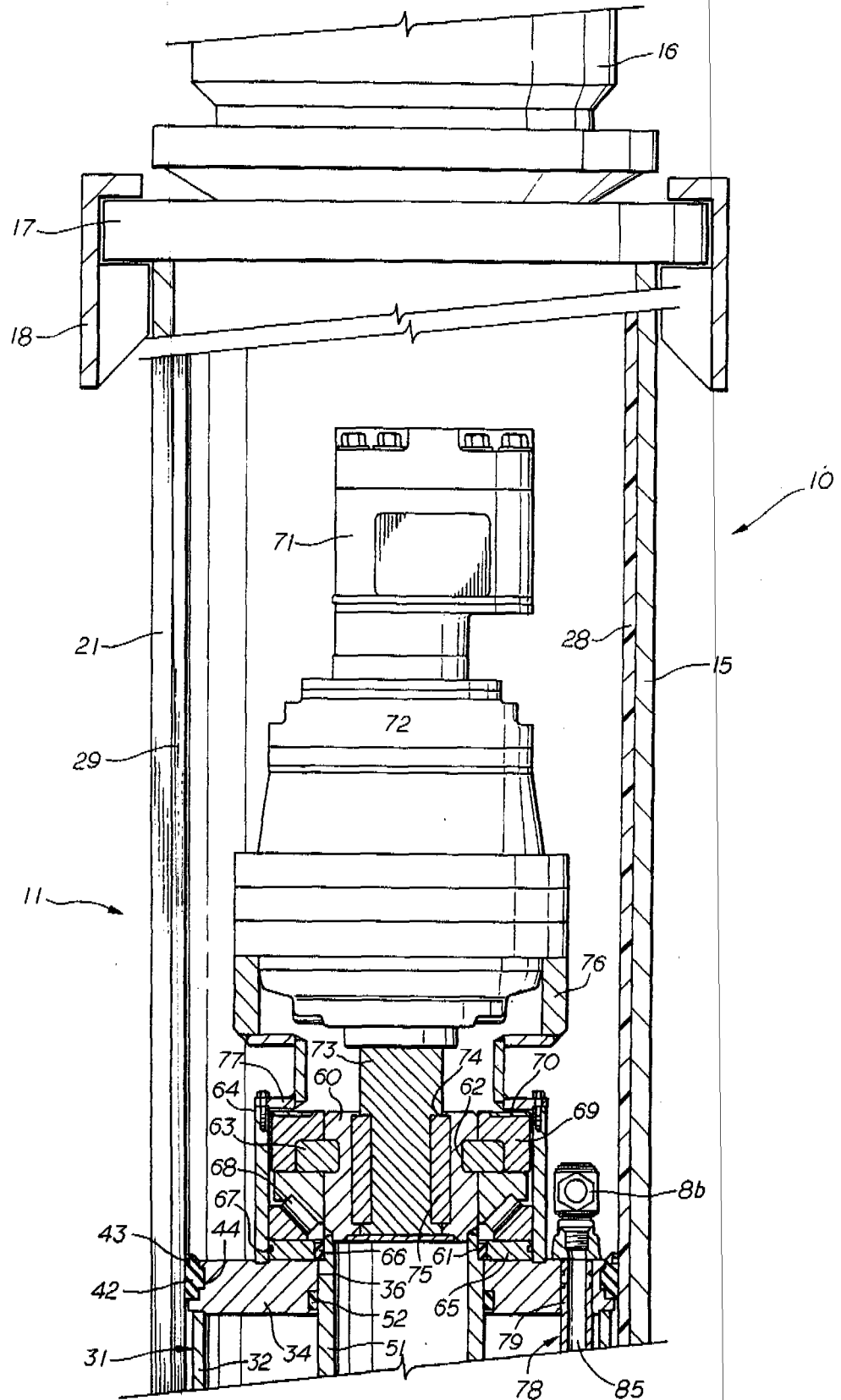


fig. 1

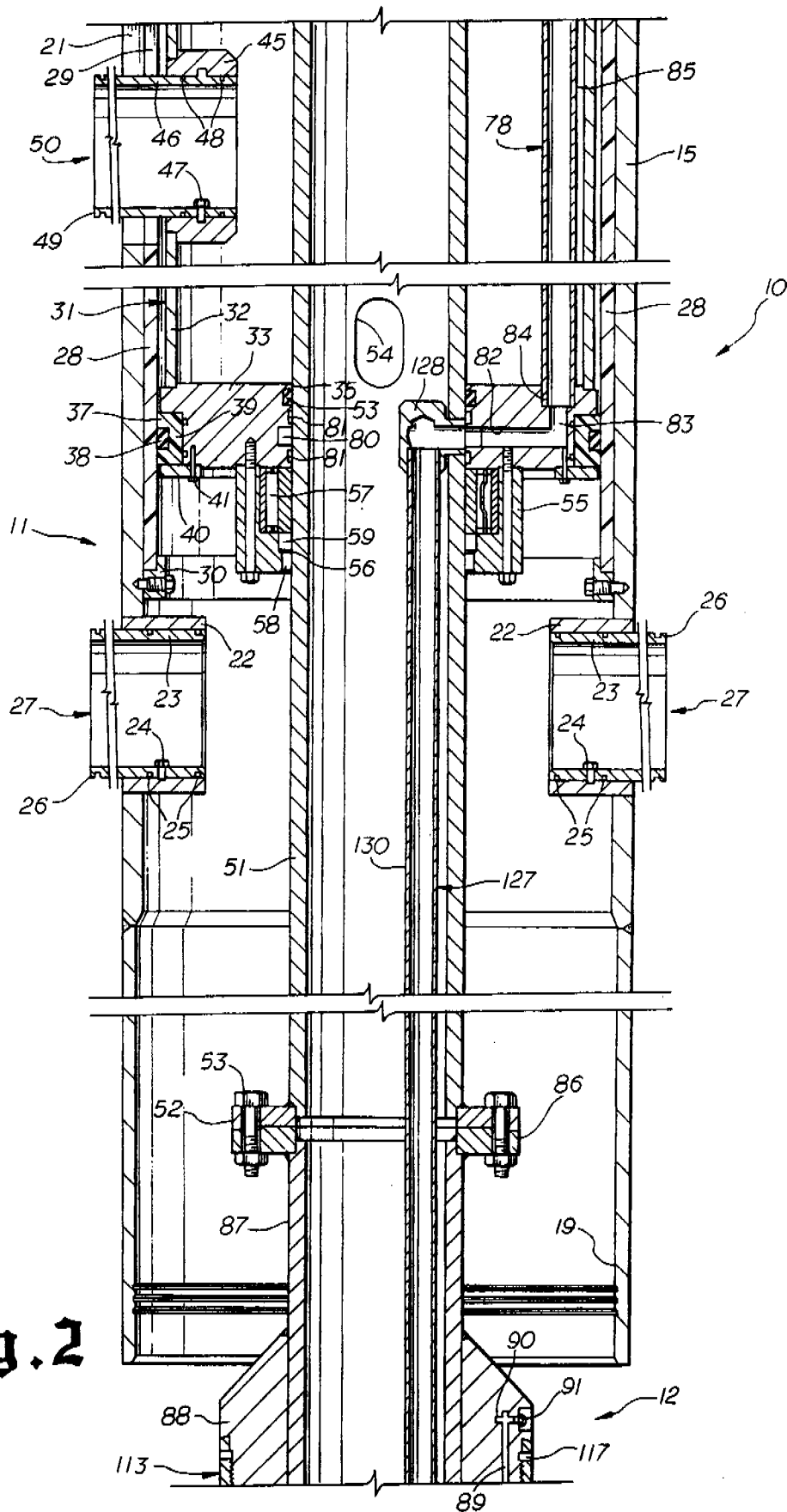


fig. 2

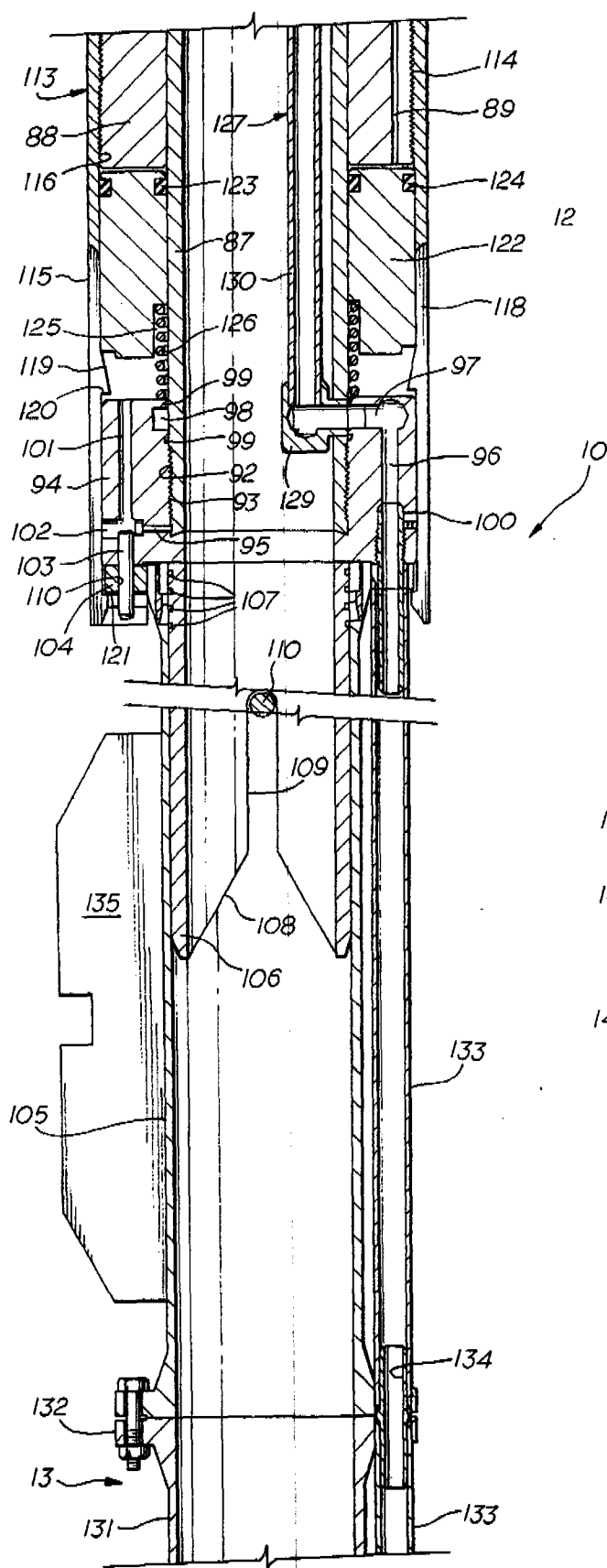


fig.3

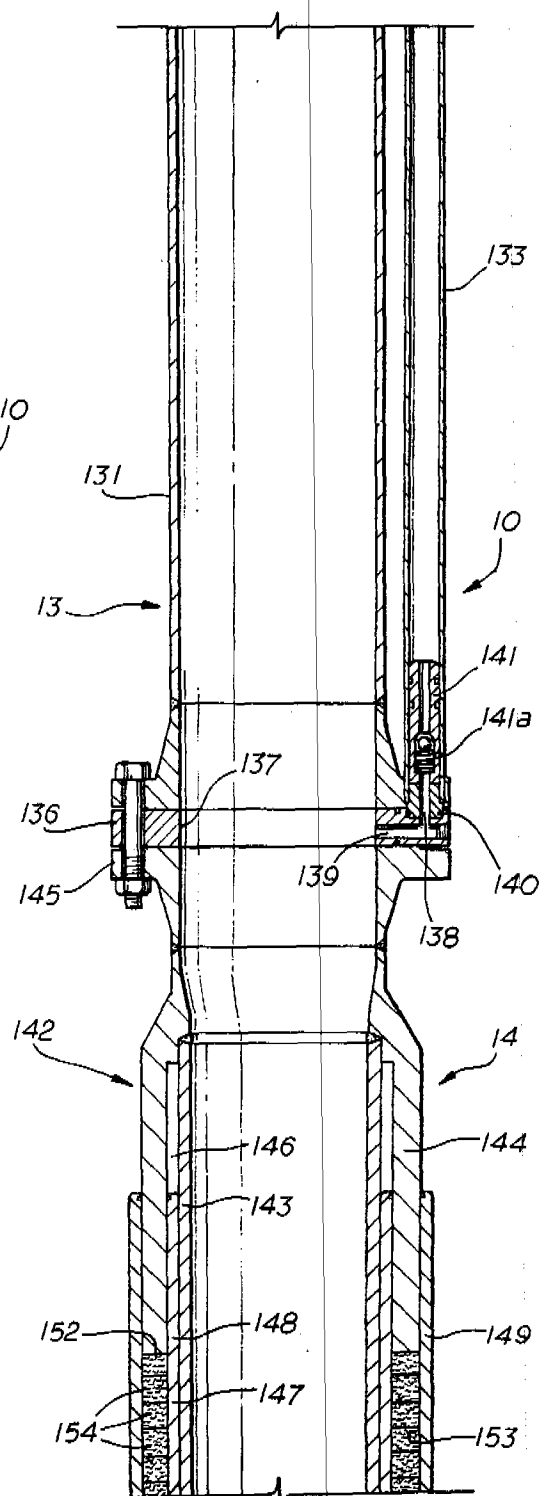


fig.4

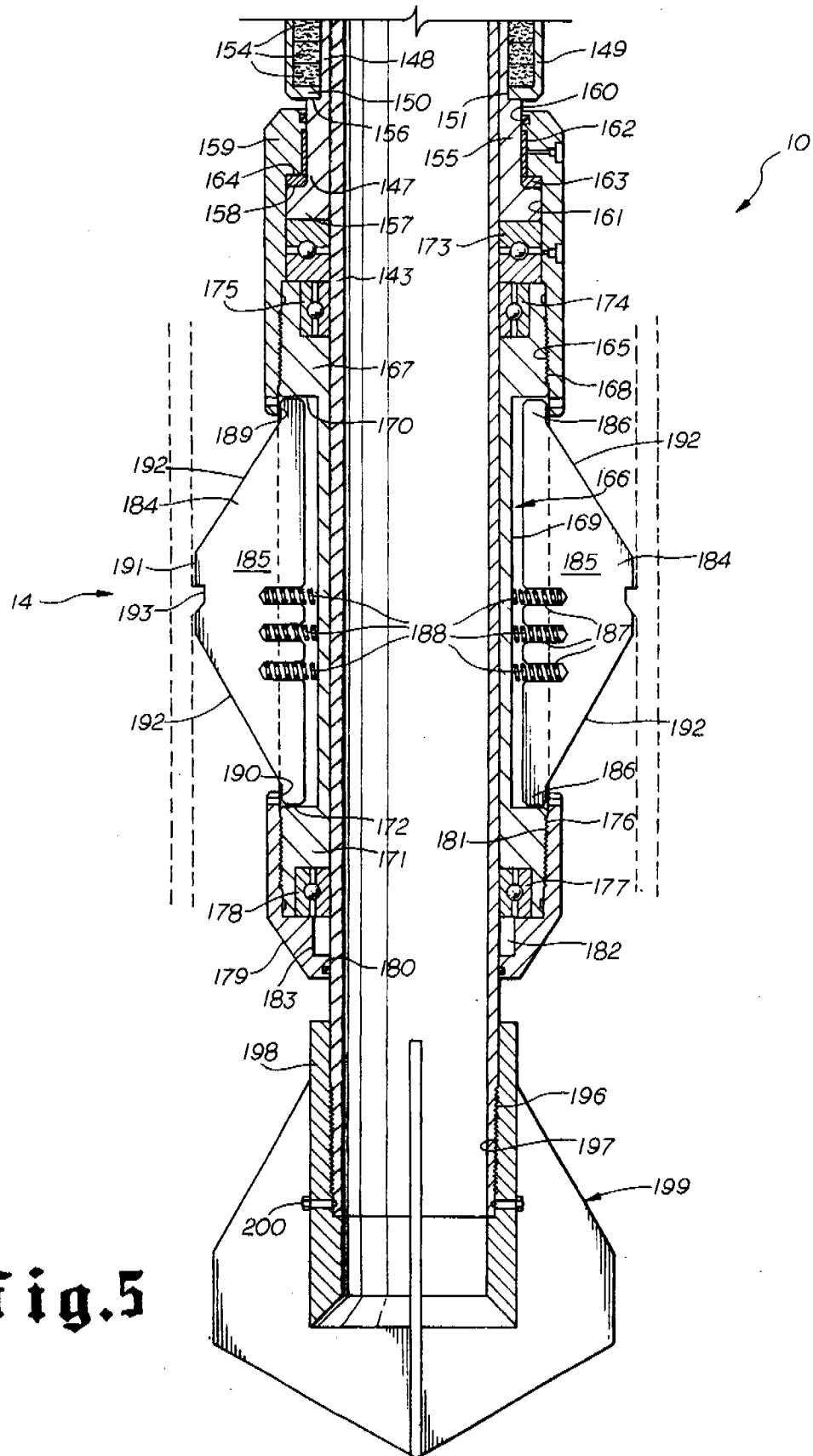


fig. 5

138

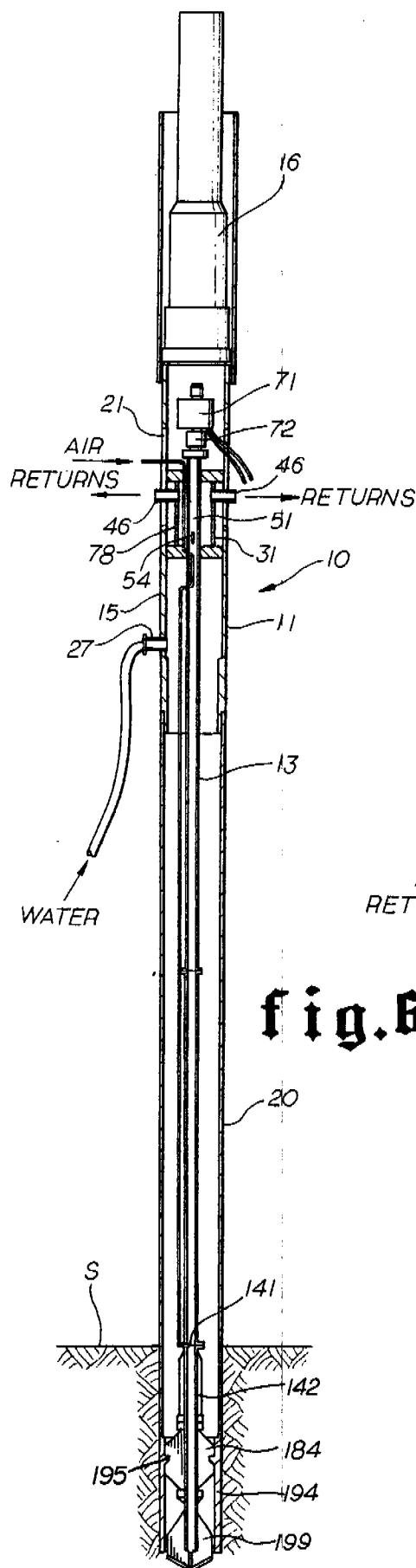


fig. 6

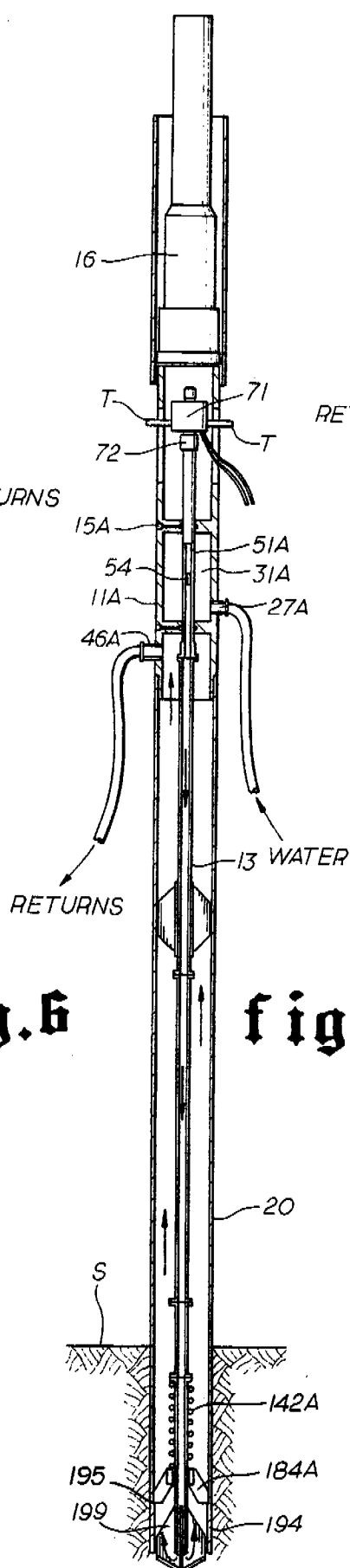


fig. 7

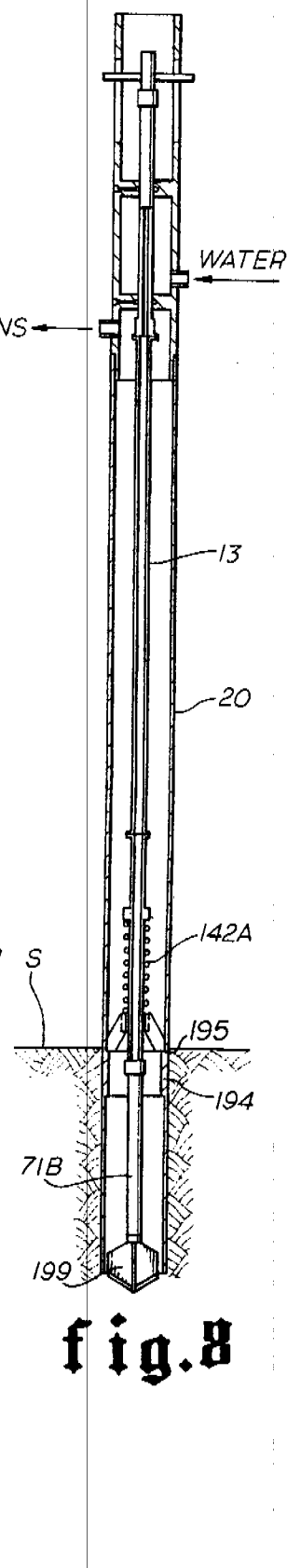


fig. 8

APPARATUS AND METHOD FOR DRIVING CASING OR CONDUCTOR PIPE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to apparatus for driving casing, piles, or conductor pipe and more particularly to an apparatus comprising in combination; an external reciprocal impact driving means supported atop the conductor pipe, internal rotatable drilling means supported within the conductor pipe, and means associated therewith for introducing air and water under pressure for creating a pressure differential to evacuate the drilling debris and cuttings to the surface. The drilling means is supported within said conductor pipe at the bottom portion thereof near the point of least energy absorption and rebound. The driving and drilling operations may be performed simultaneously or sequentially.

2. Brief Description of the Prior Art

Apparatus for driving casing or conductor pipe are known in the art, there are several patents which disclose various devices for accomplishing this end most of which merely provide for drilling in advance of the lower end of the casing.

Wiredal, U.S. Pat. No. 4,408,669 discloses a drilling means having a pilot bit, a reamer, and a guide member mounted in the bottom end of a casing tube, and which transmits impacts to the casing. The guide member has a plurality of channels which are segments of a spiral through which drilling debris is discharged upwardly to the casing tube.

Tschirky, U.S. Pat. No. 4,133,396 discloses a fluid motor and drill apparatus supported in the casing, with the drill extending below the lower end of the casing to drill the bore hole in advance of the casing.

Pulk, et al, U.S. Pat. No. 3,870,114 discloses a ground drilling apparatus which is operated from within a casing which is sunk into the hole drilled by the drill unit. The casing is pulled without rotation into the hole by a drill bit which includes a pilot bit having an axis which coincides with the centerline of the drill hole and is parallel to and separate from the central axis of the drill unit which is the line of action of the percussion force.

Sewell, U.S. Pat. No. 2,330,083 discloses a wireline retractable drill bit which is locked into drilling position within a casing by outwardly extendable dog members.

Kammerer, U.S. Pats. Nos. 3,097,706 and 3,097,707 discloses an apparatus for drilling well bores with casing. The apparatus is lowered through a bore of a string of drill pipe that will form the ultimate casing for the well bore, positively coupled to the lower portion thereof, and rotating the casing the accomplish the drilling of the bore.

Kammerer, U.S. Pat. No. 3,196,960 discloses a fluid expansible rotary drill bit in which greater fluid pressure can be developed in the bit for expanding its cutters outwardly, and in which the bit permits a large flow of circulating fluid through it for cleaning the bit and flushing the cuttings from the well bore.

The following patents of interest issued to Brown disclose apparatus for drilling wells using the casing itself as the drill string: U.S. Pats. Nos. 3,552,507; 3,552,507; 3,552,508; 3,552,509; 3,552,510; 3,656,564; and 3,747,675 disclose apparatus employing well casing as the drill string, a drill bit having radially expansible cutters insertable and removable through the bore of the casing and releasably connected thereto, and a drive

connection means releasably insertable into the upper end of the casing bore including gripping means engageable with the casing bore for transmitting rotational torque to the casing.

The prior art in general, and none of these patents in particular, disclose the present apparatus for driving casing, piles, or conductor pipe into the ground which comprises in combination, an external reciprocal impact driving means supported atop the conductor pipe, internal rotatable drilling means supported within the conductor pipe, and means associated therewith for introducing air and water under pressure for creating a pressure differential to evacuate the drilling debris and cuttings to the surface. The drilling means being supported within said conductor pipe at the bottom portion thereof near the point of least energy absorption and rebound.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a method and apparatus for simultaneously or sequentially drilling a pilot hole, driving a conductor pipe, and extracting drilling debris from the drilled bore.

Another object of this invention is to provide a method and apparatus whereby less energy is required to drive a conductor pipe into difficult soil formations.

Another object of this invention is to provide a method and apparatus which will greatly reduce the cost of driving conductor pipe by reducing the time consumed by repeated driving, backing out, and jetting operations now required in when encountering extremely hard driving conditions.

A further object of this invention is to provide a method and apparatus which will greatly reduce the cost of driving conductor pipe by allowing the use of conductor pipe having a thinner wall thickness than is now required to absorb the energy required to drive it.

Other objects of the invention will become apparent from time to time throughout the specification and claims as hereinafter related.

The above noted objects and other objects of the invention are accomplished by an apparatus for driving casing, piles, or conductor pipe into the ground which comprises in combination, an external reciprocal impact driving means supported atop the conductor pipe, internal rotatable drilling means supported within the conductor pipe, and means associated therewith for introducing air and water under pressure for creating a pressure differential to evacuate the drilling debris and cuttings to the surface. The drilling means being supported within said conductor pipe at the bottom portion thereof near the point of least energy absorption and rebound.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 through 5 are detailed elevational views in cross section of portions of a preferred tool for driving casing or conductor pipe in accordance with the present invention.

FIG. 6 is a schematic elevational view in cross section illustrating one method and a preferred embodiment of the apparatus for driving casing or conductor pipe.

FIG. 7 is a schematic elevational view in cross section illustrating another method and an alternate embodiment of the apparatus for driving casing or conductor pipe.

FIG. 8 is a schematic elevational view in cross section illustrating another method and an alternate embodiment of the apparatus for driving casing or conductor pipe. cDESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1 through 5, a preferred embodiment of the apparatus 10 comprises an upper drive assembly 11 (FIGS. 1 and 2), a latch assembly 12 (FIGS. 2 and 3), a drive string assembly 13 (FIGS. 3 and 4), and a lower assembly 14 (FIGS. 4 and 5). The upper drive assembly 11 comprises an elongated hollow cylindrical housing 15. A conventional reciprocating percussion hammer 16, impact block 17, and helmet member 18 are supported at the top end of the housing 15. The bottom end of the housing 15 is provided with suitable connecting means 19 for securing the housing 15 to the top of a section of conductor pipe 20. Two opposing elongated longitudinal slots 21 are disposed on the circumference of the upper portion of the housing 15 (shown only on one side). Two opposed hollow cylindrical collars 22 secured to the circumference of the housing 15 intermediate the slots 21 and the connecting means 19 extend inwardly into the housing 15 a short distance and each receives a nipple 23 which is secured therein by set screws 24. The nipple members 23 extend outwardly from the collars 22 and are provided with circumferential seals 25 to form a fluid tight seal on the inner diameter of the collars 22 and their extended end 26 is adapted to receive conventional hose connections. The collars 22 and nipples 23 provide a fluid inlet 27 into the housing 15 from a suitable source.

A hollow cylindrical liner 28 of suitable low friction material such as PVC plastic extends upwardly from just above the collars 22 to terminate a distance above the slots 21 and is provided with opposing circumferentially disposed slots 29 which match those of the housing 15. The liner 28 is secured at its bottom end to the inner diameter of the housing 15 by an annular retaining ring 30 screwed to the inner diameter of the housing 15. The liner 28 provides a reduced friction inner surface on the upper section of the housing 15.

A returns chamber 31 is concentrically disposed within the housing 15 to travel vertically along the lined portion thereof. The chamber 31 comprises a hollow cylindrical drum member 32 having an outer diameter less than the inner diameter of the liner 28. The drum 32 is enclosed by a flat cylindrical bottom plate 33 secured to its bottom end and a flat cylindrical top plate 34 secured to its top end. Centrally disposed circular openings 35 and 36 are provided in the bottom plate 33 and top plate 34 respectively in longitudinal axial alignment. A lower annular nylon reciprical seal 37 having a cooperative poly seal 38 peripherally disposed therein is secured in a circumferential groove 39 on the outer periphery of the bottom plate 33 to provide sliding contact with the inner surface of the liner 28. The lower seal 37 is retained in the groove 39 by a flat cylindrical retaining ring 40 secured to the bottom surface of the bottom plate 33 by bolts 41. An upper annular nylon reciprical ring 42 having a cooperative o-ring seal 43 peripherally disposed therein is secured in a circumferential groove 44 on the outer periphery of the top plate 34 to provide sliding contact with the inner surface of the liner 28, and serves as a wiper ring and shock absorbing means.

Two opposed hollow cylindrical collars 45 (only one shown) secured to the circumference of the drum 32 intermediate the top plate 34 and the bottom plate 33

extend inwardly into the chamber 31 a short distance and each receives a nipple 46 which is secured therein by set screws 47. The nipple members 46 extend outwardly from the collars 45 and are provided with circumferential seals 48 to form a fluid tight seal on the inner diameter of the collars 45 and their extended end 49 is adapted to receive conventional hose connections. The collars 45 and nipples 46 provide an outlet 50 from the returns chamber 31 to discharge drilling debris from within the chamber to a suitable destination. Only one outlet 50 is shown, so that other parts of the drawing may be shown and described more clearly. The outlets 50 extend outwardly through, and travel longitudinally within the slots 21 and 29.

An elongated hollow cylindrical upper rotation drive tube 51 is concentrically disposed within the chamber 31 and extends downwardly therethrough. The drive tube 51 is rotatably received within the circular openings 35 and 36. A rotary poly seal element 52 is provided between the outer diameter of the tube 51 and the top plate 34 and an opposing poly seal 53 is provided between the outer diameter of the tube 51 and the bottom plate 33 where the tube 51 passes through.

At least one elongated circular opening 54 is provided on the circumference of the tube 51 just above the top surface of the bottom plate 33 to provide communication between the inside of the tube 51 and the inside of the chamber 31.

A generally cylindrical cup shaped lower bearing carrier 55 having a central opening 56 to rotatably receive the downwardly extending portion of the tube 51 is bolted to the bottom surface of the bottom plate 33. A roller bearing 57 is provided in the upper portion of the carrier 55 and a rotary poly seal 58 is provided in the bottom portion thereof to provide a seal between the outer diameter of the tube 51 and the carrier 55. An annular oil seal 59 is disposed directly below the bearing 57 to retain the bearing lubricant.

A cylindrical drive shaft connector 60 is secured to the reduced diameter upper end of the rotation drive tube 61 which extends upwardly a short distance from the top plate 34. The outer diameter of the connector 60 is provided with an annular groove 62 and to receive a split ring 63. A cylindrical upper bearing carrier 64 is secured at its bottom end to the top surface of the top plate 34. A flat cylindrical lower spacer ring 65 having a central circular opening which rotatably receives the reduced diameter 61 of the drive tube 51 is disposed within the carrier 64 at the lower portion. An oil seal 66 is provided between the tube 51 and the ring 65, and an o-ring seal 67 is disposed between the circumference of the spacer ring 65 and the inner diameter of the carrier 64. A spherical thrust bearing 68 is supported on the spacer 65 and is in operational contact with inner diameter of the carrier 64 and the outer diameter of the connector 60. A spring ring 63 is received within the groove 62 and is supported on the top of bearing 68. An annular split ring housing 69 surrounds the split ring 63. The upper surface of the split ring housing 69 is provided with a brass thrust bushing 70.

Rotary motion to the upper rotation drive tube 51 is provided by means of a conventional hydraulic motor 71 through a planetary reduction gear 72 disposed therebelow and provided with a downwardly extending drive shaft 73. The connector 60 is provided with a central opening 74 which is adapted to receive the extended end of the shaft 73 and the shaft is secured thereto by keys 75. The upper cylindrical portion of a

gear box adapter 76 receives and supports the planetary gear 72 and motor 71. The lower portion of the adapter 76 is provided with a flange 77 which is bolted to the top surface of the upper carrier 64. The flange 77 also retains the aforementioned components within the carrier 64.

An isolated air inlet passageway 78 is provided through the returns chamber 31 between the top plate 34 and the bottom plate 33. A vertical bore 79 spaced radially outward from the central longitudinal axis is provided in the top plate 34. The bottom plate 33 is provided with an annular groove 80 within the central opening 35. Annular seals 81 above and below the groove 80 provide an air seal between the groove 80 and the tube 51. An air passage bore 82 extends laterally outward from the groove 80 to terminate a distance from the periphery of the bottom plate 33. A vertical bore 83 in longitudinal axial alignment with the bore 79 in the top plate 34 extends downward from the top surface of the bottom plate 33 to communicate with the lateral bore 82 and groove 80. A counter bore 84 of the same diameter as the bore 79 in the top plate 34 and in longitudinal axial alignment therewith extends downward a short distance from the top surface of the bottom plate. One end of a tubular air supply conduit 85 is received within the bore 79 and the opposed end is received within the counter bore 84. The ends of the conduit 85 are provided with seals to provide an isolated air passageway through the chamber 31. A conventional hose connection 86 is provided atop the bore 79 to supply air to the conduit 85.

The bottom end of the upper rotation drive tube 51 is provided with a flange 52 which is connected by bolts 53 to the mating flange 86 of a latch drive tube 87. The latch drive tube 87 is of the same internal and external diameter as the upper rotation drive tube 51 and extends downwardly therefrom to form the central member of the latch assembly 12.

The latch assembly 12 comprises a cylindrical latch nipple 88 which is welded onto the outer periphery of the latch drive tube 87. A small bore 89 spaced radially outward from the longitudinal axis extends vertically upwardly a distance from the bottom surface of the nipple 88 to communicate with a small horizontal bore 90 extended to the exterior of the nipple 88 to provide a pressure inlet. A zerk fitting 91 is secured into the bore 90 for connection to a suitable pressurizing means. The bottom portion of the latch drive tube 87 is provided with external threads 92 which engage mating internal threads 93 on the internal diameter a cylindrical bottom flange 94. A set screw 95 secures the bottom flange 94 to the latch drive tube 87.

The cylindrical bottom flange 94 is provided with an air passage bore 96 spaced radially outward from the longitudinal axis and extended upwardly a distance from the bottom surface of the bottom flange 94 to communicate with a horizontal bore 97 extended inwardly to an annular groove 98 above the internal threads 93. Seals 99 are provided above and below the groove 98 to form a rotary seal on the outer diameter of the latch drive tube 87. A connecting nipple or latch air stinger 100 is sealably secured into the bottom portion of the bore 96 and extends downwardly a distance therefrom. A pressure relief bore 101 spaced radially outward from the longitudinal axis extends downwardly a distance from the top surface of the bottom flange 94 to intersect a horizontal bore 102 to establish communication with atmosphere. A plurality of pins

103 are press fitted into the bottom of the bottom flange 94 and extend downwardly a short distance therefrom. The pins 103 are positioned radially outward from the longitudinal axis to be in axial alignment with the bolt circle of the mating flange 104 of a drive tube 105. A reduced diameter tubular extension or guide tube 106 is attached in axial alignment to the bottom surface of the bottom flange 94 and extends downwardly therefrom to be slidably received within the drive tube 105. Circumferential annular seals 107 are provided on the guide tube 106 near its juncture with the bottom flange 94 to seal on the inner diameter of the drive tube 105. A pair of opposed tapered openings 108 extend angularly and upwardly from the bottom of the guide tube 106 to terminate in an elongated narrow slot 109. The openings receive and guide a pin 110 disposed transversely through the drive tube 106 to align the depending pins 103 into the bolt holes 111 and the latch air stinger 100 into an air conduit 112.

A cylindrical latch dog member 113 having an internally threaded upper portion 114 and a slotted expandable bottom portion 115 is threadably received on mating external threads 166 of the nipple 88 and retained thereon by a set screw 117. The slotted bottom portion 115 forms a series of expandable fingers or collets 118. The internal diameter of the dog member 113 extends straight down from the threaded portion 114 a distance below the top of the slots 115 and travels angularly inward and down to form a tapered surface 119. At the inward termination of the tapered surface 119 an annular horizontal top shoulder 120 is defined by a large diameter which extends downwardly therefrom to terminate at a second opposing annular horizontal bottom shoulder 121. The top surface of the cylindrical bottom flange 94 is captured below the top shoulder 120 and the bottom surface of the flange 94 is held by the bottom shoulder 121.

A cylindrical latch piston 122 is slidably received on the outer diameter of the latch drive tube 87 and within the inner diameter of the latch dog 113. An annular reciprocating seal 123 is provided between the outer diameter of the tube 87 and the inner diameter of the piston 122. Another reciprocating annular seal 124 is provided between the outer diameter of the piston 122 and the inner diameter of the latch dog 113 above the slotted portion 115. A counterbore 125 extends upwardly a distance from the bottom of the piston 122 to receive one end of a compression spring 126. The other end of the spring 126 is biased on the top surface of the bottom flange 94 to urge the piston 122 upwardly to a position just below the bottom of the latch nipple 88.

When pressure is applied through the zerk fitting 91 the piston 122 travels down on the tapered surface 119 to expand the collets 118 and release their grip on the mating flange 104 to add or remove sections of drill tube below the latch assembly 12 as length requirements change.

An internal air passageway 127 is provided between the returns chamber 31 and the latch assembly 12 within the upper rotation drive tube 51 and the latch drive tube 87 and extends downwardly along the inner diameters thereof. An ell fitting 128 is disposed within the upper rotation drive tube 87 the inlet of which extends through the tube 51 and is secured thereto in horizontal alignment with the groove 80 of the bottom plate 33. A second opposing ell fitting 129 disposed within the latch drive tube 87 the outlet of which extends through the tube 87 and is secured thereto in horizontal alignment

with the groove 98 in the bottom flange 94. The ell fittings 128 and 129 are in longitudinal axial alignment. One end of an elongated tubular air supply conduit 130 is received within the outlet of the ell fitting 128 and the opposed end is received within the inlet of the ell fitting 129. The ends of the conduit 130 are provided with seals to provide an isolated air passageway within the tubes 51 and 87. The air passageway continues through the bottom flange 94 and to the latch air stinger 100.

The drive string assembly 13 (FIGS. 3 and 4) comprises one or more elongated sections of drive tubes 131 having a flange 132 at each end. Air passage conduit 133 laterally offset from the drive tube 131 extends between the flanges. Successive sections of drive tubes are added by operation of the latch assembly 12 in the manner previously described, and conventionally bolted together with the air passage conduits 133 in longitudinal alignment. As the flanges are being aligned for bolting, conventional stingers 134 are placed within opposing ends of the air passage conduit 133 providing an air tight junction therebetween when the flanges are made up. Certain sections of drive tubes 131 may be provided with stabilizer fins to maintain vertical alignment inside the conductor pipe 20. A flat cylindrical air injector flange 136 having a central bore 137 is bolted between the lowermost drive tube 131 and the flange 145 of a shock absorbing nipple 142 (described hereafter). An air passage bore 138 spaced radially outward from the longitudinal axis extend vertically downward from the top surface of the flange 136 to communicate with a horizontal bore 139 extended radially outward from the central bore 137.

A counterbore 140 concentric with the air passage bore 138 receives one end of a check valve stinger 141. One end of the check valve stinger is sealably secured into the counterbore 140 and the opposing end extends vertically upward to be sealably received within the air passage conduit 133 of the lowermost drive tube 131. The check valve stinger 141 contains a check valve mechanism 141a to allow air under pressure to be directed only into the drive tube 131 through the passageways 138 and 139. The air injector flange 136 will fit between any flanged connections on the assembly 10.

The lower assembly 14 (FIGS. 4 and 5) comprises a shock absorbing nipple 142 which is made up an elongated inner tubular member or drill bit drive string 143 and a shorter concentric outer cylindrical member 144 joined at their upper ends. A flange 145 at the top of the outer member joins the nipple 142 to the air injector flange 136. The difference between the outer diameter of the drive string 143 and the inner diameter of the outer member 144 forms a cylindrical cavity 146 therebetween. A cylindrical thrust spool carrier 147 slidably received on the drive string 143 has a thin cylindrical vertical upper portion 148 which is telescopically received within the cavity 146. A thin cylindrical cup shaped outer housing 149 has a bottom 150 provided with a concentric opening 151 which is slidably received on the vertical upper portion 148 of the carrier 147. The inner surface of the cylindrical wall of the housing 149 is slidably received on the outer circumference of the nipple 144, and the bottom portion 150 is spaced downwardly from the bottom surface 152 of the nipple 144 to form an enclosed cylindrical cavity around the vertical upper portion 148 of the carrier 147. Several layers or rings of conventional shock absorbing material 154 are disposed within the cavity 153. An intermediate portion 155 of the carrier 147 is of larger

diameter than the upper portion 148 to define an annular shoulder 156 therebetween which supports the bottom 150 of the housing 149. The bottom portion 157 of the carrier 147 is of larger diameter than the intermediate portion 155 to define an annular shoulder 158 therebetween. An inverted cup shaped cylindrical upper bearing retainer cap 159 has a central opening 160 which is slidably received on the intermediate portion 155 of the carrier 147 and the diametrically larger inner surface 161 of the cylindrical wall is slidably received on the circumference of the bottom portion 157. A cylindrical thrust bushing 162 is disposed between the intermediate portion 155 of the carrier 147 and the top portion of the cap 159. A flat annular thrust bushing 163 is disposed between the shoulder 158 and an opposing shoulder 164 on the cap 159. The bottom portion of the upper bearing cap 159 is provided with internal threads 165 which extend upwardly therefrom.

A cylindrical lock-in stabilizer spool 166 is slidably received on the circumference of the drill bit drive tube 143. The spool 166 has a cylindrical upper portion 167 provided with external threads 168, an intermediate portion provided with longitudinal, radially opposed slots 169, and a cylindrical bottom portion 171. Each end of the slots 169 form an upper shoulder 170 and a lower shoulder 172. The top portion 167 is threadably secured into the upper cap 159 with the shoulder 170 slightly above the bottom surface of the cap 159. The top surface of the spool 166 is spaced from the bottom surface of the carrier 147 and a thrust bearing 173 is disposed therebetween. A spherical roller bearing 174 is disposed between the drive tube 143 and a counterbore 175 in the top portion 167. The bottom portion 171 of the spool 166 is provided with external threads 176 and a central counterbore 177. A spherical roller bearing 178 is disposed between the drive tube 143 and the counterbore 177.

A generally cup shaped cylindrical lower bearing retainer cap 179 has a central opening 180 which is slidably received on the drive tube 143. The upper portion of the cap 179 is provided with internal threads 181. A thrust bearing 182 is disposed between the circumference of the tube 143 and a bearing recess 183 in the lower portion of the cap 179. The upper portion of the cap 179 is threadably secured onto the lower portion of the spool 166 with the shoulder 172 slightly below the top surface of the cap 179.

A set of four circumferentially spaced apart radially opposed lock-in blades 184 are slidably disposed within the slots 169 around the circumference of the intermediate portion of the spool 166 between the shoulders 170 and 172. Each blade 184 is comprised of an outwardly extending intermediate blade portion 185 and at each end a flat rectangular tongue portion 186 extending vertically therefrom. A series of horizontal bores 187 in the blade portion receive compression springs 188 which are biased against the inner surface of slots 169 to urge the blades outwardly therefrom. The tongue portions 186 ride outwardly on the shoulders 170 and 172 and are contained within the exposed portions of 189 and 190 of the upper and lower caps 159 and 179. The extended outer surface of the blades portions are provided with a short straight vertical surface 191 and opposing angular surfaces 192 which travel inwardly to terminate just below the top of the tongue portions 186. A lock-in notch 193 is provided in the straight vertical portion 191. As the tool travels downwardly within the

conductor pipe 20 the blades 184 expand outwardly to ride on the interior of the conductor 20.

A landing nipple 194 is provided on the lower portion of the conductor pipe 20. The interior of the landing nipple 194 is provided with a stop shoulder 195 which corresponds in profile to the notch 193. When the blades 184 reach the shoulder 195, they will expand to become locked therein against further downward movement.

The extended end of the drill bit drive tube 143 is provided with threads 196 which receive the internal threads 197 of the collar portion 198 of the drill bit 199. A retaining bolt 200 further secures the collar to the drive tube 143. The drill bit collar 198 is open ended to accept drilling debris and returns into the drive tube where they are carried upward and discharged as hereinafter described.

Referring now to FIGS. 6, 7, and 8, there are illustrated several methods and apparatus for setting a casing or conductor pipe in accordance with the present invention. FIG. 6 illustrates schematically one method of setting a casing or conductor pipe in the ground using a preferred apparatus 10. As shown, the conductor pipe 20 is driven into the soil S until it stops by the conventional reciprocating hammer 16 mounted at the top. The hammer is removed and the assembly is lowered inside the conductor pipe 20 until the upper drive assembly 11 contacts the top of the conductor pipe. The upper drive assembly 11 is made up and the drive string assembly 13 is lowered further until the lock-in blades 184 disposed at the lower end of the drive string 13 are received into mating shoulders in the landing nipple 194 affixed to the bottom of the conductor pipe 20 and the drill bit 199 comes to rest on the soil at the bottom of the conductor pipe 20. A shock absorbing nipple 142 is disposed directly above the drill bit. The hammer 16 is placed on top of the upper drive assembly 11 with a conventional impact block disposed therebetween.

The upper drive assembly 11 comprises a hydraulic rotary motor 71 and gear box 72 mounted at the top and coupled to the upper rotation drive tube 51 which passes through the cylindrical returns chamber 31 slidably disposed within the cylindrical housing 15 of the assembly 11. Air under pressure is introduced into the lower portion of the drive string 13 through the air injector flange 136 to exit through slots 54 in the rotation drive tube 51 and outlet nipples 46 in the returns chamber 31. The nipples 46 protrude outwardly through slots provided in the upper portion of the housing 15. Air supply conduit 78 bypasses the upper portion of rotation drive tube 51. The purpose of the slot arrangement is to provide a means whereby the bottom portion of the rotation drive tube may be extended below the bottom of the housing 15 sufficiently to connect additional sections of drill string as they are required.

Sea water is introduced under pressure through inlets 27 in the housing 15 to flow into the area between the outer surface of the drive string 13 and the inner surface of the conductor pipe 20. A pressure differential is created between the hydrostatic head of the sea water column and the reduced pressure within the drill string to effectively evacuate drilling debris and cuttings from the drilled hole and eject them through the outlet nipples 46. With the apparatus thus assembled, rotary drilling and reciprocal hammering actions may begin.

The driller may coordinate drilling speed with the driving action by observing the outlet nipples. As the

soil plug is moving up in the conductor pipe, the nipples will ride up in the slots to indicate that drilling speed should be increased to get the drill bit back down to the landing nipple.

It should be noted that the apparatus is supported near the drill bit on the landing nipple at the bottom of the conductor pipe where the least energy absorption and rebound is noticed, and the percussion force applied to the casing by the driving hammer is absorbed throughout the entire length of the casing and by the time it reaches the bottom, the minimal amount of force is being absorbed by the apparatus. The shock absorbing nipple further absorbs any force that is transmitted into the string to reduce fatigue problems.

FIG. 7 illustrates schematically another embodiment of the apparatus wherein the air flow arrangement is deleted and only water is used to evacuate the drilling debris and cuttings. The conductor pipe 20 is driven into the soil, the assembly is lowered inside the conductor pipe 20, and the upper drive assembly 11A is made up, as previously described. As shown, the lock-in device 184A in this embodiment comprises a plurality of flat radially expanding blade members which are pivotally connected at their upper ends to a concentric sliding ring member. A compression spring 142A disposed on the outer diameter of the drill string 13 between the sliding ring and the lower flanged connection serves as the shock absorbing device. The lock-in members 184A are received into mating shoulders in the landing nipple 194 affixed to the bottom of the conductor pipe 20.

The upper drive assembly 11A of this embodiment comprises a hydraulic rotary motor 71 and gear box 72 mounted at the top and coupled to the upper rotation drive tube 51A which passes through an isolated water chamber 31A formed in the cylindrical housing 15A of the assembly 11A. Torque arms T protrude outwardly through slots 21A provided in the upper portion of the housing 15A.

Sea water is introduced under pressure through inlets 27A in water chamber 31A of the housing 15A to flow into slots 54A in the upper portion of the rotation drive tube 51A. The water is pumped into the annulus of the drive tube and drill string to exit at the drill bit 199. Drilling debris and cuttings are carried by the water upward in the area between the outer surface of the drive string 13 and the inner surface of the conductor pipe 20 to exit through outlets 46A provided in the lower portion of the housing 15A. With the apparatus thus assembled, rotary drilling and reciprocal hammering actions may begin.

FIG. 8 shows schematically another alternate method and embodiment of the apparatus wherein various combinations of the upper housing arrangement, latching device, debris return system, and shock absorbing devices of the aforementioned embodiments may be incorporated. The conductor pipe 20 is driven into the soil, the assembly is lowered inside the conductor pipe 20, and the upper drive assembly is made up, as previously described.

In this embodiment, a down hole motor 71B is disposed in the drive string 13 between the drill bit 199 and the shock absorbing device 142A to rotate the drill bit from the bottom of the drill string rather than rotating it from the surface as previously described. The down hole motor 71B may be a conventional down hole motor for rotating the drill bit with or without reciprocating impact capabilities.

While this invention has been described fully and completely with special emphasis upon a preferred embodiment, it should be understood that within the scope of the appended claims the invention may be practiced otherwise than is specifically described herein.

What is claimed is:

1. Apparatus for driving casing or conductor pipe into the ground comprising in combination;
 - a casing or conductor pipe adapted to be driven into the ground and having an internally disposed support shoulder at the bottom portion thereof,
 - reciprocal impact driving means supported atop said casing or conductor pipe for applying percussive force thereto,
 - a drill string assembly supported upon said support shoulder within said casing or conductor pipe for drilling a hole at the bottom thereof, said drill string supported within said casing or conductor pipe a sufficient distance beneath said impact driving means to substantially reduce the effects of percussive action imparted to said casing or conductor pipe by said driving means,
 - a drill bit connected to the lower end of said drill string assembly,
 - a fluid driven drilling means reasonably connected to said drilling string assembly for imparting rotary motion thereto independently from the movement of said casing or conductor pipe, and
 - means associated with said drill string assembly for creating a fluid pressure differential between the interior and the exterior of said drill string assembly to evacuate drilling debris and cuttings from the drilled hole,
 - said driving means and said drilling means operative simultaneously or sequentially.
2. The apparatus according to claim 1 further comprising
 - shock absorbing means interposed between said drill string assembly and said casing or conductor pipe support shoulder for reducing the percussive force transmitted therebetween by said driving means.
3. The apparatus according to claim 1 wherein said drill string assembly is supported within said casing or conductor pipe at the bottom portion thereof near the point of least percussive action imparted to said casing or conductor pipe by said driving means.
4. The apparatus according to claim 1 wherein said drilling means comprises a down hole motor disposed in the drill string at the lower portion thereof to rotate a drill bit from the bottom of the drill string.
5. The apparatus according to claim 1 wherein said means for creating a pressure differential includes means for introducing air under pressure to the interior of said drill string assembly.
6. Apparatus for driving casing or conductor pipe into the ground comprising in combination;
 - a casing or conductor pipe adapted to be driven into the ground and having an internally disposed support shoulder,
 - an elongated hollow cylindrical housing, having a top end adapted to operatively receive and support a reciprocating percussion hammer and impact block, and a bottom end provided with connecting means for securing said housing to the top of said casing or conductor pipe,
 - opposing elongated longitudinal slots disposed on the circumference of the upper portion of said housing,

- at least one fluid inlet secured to the circumference of said housing longitudinally intermediate said slots and bottom end in fluid communication with the interior of said housing and having one end extending outwardly therefrom and adapted to receive hose connections for connecting said inlet to a fluid source,
- an enclosed hollow cylindrical chamber concentrically disposed within said housing adapted for reciprocal non-rotating vertical movement therein, said chamber enclosed at its top end by a top plate member and at its bottom end by a bottom plate member,
- horizontally opposed fluid outlets secured to the circumference of said chamber vertically intermediate said top and bottom plate members in fluid communication with the interior of said chamber and having one end extending outwardly therefrom and adapted to receive hose connections for connecting said outlet to a discharge hose,
- the intermediate portion of said outlets slidably received within said slots of said housing and said liner for longitudinal reciprocal movement therein,
- a longitudinal elongated hollow cylindrical upper drive tube member disposed concentrically within said chamber having one end extending upwardly therefrom and its other end extending downwardly therefrom, said tube secured to said chamber and journaled thereabove and therebelow for rotational movement relative thereto,
- said upwardly extending end provided with drive shaft connecting means and said downwardly extending end provided with a flange,
- at least one elongated circular opening on the circumference of said tube to provide communication between the interior of said tube and the interior of said chamber,
- a fluid driven motor and gear reduction means having a downwardly depending drive shaft member releasably connected to said connecting means for imparting rotary motion to said upper rotation drive tube, said motor and gear reduction means supported upon said chamber for vertical movement therewith,
- a hydraulically operated latch assembly having a top flange connected to said flange of said rotation drive tube and a bottom flange provided with means for releasably guiding and connecting said latch assembly to the top flange of a drive string assembly,
- a drive string assembly in axial alignment with said drive tube comprising one or more longitudinal hollow cylindrical tubes having a top flange and a bottom flange, the uppermost tube having its top flange releasably connected to said bottom flange of said latch assembly,
- a drill bit drive tube in axial alignment with said drive tube assembly comprising a longitudinal hollow cylindrical tube having a top flange and its bottom end adapted to receive a drill bit, said top flange connected to said bottom flange of said drive string tube,
- expandable support means carried by said drill bit drive tube adapted to expand radially outward therefrom to be received within said casing or conductor pipe on said support shoulder,
- shock absorbing means interposed between said drill bit drive and said expandable support means for

13

reducing the percussive force transmitted therebetween by said driving means.

7. The apparatus according to claim 6 further comprising a hollow cylindrical liner of material having a low coefficient of friction secured to the interior surface of said housing to extend upwardly from above said inlet and terminate a distance above said slots.

8. The apparatus according to claim 6 or 7 further comprising:

an isolated air inlet passageway having a longitudinally offset stationary upper portion extending from above said top plate of said chamber, through said chamber into said bottom plate of said chamber to communicate through a first sealed rotary connection with a second portion disposed longitudinally and extending downwardly along the interior sidewall of said upper rotation drive tube and said latch assembly to communicate through a second sealed rotary connection with a longitudinally offset bore extending downwardly therefrom, said bore provided with depending connecting means to be received within an axially aligned air passage conduit which extends longitudinally adjacent the exterior of said drive string assembly between said top and bottom flanges thereof, conduit connecting means disposed between mating flanges of said drive tubes for sealably joining opposing ends of said conduit,

flange connecting means for joining the bottom flange of the lowermost said drive tube to a mating flange, said flange connecting means having an air conduit connecting means in axial alignment with said air passage conduit for sealably connecting therein,

said air conduit connecting means having an air passageway for establishing air communication between said air passage conduit and the interior of said drive string assembly, and

a check valve disposed within said air conduit connecting means to allow air under pressure to be directed only into said drive tube.

9. Apparatus for driving casing or conductor pipe into the ground comprising in combination;

a casing or conductor pipe adapted to be driven into the ground and having an internally disposed support shoulder,

an elongated hollow cylindrical housing, having a top end adapted to operatively receive and support a reciprocating percussion hammer and impact block, and a bottom end provided with connecting means for securing said housing to the top of said casing or conductor pipe, an enclosed hollow cylindrical water chamber portion disposed within said housing, said chamber enclosed at its top end by a top plate member and at its bottom end by a bottom plate member,

opposing elongated longitudinal slots disposed on the circumference of the upper portion of said housing, at least one fluid inlet secured to the circumference of said housing longitudinally intermediate said top and bottom plate members in fluid communication with the interior of said water chamber and having one end extending outwardly therefrom and adapted to receive hose connections for connecting said inlet to a fluid source,

at least one fluid outlet secured to the circumference of said housing vertically intermediate said bottom plate and said connecting means in fluid communi-

14

cation with the interior of said casing or conductor pipe and having one end extending outwardly therefrom adapted to receive hose connections for connecting said outlet to a discharge hose,

a longitudinal elongated hollow cylindrical upper drive tube member disposed concentrically within said housing having one end extending upwardly from said water chamber and its other end extending downwardly therefrom, said tube journaled thereabove and therebelow for rotational and reciprocal movement relative thereto,

said upwardly extending end provided with drive shaft connecting means and said downwardly extending end provided with a flange,

at least one elongated circular opening on the circumference of said tube to provide fluid communication between the interior of said tube and the interior of said water chamber,

a fluid driven motor and gear reduction means having a downwardly depending drive shaft member releasably connected to said connecting means for imparting rotary motion to said upper rotation drive tube, said motor and gear reduction means supported upon said drive tube for vertical movement therewith,

at least two opposing arms connected to said motor and gear reduction means and extending outwardly therefrom, the intermediate portion of which are slidably received within said slots of said housing for longitudinal reciprocal movement therein,

a hydraulically operated latch assembly having a top flange connected to said flange of said rotation drive tube and a bottom flange provided with means for releasably guiding and connecting said latch assembly to the top flange of a drive string assembly,

a drive string assembly in axial alignment with said drive tube comprising one or more longitudinal hollow cylindrical tubes having a top flange and a bottom flange, the uppermost tube having its top flange releasably connected to said bottom flange of said latch assembly,

a drill bit drive tube in axial alignment with said drive tube assembly comprising a longitudinal hollow cylindrical tube having a top flange and its bottom end adapted to receive a drill bit, said top flange connected to said bottom flange of said drive string tube,

expandable support means carried by said drill bit drive tube adapted to expand radially outward therefrom to be received within said casing or conductor pipe on said support shoulder,

shock absorbing means interposed between said drill bit drive tube and said expandable support means for reducing the percussive force transmitted therebetween by said driving means.

10. Apparatus for driving casing or conductor pipe into the ground comprising in combination;

a casing or conductor pipe adapted to be driven into the ground and having an internally disposed support shoulder,

an elongated hollow cylindrical housing, having a top end adapted to operatively receive and support a reciprocating percussion hammer and impact block, and a bottom end provided with connecting means for securing said housing to the top of said casing or conductor pipe, an enclosed hollow cylindrical water chamber portion disposed within

said housing, said chamber enclosed at its top end by a top plate member and at its bottom end by a bottom plate member, opposing elongated longitudinal slots disposed on the circumference of the upper portion of said housing, at least one fluid inlet secured to the circumference of said housing longitudinally intermediate said top and bottom plate members in fluid communication with the interior of said water chamber and having one end extending outwardly therefrom and adapted to receive hose connections for connecting said inlet to a fluid source, at least one fluid outlet secured to the circumference of said housing vertically intermediate said bottom plate and said connecting means in fluid communication with the interior of said casing or conductor pipe and having one end extending outwardly therefrom adapted to receive hose connections for connecting said outlet to a discharge hose, a longitudinal elongated hollow cylindrical upper drive tube member disposed concentrically within said housing having one end extending upwardly from said water chamber and its other end extending downwardly therefrom, said tube journaled thereabove and therebelow for reciprocal movement relative thereto, said upwardly extending end provided with at least two opposing arms connected thereto and extending outwardly therefrom, the intermediate portion of which are slidably received within said slots of said housing for longitudinal reciprocal movement therein, and said downwardly extending end provided with a flange, at least one elongated circular opening on the circumference of said tube to provide fluid communication between the interior of said tube and the interior of said water chamber, a hydraulically operated latch assembly having a top flange connected to said flange of said rotation drive tube and a bottom flange provided with means for releasably guiding and connecting said latch assembly to the top flange of a drive string assembly, a drive string assembly in axial alignment with said drive tube comprising one or more longitudinal hollow cylindrical tubes having a top flange and a bottom flange, the uppermost tube having its top flange releasably connected to said bottom flange of said latch assembly, a drill bit drive tube in axial alignment with said drive tube assembly comprising a longitudinal hollow cylindrical tube having a top flange and its bottom end adapted to receive a drill bit, said top flange connected to said bottom flange of said drive string tube, expandable support means carried by said drill bit drive tube adapted to expand radially outward therefrom to be received within said casing or conductor pipe on said support shoulder, shock absorbing means interposed between said drill bit drive tube and said expandable support means for reducing the percussive force transmitted therebetween by said driving means, a fluid driven down hole motor interposed between said drill bit drive tube and said drill bit for imparting rotary motion to said drill bit.

11. The apparatus according to claim 6, 9, or 10, wherein said shock absorbing means comprises

an elongated inner tubular member provided with a flange at its upper end and a shorter concentric outer cylindrical member joined at its upper end to said inner member, said outer member of larger diameter than said inner member to form a cylindrical cavity therebetween, a cylindrical thrust spool member slidably received on said inner member, said spool having a thin cylindrical vertical upper portion which is telescopically received with said cavity, an intermediate portion of larger diameter than said upper portion to define an upper annular shoulder therebetween, a bottom portion of larger diameter than said intermediate portion to define a lower annular shoulder therebetween, a thin cylindrical cup shaped outer housing having a bottom portion slidably received on the vertical upper portion of said spool member and supported on said upper shoulder, the inner surface of the cylindrical wall of said outer housing slidably received on the circumference of outer member and the bottom portion spaced downwardly from the bottom surface thereof to form an enclosed cylindrical cavity around the vertical upper portion of said spool member, and several layers or rings of shock absorbing material disposed within said cavity to absorb percussive force transmitted thereto by vertical movement of said spool.

12. The apparatus according to claim 6, 9, or 10, wherein said expandable support means comprises; a cylindrical lock-in stabilizer spool slidably received on the circumference of the drill bit drive tube and journaled therebetween for rotary movement relative thereto, said spool having a cylindrical upper portion, an intermediate portion provided with circumferentially disposed longitudinal radially opposed slots, and a cylindrical bottom portion, each said slot defining at each end thereof an upper shoulder and a lower shoulder therebetween, a cylindrical outer upper retaining cap member secured to said upper portion, the lower end positioned slightly below said upper shoulder of said slots, a cylindrical outer lower retaining cap member secured to said bottom portion, the upper end positioned slightly below said lower shoulder of said slots, a series of circumferentially spaced apart radially opposed lock-in blades slidably disposed within said slots vertically around the circumference of said intermediate portion of said spool between said upper and lower shoulders of said slots, said blades spring biased outwardly from the inner surface of said slots to ride on said shoulders and their upper and lower portions captured by the inner surface of the upper and lower cap members which extend above and below said shoulders of said slots, said blades provided with a short straight vertical surface on their outer periphery having a shoulder receiving notch therein to receive and be supported by a mating support shoulder disposed within said casing or conductor pipe.

13. The apparatus according to claim 6, 9, or 10, wherein said expandable support means comprises;

17

a concentric cylindrical ring member slidably disposed on the circumference of said drill bit drive tube,
 a plurality of radially expanding members having their upper ends pivotally connected to said ring member and their lower ends adapted to expand radially outward therefrom to be received within said support shoulder, and wherein said shock absorbing means comprises;
 a compression spring disposed on the circumference of said drill string and biased between the top surface of said sliding ring and the bottom surface of the top flange of said drill bit drive tube.

14. The apparatus according to claim 6, 9, or 10 wherein said latch assembly comprises;
 an elongated longitudinal hollow cylindrical latch drive tube having a top flange and a cylindrical bottom flange spaced downwardly therefrom,
 a cylindrical latch dog member having a cylindrical upper portion secured to said latch drive tube below said top flange and a hollow slotted expandable bottom portion extending downwardly therefrom forming a series of expandable fingers or collets having a recess therein and a tapered surface above said recess,
 said recess adapted to receive and capture said bottom flange and said flange of said drive string assembly,
 said upper portion provided with a pressure inlet bore extending from its exterior surface to its bottom surface and having a pressure connection secured therein for receiving fluid pressure from a source,
 said bottom flange provided with a pressure relief bore from its top surface in communication with atmosphere, a downwardly extending pin member to be received within a bolt hole of the top flange of said drill string assembly, and a tubular guide tube member adapted to be received within the top flange of said drill string assembly,
 a cylindrical latch piston slidably received on the circumference of said latch drive tube intermediate said top flange and said bottom flange and within the inner diameter of said collets,
 said piston provided with a counterbore extended upwardly a distance from the bottom surface thereof
 a compression spring having one end received within said counterbore and the other end biased on the top surface of said bottom flange to urge said piston upwardly therefrom,
 said piston to travel downward upon receiving fluid pressure applied through said inlet bore to contact and travel down on said tapered surface to expand said collets and release their grip on said bottom flange and said top flange of said drill string assembly to connect or disconnect sections of drill string below said latch assembly.

15. The method of driving casing or conductor pipe into the ground comprising the following steps;
 attaching a reciprocating percussion hammer and impact block to the top of a section of casing or conductor pipe and driving the casing or conductor pipe into the ground until it stops, said casing or conductor pipe provided with an internal support means within its lower portion,
 removing the hammer from the top of the casing or conductor pipe,

18

lowering into the casing or conductor pipe an apparatus having an upper housing, a drill string assembly, a drill bit connected to said drill string assembly, and a fluid driven drilling means connected thereto for imparting rotary motion to said bit, means for creating a fluid pressure differential between the interior and the exterior of said drill string to evacuate drilling debris and cuttings from the drilled hole, shock absorbing means, and expandable support means,
 connecting the upper housing of said apparatus to the top of said casing or conductor pipe,
 further lowering the apparatus within the casing or conductor pipe until the expandable support members are received on the support shoulder of the casing or conductor pipe,
 further lowering the apparatus within the casing or conductor pipe until the drill bit comes to rest on the soil at the bottom of the casing or conductor pipe,
 placing said hammer and impact block at the top portion of said upper housing,
 actuating the fluid driven drilling means and the hammer to begin rotary drilling and reciprocal hammering actions,
 creating a hydrostatic head by pumping water into the area between the outer surface of the drill string and the inner surface of the conductor pipe, creating a pressure differential between the interior of the drill string and the hydrostatic head by introducing air under pressure into the drill string portion,
 establishing circulation to the top of said apparatus to effectively evacuate drilling debris and cuttings from the drilled hole and eject them through outlets at the upper housing,
 coordinating drilling speed with driving action so that as the soil plug moves up in the conductor pipe, drilling speed may be increased to get the drill bit back down to the bottom portion of the casing or conductor pipe.

16. The method of driving casing or conductor pipe into the ground comprising the following steps;
 attaching a reciprocating percussion hammer and impact block to the top of a section of casing or conductor pipe and driving the casing or conductor pipe into the ground until it stops, said casing or conductor pipe provided with an internal support means within its lower portion,
 removing the hammer from the top of the casing or conductor pipe,
 lowering into the casing or conductor pipe an apparatus having an upper housing, a drill string assembly, a drill bit connected to said drill string assembly, and a fluid driven drilling means connected thereto for imparting rotary motion to said bit, means for creating a fluid pressure differential between the interior and the exterior of said drill string to evacuate drilling debris and cuttings from the drilled hole, shock absorbing means, and expandable support means,
 connecting the upper housing of said apparatus to the top of said casing or conductor pipe,
 further lowering the apparatus within the casing or conductor pipe until the expandable support members are received on the support shoulder of the casing or conductor pipe,

19

further lowering the apparatus within the casing or conductor pipe until the drill bit comes to rest on the soil at the bottom of the casing or conductor pipe,
 placing said hammer and impact block at the top 5 portion of said upper housing,
 actuating the fluid driven drilling means and the hammer to begin rotary drilling and reciprical hammering actions,
 creating a hydrostatic head by pumping water into 10 the drill string,
 creating a pressure differential between the interior of the drill string and the hydrostatic head by removing water from the area between the outer surface of the drill string and the inner surface of the casing 15 or conductor pipe,
 establishing circulation to the top of said apparatus to effectively evacuate drilling debris and cuttings from the drilled hole and eject them through outlets at the upper housing, 20
 coordinating drilling speed with driving action so that as the soil plug moves up in the conductor pipe, drilling speed may be increased to get the drill bit back down to the bottom portion of the casing or conductor pipe. 25

17. The method of driving casing or conductor pipe into the ground comprising the following steps;
 attaching a reciprocating percussion hammer and impact block to the top of a section of casing or conductor pipe and driving the casing or conductor 30 pipe into the ground until it stops, said casing or conductor pipe provided with an internal support means within its lower portion,
 removing the hammer from the top of the casing or conductor pipe, 35
 lowering into the casing or conductor pipe an apparatus having an upper housing, a drill string assembly, a drill bit connected to said drill string assembly, and a fluid driven down hole motor connected 40

20

thereto for imparting rotary motion to said bit, means for creating a fluid pressure differential between the interior and the exterior of said drill string to evacuate drilling debris and cuttings from the drilled hole, shock absorbing means, and expandable support means,
 connecting the upper housing of said apparatus to the top of said casing or conductor pipe,
 further lowering the apparatus within the casing or conductor pipe until the expandable support members are received on the support shoulder of the casing or conductor pipe,
 further lowering the apparatus within the casing or conductor pipe until the drill bit comes to rest on the soil at the bottom of the casing or conductor pipe,
 placing said hammer and impact block at the top portion of said upper housing,
 actuating the fluid driven down hole motor and the hammer to begin rotary drilling and reciprical hammering actions,
 creating a hydrostatic head by pumping water into the drill string,
 creating a pressure differential between the interior of the drill string and the hydrostatic head by removing water from the area between the outer surface of the drill string and the inner surface of the casing or conductor pipe,
 establishing circulation to the top of said apparatus to effectively evacuate drilling debris and cuttings from the drilled hole and eject them through outlets at the upper housing,
 coordinating drilling speed with driving action so that as the soil plug moves up in the conductor pipe, drilling speed may be increased to get the drill bit back down to the bottom portion of the casing or conductor pipe.

* * * * *

45

50

55

60

65

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
17 June 2004 (17.06.2004)

PCT

(10) International Publication Number
WO 2004/051004 A2

- (51) International Patent Classification⁷: **E02D**
- (21) International Application Number:
PCT/US2003/038022
- (22) International Filing Date: 1 December 2003 (01.12.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/430,195 2 December 2002 (02.12.2002) US
60/437,807 3 January 2003 (03.01.2003) US
- (71) Applicant (for all designated States except US): **BJ SERVICES COMPANY** [US/US]; 5500 Northwest Central Drive, Houston, TX 77092 (US).

32 Jalan U-Thant, Kuala Lumpur, 50400 Malaysia (AE).
MUELLER, Dan, T. [US/US]; 14506 Markhurst Dr., Cypress, TX 77429 (US). **GRAY-STEPHENS, Malcolm** [GB/GB]; 22a Bank Street, Aberdeen, Aberdeenshire AB11 7SX (GB).

(74) Agent: **PYLE, Jeffrey, A.**; Williams, Morgan & Amerson, Suite 1100, 10333 Richmond Ave., Houston, TX 77042 (US).

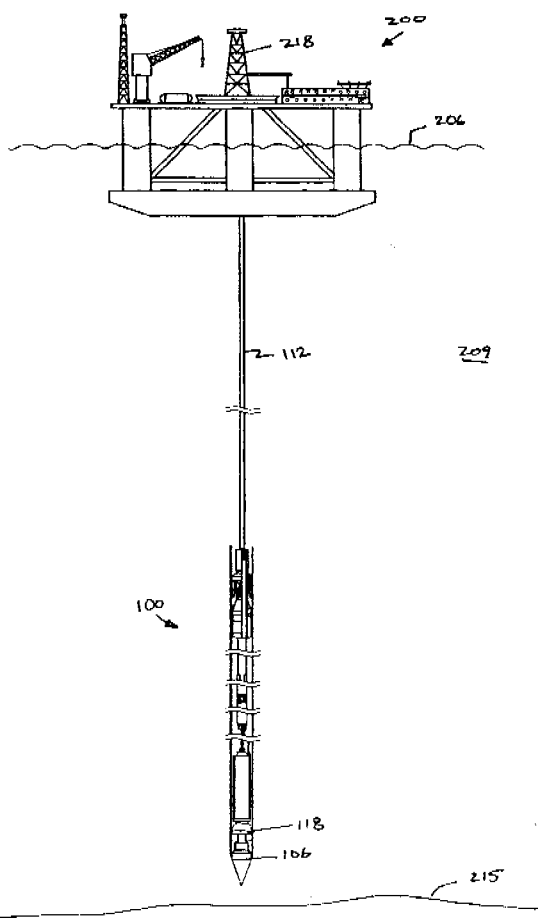
(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

- (72) Inventors; and
(75) Inventors/Applicants (for US only): **BELL, Douglas, B.** [NZ/AE]; Unit B-2-1, Damai Surya Condominium,

(84) Designated States (regional): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),

[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR THROUGH ROTARY SUB-SEA PILE-DRIVING



(57) Abstract: A method and apparatus for driving a pile are disclosed. The pile-driving apparatus comprises a pile, a shoe tip coupled to a toe of the pile, and a drill string disposed within the pile. The drill string comprises a gripping device coupling the drill string to the pile and a hammer deployed into the pile such that the hammer is capable of transmitting a force to the shoe tip. The method, comprises positioning a hammer in a pile such that the hammer is capable of transmitting a force to a shoe tip; positioning, in the pile, a portion of drill pipe having a gripping device to engage the pile; and deploying the pile beneath the surface of a body of water.

WO 2004/051004 A2



Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE,
SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

- *without international search report and to be republished upon receipt of that report*

145

METHOD AND APPARATUS FOR THROUGH ROTARY SUB-SEA PILE-DRIVING**BACKGROUND OF THE INVENTION****1. FIELD OF THE INVENTION**

5 This invention relates generally to underwater pile-driving, and, more particularly, to through rotary sub-sea pile-driving.

2. DESCRIPTION OF THE RELATED ART

10 Sub-sea, sometimes called "subsurface" in the sense of being under the surface of the water, pile-driving may be used to drill into the sediment at the bottom of a variety of underwater environments. For example, sub-sea pile-driving may be used to facilitate the installation of offshore production structures such as sub-sea platform skirt piles, sub-sea templates, drilling conductors, sub-sea manifolds, and the like. Sub-sea pile-driving may be performed in shallow water, typically less than 150 meters in depth, or in deep water.

15 The pile-driving apparatus typically includes a hammer, which drives a guide shoe tip into the sediment. The hammer and guide shoe tip are typically suspended from a platform by a crane or some cables, or, alternatively, a drill string and an umbilical. In various embodiments, the umbilical provides air, electricity, and hydraulic oil to the hammer, as well as retrieving the used hydraulic oil from the hammer. Examples of rigs used in sub-sea pile-driving include jack-up rigs, derrick barges, submersible rigs, semi-submersible rigs, drill ships, and the like. These types of rigs are sometimes referred to as mobile offshore drilling units ("MODUs").

20 Conventional sub-sea pile-driving methods suffer from a number of disadvantages. For example, friction from the sediment beneath the mud line may reduce the penetration depth of the guide shoe tip. For yet another example, sub-sea pile-driving typically uses hydraulic oil, which may leak or spill into the undersea environment. Reels used to store and deploy the umbilical used to provide and retrieve the hydraulic oil may also consume valuable deck space on the platform. Furthermore, conventional pile-driving techniques may be limited to shallow water applications, at least in part because of the large hydraulic pressure that must be supplied to the hammer.

SUMMARY OF THE INVENTION

30 The invention comprises, in its various aspects and embodiments, an method and apparatus for driving a pile. The pile-driving apparatus comprises a pile, a shoe tip coupled to a toe of the pile, and a drill string disposed within the pile. The drill string comprises a gripping device coupling the drill string to the pile and a hammer deployed into the pile such that the hammer is capable of transmitting a force to the shoe tip. The method, comprises positioning a hammer in a pile such that the hammer is capable of transmitting a force to a shoe tip; positioning, in the pile, a portion of drill pipe having a gripping device to engage the pile; and deploying the pile beneath the surface of a body of water.

35

145

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements, and in which:

5 Figure 1 conceptually illustrates, in an assembled, partially-sectioned, plan view of one embodiment of an apparatus in accordance with the present invention;

 Figure 2 conceptually illustrates a portion of the deployment of the pile-driving apparatus of Figure 1 in one particular embodiment;

10 Figure 3 illustrates a shoe joint for the apparatus of Figure 1, including an optional membrane covering the end thereof;

 Figure 4 depicts a clamp for clamping an umbilical of the apparatus of Figure 1 to the drill string thereof;

 Figure 5 illustrates a first percussive hammer as may be used in the apparatus of Figure 1, the percussive hammer being a nitrogen cap hydraulic percussive hammer, with control umbilical;

15 Figure 6 illustrates a second percussive hammer as may be used in alternative embodiments of the present invention, the percussive hammer being an automatic reciprocating hydraulic percussive hammer;

 Figure 7 illustrates a port collar;

 Figure 8 depicts a telescoping pipe joint as may be employed in the embodiment of Figure 1;

20 Figure 9 depicts a filtration for a filter sub as may be used in some alternative embodiments of the present invention;

 Figure 10 depicts a gripping device that may be used to couple the drill pipe of the apparatus in Figure 1 to the pile thereof;

 Figure 11A – Figure 11D illustrates one particular embodiment of the pile-driving apparatus in Figure 1; and

25 Figure 12A – Figure 12D illustrate a second particular embodiment of the pile-driving apparatus in Figure 1 alternative to the embodiment in Figure 11A – Figure 11D.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

30 Illustrative embodiments of the invention are described below. In the interest of clarity, not all features of an actual implementation are described in this specification. It will of course be appreciated that in the development of any such actual embodiment, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which will vary from one implementation to another. Moreover, it will be appreciated that such a development effort might be complex and time-consuming, but would nevertheless be a routine undertaking for those of
35 ordinary skill in the art having the benefit of this disclosure.

40 The present invention relates to a method and apparatus for single journey conveyance of a sub-sea pile-driving device from the surface of a body of water to the sea floor, and the subsequent concussive installation of sub-sea caissons, tubular piles, and/or surface sections of well casing using the sub-sea pile-driving device. The sub-sea pile-driving device may, in various embodiments, be used in either shallow water

or deep water environments. The caissons or tubular piles may, in one embodiment, be used to attach various structures to the sea floor. Examples of the various structures include sub-sea platform skirt piles, sub-sea templates, drilling conductors, sub-sea manifolds, and the like. The well casing is generally used for providing a stable foundation for drilling oil wells at depths in excess of 600'.

5

Figure 1 conceptually illustrates, in an assembled, partially-sectioned plan view, one embodiment of a pile-driving apparatus 100 in accordance with the present invention. The pile-driving apparatus 100 comprises a pile 103, a shoe tip 106 coupled to a toe 109 of the pile 103, and a drill string 112 disposed within the pile 103. The drill string 112 includes a gripping device 115 and a percussive hammer 118. The gripping device

10

The percussive hammer 118 is deployed into the pile 106 such that the percussive hammer 118 is capable of transmitting a force to the shoe tip 106 directly or indirectly. Some embodiments are "toe-driven." In these embodiments, the shoe tip 106 is coupled to the pile 103 at the toe 109 thereof, such that the percussive hammer 118 delivers the force directly to the shoe tip 106 at the toe 109. Some embodiments are "top-driven." In these embodiments, the shoe tip 106 is coupled to the top 121 of the pile 103 such that the percussive hammer 118 delivers the force indirectly to the shoe tip 106 at the top 121. The embodiment in Figure 1 is toe-driven.

15

20

Figure 2 conceptually illustrates a portion of the deployment of the pile-driving apparatus 100 in one particular embodiment. In Figure 2, the pile-driving apparatus 100 is deployed from a semi-submersible rig 200 after rig-up. However, the rig 200 may be any of a variety of MODUs, including, but are not limited to, jack-up rigs, semi-submersible rigs, and drill ships. The drill string (also known as a drill pipe column) is generally used to suspend the pile 103 from the rig 200 and deploy the pile 103 beneath the surface 206 of a body of water 209. In one embodiment, the casing is suspended from the rig by the drill string and descends through the rotary table as additional stands of drill pipe are added. Suitable rigs may include, but are not limited to, jack-up rigs, semi-submersible rigs, and drill ships. The pile-driving apparatus 100 is suspended from the rig 200 by the drill string 112 and lowered to the sea floor 215. On contact with the sea floor 215, the operation of the percussive hammer 118 delivers the force, directly or indirectly, to the shoe tip 106. Because the shoe tip 106 is coupled to the pile 103, the force of the impact is transferred through the shoe tip 106 to the pile 103 to drive the pile 106 into the sea floor 215. Note that, in this description, the labels "toe" and "top" are defined relative to the orientation of the pile-driving apparatus 100 during deployment, as shown in Figure 2.

25

30

35

Returning to Figure 1, as previously noted, the pile-driving apparatus 100 shown therein is but one embodiment and the invention admits variation in the implementation of the apparatus of the invention. One such variation was previously mentioned, *i.e.*, the apparatus may be toe-driven or top-driven. Another such variation is the nature of the pile 103. In the embodiment of Figure 1, the pile 103 comprises a surface casing installation or a deep water conductor. In the interest of clarity, the term "casing" will hereinafter be understood to refer to either a surface casing installation or a deep water conductor. In this particular embodiment, the casing includes a plurality of casing joints.

40

Also in the embodiment of Figure 1, the shoe tip 106 is deployed in the pile 103 and the percussive hammer 118 is deployed in the pile 103 such that the percussive hammer 118 is capable of transmitting a force to the shoe tip 106. For example, in one embodiment, the shoe tip 106 may be deployed in one casing joint. A vocationally designed, or implementation specific, shoe joint 300, shown in Figure 3, is provided in the casing to accept energy transfer, *i.e.*, the aforementioned force, from the percussive hammer 118 and transmit the force to the guide shoe tip 106. In one embodiment, the shoe joint 300 may include a membrane 303, also shown in Figure 3, to prevent ingress of material from the sea floor 215 during self-penetration. In one embodiment, the shoe joint 300 may allow subsequent piles 103 to pass through by hammering or drilling while closing the pile 103.

The percussive hammer 118 in the embodiment of Figure 1 is a hydraulic hammer. The percussive hammer 118 may receive hydraulic oil provided by an umbilical 127 to generate the force that is used to drive the shoe tip 106 into the sea floor 215, shown in Figure 2. The umbilical 127 may be coupled to the drill string 112 by quick attach and release clamps, such as the clamp 400 in Figure 4. Alternatively, the percussive hammer 118 may employ ambient water, or other fluids such as soapy water as described further below, to generate the force that is used to drive the shoe tip 106 into the sea floor 215. The percussive hammer 118 in this embodiment is generally controlled by signals transmitted via the umbilical 127.

The percussive hammer 118 of Figure 1, shown in greater detail in Figure 5, is an accelerated fluid driven hammer controlled by signals conveyed by umbilical 127 from the surface. The hydraulic fluid is, in this particular embodiment, derived from the ambient seawater. The tip 503 of the percussive hammer 118 displaces soil and the pile 103 is pulled down by the engagement ring, thus following the percussive hammer 118 into the sea floor 215, shown in Figure 2, and through the formation in question. The percussive hammer 118, in one implementation of this particular embodiment, is an IHC S-90 hydraulic hammer, commercially available from BJ Services, Inc. at:

Hareness Circle

Altens, Aberdeen AB1 4YL

United Kingdom

Phone: 44-1224-249-678

Fax: 44-1224-249-106

Email enquiries.tubular@bjsservices.co.uk

Other suitable hydraulic percussive hammers known to the art may be employed.

However, the percussive hammer 118 need not be hydraulic in all embodiments. For instance, the percussive hammer 118 may also be rotated from the rig 200, in Figure 2, by the drill string 112. The rotational percussive hammer may engage the pile 103 through a landing ring (not shown) in a shoe joint (also not shown) of the pile 103. The hole would be bailed by return of fluids (*e.g.*, seawater derived) discharged thru the top 121 of the pile 103 to open ocean or via a port collar, such as the port collar 130, first shown in Figure 1 and best shown in Figure 7, to sea floor 215 that can be closed after drive is completed. The automatic reciprocating

percussion hammer may be implemented using, for instance, the automatic reciprocating percussion hammer sold as the Fluid Hammer 185 mud hammer, available from

SDS Digger Tools, Pty., Ltd.

49 Vulcan Road

5 Canning Vale, Western Australia 6155.

Note this hammer is relatively small and is primarily suitable driving relatively small piles, e.g. 30' piles in soft conditions with the feeble existing item. Rotational percussive hammers used as drilling tools for pulling casing in by drilling with drill bits, as opposed to piling, may also be adapted to toe drive.

10 In several instances above, reference is made to the use of ambient seawater in various embodiments of the invention. In those embodiments, the seawater is filtered by, for example, a filtration unit 900, shown in Figure 9, of a filter sub (not otherwise shown) assembled into the drill string 112. The seawater ingresses the filtration unit 900 from the top 903 thereof, is filtered by the filter screen 906 within the filter housing 909, and egresses through the bottom 912. The filtration unit 900 also includes a plug 915. Some embodiments may
15 employ multiple filtration units 900. The position of the filtration unit(s) 900 within the drill string 112 will be implementation specific, but will generally be above the hammer 118. The seawater would also be filtered prior to entry into the drill string. Thus, in some alternative embodiments, pressurized ambient seawater is conveyed via the drill string 112 and provided to the percussive hammer 118.

20 Various other fluids may be provided to the percussive hammer 118 in assorted alternative embodiments. In one embodiment, the umbilical 127 provides hydraulic oil to the percussive hammer 118. The umbilical may also retrieve the hydraulic oil. In one embodiment, lubricating fluids may be provided to the percussive hammer 118 via the umbilical or, alternatively, via the drill string 112. The lubricating fluids may include, but are not limited to, soapy water, coco fatty ketaine, various ethoxylated compounds such as alkyl
25 phenols, fatty alcohols, amines, amides, diamines, quaternary ammonium chlorides, as well as sulphonated naphthalene formaldehyde condensate, sulfonated styrene maleic anhydrides, and various polyacrylamides. The lubricating fluids may be used to reduce friction between the formation and the pile/casing. Additional fluids that may be provided to the percussive hammer are described in U.S. Patent No. 5,748,665, U.S. Patent No. 5,020,598, U.S. Patent No. 5,016,711, and U.S. Patent No. 5,284,513, which are incorporated herein by
30 reference.

A diverter valve system (not shown) may, in various embodiments, be used to direct the flow of the fluids. For example, the diverter valve system may redirect hydraulic fluid, such as the ambient seawater, to the toe of the shoe joint. Alternatively, the diverter valve system may be used to direct the hydraulic fluid, such as
35 the ambient seawater, back into the pile 103 for eventual return to the surface of the sea floor 215 or the surrounding body of water. Filter systems may also be included in the drill string for filtering the various fluids. For example, sea water may be filtered as it passes into and/or out of the drill string 112.

Thus, any given embodiment may use one or more of the following fluid conveyance techniques:

147

- for deep-water applications it is considered feasible to utilize the drill pipe column to carry the fluid to the Percussion device in question;
- in certain instances it may practical to use coil tubing in either concentric or single tube configuration;
- 5 · filtration media can be introduced by virtue of filter subs at strategic and readily accessible points in the conveyance system; and
- for shallow water jack-up installations, any of the above or standard hydraulic hoses can be considered.

Still other fluid conveyance techniques known to the art may be employed in alternative embodiments.

10 Vocationally designed, or implementation specific, adaptor sub and/or crossover components (not shown) may also be included in the casing to merge individual items into the operational system. As is well known in the art, the assembly of drill strings frequently utilize adaptors, crossovers, *etc.* to line up connections and to provide interfaces between tools and pieces of pipe. Also, the use of these types of components is
15 implementation specific, as the design for any given drill string will be unique for the given goals and conditions. The drill string 112 of the present invention, shown in Figure 1, employs these types of components in accordance with conventional practice.

20 Returning to Figure 1, in the illustrated embodiment, the surface casing installation may also include one or more telescopic drill pipe sections 124, shown in greater detail in Figure 8. The telescopic drill pipe sections 124 may be used to position the percussive hammer 118 within the pile 103. In one embodiment, the telescopic drill pipe sections 124 are capable of being locked and unlocked. In one embodiment, the telescopic drill pipe sections 124 may be locked and/or unlocked by rotating the drill string 112 coupled to the pile 103. However, it will be appreciated that the telescopic drill pipe sections 124 are not necessary for the practice of
25 the present invention. In alternative embodiments, a variety of hammer suspension systems, such as slings and the like, may also be used to position the percussive hammer 118 within the pile 103.

30 As previously mentioned a drill pipe section having a gripping device 115, shown best in Figure 10, is also deployed in the pile 103. The gripping device 115 is set and/or unset by the rotation of the drill string 112. The gripping device 115 is substantially coupled to the pile 103 and holds the pile 103 substantially fixed with respect to the drill string 112. In the present context, the term "substantially" is used to indicate that, in the practice of the present invention, the gripping device 115 may not hold the pile 103 perfectly fixed with respect to the drill string 112. Those of ordinary skill in the art having the benefit of this disclosure will appreciate that the gripping device 115 may allow some movement of the pile 103 with respect to the drill string 112 during
35 operation of the present invention. The amount of movement is a matter of design choice and not material to the present invention. The gripping device 115 will typically engage the hammer 118 to the pile 103 at the top of the pile 103, but this is not necessary to the practice of the invention. The gripping device 115 may engage the hammer 118 to the pile 103 at the bottom of the pile 103, but additional support devices, such as slings, *etc.* may be desirable to support the weight of the pile 103 and drill string 112.

Figure 11A – Figure 11D and Figure 12A – Figure 12D illustrate a two particular, alternative embodiments of the embodiment of the pile-driving apparatus in Figure 1 alternative to the embodiment in Figure 11A – Figure 11D. Figure 11A illustrates a toe-drive embodiment 1100, with enlarged views of the sections 1103, 1106, and 1109 in Figure 11B – Figure 11D. Similarly, Figure 12A illustrates a top-drive embodiment 1200, with enlarged views of the sections 1203, 1206 in Figure 12B and Figure 12C – Figure 12D, respectively. Note that both Figure 12C and Figure 12D are enlarged views of the section 1206, one a plan view and the other a partially sectioned view, respectively.

Turning now to Figure 11A – Figure 11D, the section 1103, best shown in Figure 11B, contains the gripping device 1112, a part of the drill string 1115, disposed within the pile 1118, which is a casing string in this particular embodiment. The umbilical 1121 is also shown running through the interior 1124 of the pile 1118 and, in Figure 11C, to the hammer 1127. Figure 11B also shows a telescopic drill pipe section 1130 intermediate the gripping device 1112 and the hammer 1127, and interfacing with the hammer 1127 through an interface sub 1133. The pile 1118 terminates in a shoe collar 1136 and the embodiment 1100 terminates in a ported shoe 1139 defining several ports 1142 (only one indicated) through which fluids (not shown) may pass as described elsewhere.

Referring now to Figure 12A – Figure 12D, the top-drive embodiment 1200 includes a sling 1205 fastened to the wings 1207 of a drill plate 1206, shown in Figure 12B, as part of the drill string 1209. The sling 1205 is also fastened to the pile 1212, which is also a casing string, to support the weight of the pile 1212, as is shown in Figure 12C – Figure 12D. (To release the pile, the fasteners 1213 can be explosive bolts that are set off or can be released through the use of a remotely operated vehicle, not shown.) Note that, in some alternative embodiments, the hammer 1218 may be coupled to the drill string 1209 in some other manner, for example, through an external gripper known as an “elevator” in combination with a sling. A telescopic drill pipe section 1215 is positioned intermediate the drill plate 1206 and the hammer 1218, as best shown in Figure 12B. The hammer 1218 receives power and control signals, *etc.* over the umbilical 1221. The hammer 1218 in top-drive embodiment 1200 interfaces with the pile 1212 through a chaser sub 1224 and an interface 1227.

To “rig-up” the pile-driving apparatus 100 in a toe-drive embodiment, percussive hammer 118 is deployed into the pile 103. In various alternative embodiments, the rig-up process may also include positioning one or more transfer subs, filter subs, flexible hoses, diverter valve assemblies, and at least one joint of drill pipe. The pile-driving apparatus 100 is racked back into a derrick 218, shown in Figure 2. In this particular embodiment, the pile is a casing string and the casing string is made up, in a manner well known to those of ordinary skill in the art, starting with the shoe joint and extending to the desired length. The pile 103 to be driven is then set in a rotary table/drill floor.

A false rotary table (not shown) is positioned over the pile 103, having been set in the rotary table/drill floor (also not shown), to support the running of the percussive hammer 118 and any other desired components down inside of the pile 103. In one embodiment, the percussive hammer 118 is positioned inside the pile 103. A first stand of drill pipe is added. Although not necessary for the practice of the present invention, in one

embodiment, the first stand of drill pipe may include a lockable telescoping section 124 of drill pipe 112. Additional stands of drill pipe may then be added.

When the percussive hammer 118 is approximately at the tip of the shoe joint, a further stand of drill pipe, which includes an internal gripping device, is added. If so desired, the internal gripping device may be set by, for example, rotating the drill string 112. The hammer 118 is landed on the shoe driving ring and half the stroke of the telescopic section 124 of drill pipe is compressed. The internal gripping device 115 is then engages and the pile 103, hammer 118, and drill string 112 is lifted as one assembly by the drill string 112.

The pile-driving apparatus 100 is then tripped down to the sea floor 215, shown in Figure 2, by adding further stands of drill pipe. In one embodiment, a grooved bowl and slips may be used as each stand of drill pipe is added. In one alternative embodiment, power slips may be used as each stand of drill pipe is added. The umbilical (not shown) is fed onto the drill string 112 and, in one embodiment, supported by the quick attach and release clamps 400, shown in Figure 4. Once the sea floor 215 has been tagged, and the pile 103 is substantially in contact with a selected location on the sea floor 215, self-penetration is logged until the combined weight of the drill string 112, the pile 103, and the percussive hammer 118 is supported by the sea floor 215 except for weight required to keep pile from buckling. The operation of the percussive hammer 118 then commences to drive the pile 103.

During the pile-driving process, the percussive hammer 118 uses a prime mover fluid to generate the force, which is transmitted to the guide shoe tip to excavate a hole. In one embodiment, the prime mover fluid is hydraulic fluid provided by the umbilical. The hydraulic fluid may also be retrieved by the umbilical. In alternative embodiments, pressurized ambient sea water may be used as the prime mover fluid in the percussive hammer 118. For example, ambient sea water may be provided to the percussive hammer, which may use the sea water as the prime mover fluid when operating the percussive hammer in deep water. When ambient sea water is used as the prime mover fluid, the size of the umbilical may be reduced. In alternative embodiments, rotation of the drill string 112 may be used as the prime mover in the percussive hammer 118.

Material from the hole created by the pile-driving process is bailed by returning fluids, such as ambient sea water. In one embodiment, the returning fluids are discharged through the top of the casing to the open ocean. In an alternative embodiment, the material is discharged through a port collar to the sea floor 215. If the pile tip encounters stiff resistance or sandy layers, fluid may be dispensed from the tip to reduce external skin friction. In one embodiment, spent hydraulic fluid, such as the ambient sea water, may be dispensed. In alternative embodiments, other fluids, such as the aforementioned lubricants, may be dispensed.

Upon completion of driving, e.g. when the pile 103 has been driven to the desired depth, the drill string is rotated to unlock the internal gripping device 115. In one embodiment, the drill string 112 may also be rotated to relock the telescoping drill pipe section 124. The percussive hammer 118 is then withdrawn from the casing and tripped back to the rotary. Once in the rotary, the percussive hammer 118 is rigged-down. In one embodiment, rig-down is the reverse of rig-up.

149

5 In some embodiments, the pile 103 may be driven in stages. A second pile 103 may, for instance, be run into the rotary and made up to a desired length. The second pile 103 may have a reduced diameter and may be internally driven or top-driven. If the second pile is top-driven, a sacrificial centralizing ring may, in one embodiment, be included to allow a sleeve to pass the top of a second stage pile and establish contact with an anvil face.

10 More particularly, when the first pile 103 is driven to a desired depth, the gripping device 115 is set to release the hammer 118, and equipment the drill string 112 tripped back to the rotary, the hammer 118 is racked back into the derrick 218. A second, reduced diameter pile 103 is run into the rotary and made up to required length. Dependent on length and diameter of this second stage, this pile-driving apparatus 100 may be internally driven or top-driven. The equipment and procedure for internal driving follow closely the procedure for the first stage. In the instance of top driving for the second stage, the pile-driving apparatus 100 is set up with a sacrificial centralizing ring to allow the sleeve to pass over the top of the second stage pile and establish contact with the anvil face. The hammer is then activated and driving proceeds to desired depth. For internal drives the same procedure for first stage is followed. Choice of top drive versus internal "toe of pile" energy application is determined by the prevalent soil conditions on the location in question. The second stage is landed on the internal energy transfer ring in the toe joint of the previously driven section

20 By using the present invention, in its various embodiments and implementations, one or more of a number of advantages may be realized. For example:

- 25 · the hydraulic pressure supplied to the percussive hammer may be reduced such that the present invention may be used in deep water pile-driving applications; by driving casing through shallow water flow sand(s), the underbalanced condition found after cementing, which may initiate shallow water flow, may be reduced or prevented;
- friction from the sediment beneath the mud line may be reduced and the penetration depth of the guide shoe tip increased;
- in deep water pile-driving, the use of hydraulic oil may be reduced, or eliminated, which may reduce, or eliminate, the potential for hydraulic oil to leak or spill into the undersea environment;
- 30 · the size of the umbilical may be reduced, which may reduce the number of reels used to store and deploy the umbilical, which may also increase the amount of available deck space on the platform;
- cutting disposal from drilling may be negated for environmental and economic advantage; and
- 35 · consolidation of the formation may lead to higher pile foundation capacity and seal flows of gas or a fluid that may otherwise be initiated.

Still other advantages arising from one or more of the embodiments and implementations may become apparent to those in the art having the benefit of this disclosure.

149

Moreover, the present invention is expected to enhance prime equipment utilization by reducing the time required to carry out installations of caissons or tubular piles into the sea floor 215. By carrying out some or all of the above described functions "off the critical path," the invention may accelerate the program of batch conductor installations in deep water. The invention may also help overcome certain hostile environments found below the sea floor 215 in the early stages of the construction of oil wells in deep water conditions.

This concludes the detailed description. The particular embodiments disclosed above are illustrative only, as the invention may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below. It is therefore evident that the particular embodiments disclosed above may be altered or modified and all such variations are considered within the scope and spirit of the invention. Accordingly, the protection sought herein is as set forth in the claims below.

WHAT IS CLAIMED:

1. A pile-driving apparatus, comprising:
a pile;
a shoe tip coupled to a toe of the pile; and
5 a drill string, the drill string including a hammer coupled to the pile such that the hammer is capable of transmitting a force to the shoe tip.
2. The apparatus of claim 1, wherein the pile comprises a casing string, a deep water pile, a shallow water pile, a PLEM pile; a sub-sear template, a manifold pile, a tension leg platform anchor pile and a drill rig mooring pile.
- 10 3. The apparatus of claim 1, wherein the shoe tip includes a membrane covering.
4. The apparatus of claim 1, wherein the shoe tip is coupled to the pile interior.
5. The apparatus of claim 1, wherein the shoe tip is coupled to the pile exterior.
6. The apparatus of claim 1, wherein the hammer is coupled to the pile at the top thereof.
7. The apparatus of claim 1, wherein the hammer is coupled to the pile at the toe thereof.
- 15 8. The apparatus of claim 1, wherein the hammer is a percussive hammer.
9. The apparatus of claim 8, wherein the percussive hammer comprises a hydraulic hammer.
10. The apparatus of claim 1, wherein the drill string further includes a gripping device by which the drill string is coupled to the pile.
11. The apparatus of claim 10, wherein the gripping device couples the drill string to the pile at the top of
20 the pile.
12. The apparatus of claim 1, wherein the drill string includes a plurality of wings by which the hammer is coupled to the pile via a sling.
13. The apparatus of claim 1, further comprising an external gripping device by which the hammer is coupled to the pile via a sling.
- 25 14. The apparatus of claim 8, wherein the percussive hammer is a rotation powered hammer.
15. An apparatus, comprising:
a pile;
a shoe tip deployed at a tip of the pile; and
a hammer coupled to the pile such that the hammer is capable of transmitting a force to the shoe tip.
- 30 16. The apparatus of claim 15, further comprising a portion of drill pipe having a lockable telescoping section deployed in the pile.
17. The apparatus of claim 15, wherein the pile includes a shoe joint capable of receiving the force from the hammer and transmitting said force to the shoe tip.
18. The apparatus of claim 15, wherein the hammer comprises a percussive hammer.
- 35 19. The apparatus of claim 15, further comprising a valve system to direct a fluid to at least one of the shoe tip and the pile.
20. The apparatus of claim 15, further comprising a gripping device coupled to the hammer and coupled to the pile; and
21. The apparatus of claim 15, further comprising a sling by which the hammer is coupled to the pile.

22. The apparatus of claim 15, further comprising an external gripping device by which the hammer is coupled to the pile via a sling.
23. A method, comprising:
positioning a hammer relative to a pile such that the hammer is capable of transmitting a force to a shoe tip;
positioning a portion of drill pipe to engage the pile; and
deploying the pile beneath the surface of a body of water.
24. The method of claim 23, wherein deploying the pile comprises deploying pile such that the shoe tip is in contact with a first selected location on a floor of the body of water.
25. The method of claim 23, wherein positioning the hammer includes positioning the hammer such that the hammer is capable of transmitting a force directly to the shoe tip
26. The method of claim 23, wherein positioning the hammer includes positioning the hammer such that the hammer is capable of transmitting a force indirectly to the shoe tip
27. An apparatus, comprising:
means for positioning a hammer relative to a pile such that the hammer is capable of transmitting a force to a shoe tip;
means engaging the hammer to the pile; and
means for deploying the pile beneath the surface of a body of water.
28. The apparatus of claim 27, further comprising means for transmitting a force from the hammer to the shoe tip such that the shoe tip penetrates the floor at the first selected location.
29. The apparatus of claim 27, further comprising means for providing a lubricating fluid proximate the shoe tip.
30. A method for deploying a pile-driving apparatus, the method comprising:
rigging up the pile-driving apparatus; and
deploying the rigged-up pile-driving apparatus through the rotary of a drilling rig.
31. The method of claim 30, wherein rigging up the pile-driving apparatus includes:
positioning a percussive hammer in a pile such that the percussive hammer is capable of transmitting a force to a shoe tip; and
positioning the drill pipe to engage the pile.
32. The method of claim 30, wherein deploying the rigged-up pile-driving apparatus through the rotary of the drilling rig includes deploying the rigged-up pile-driving apparatus through a rotary of a mobile offshore drilling unit.
33. The method of claim 30, further comprising single tripping the rigged-up pile-driving apparatus to the seabed.
34. A method for deploying a pile-driving apparatus, the method comprising:
deploying the pile-driving apparatus; and
single tripping the rigged-up pile-driving apparatus to the seabed.
35. The method of claim 34, wherein rigging up the pile-driving apparatus includes:
positioning a percussive hammer relative to a pile such that the percussive hammer is capable of transmitting a force to a shoe tip; and

positioning, in the pile, a portion of drill pipe having a gripping device to engage the pile.

36. The method of claim 34, wherein deploying the rigged-up pile-driving apparatus through the rotary of the drilling rig includes deploying the rigged-up pile-driving apparatus through a rotary of a mobile offshore drilling unit.

5 37. The method of claim 34, further deploying the rigged-up pile-driving apparatus through the rotary of a drilling rig.

38. An apparatus, comprising:

a plurality of casing joints;

a shoe tip deployed at a tip of a first one of the plurality of casing joints;

10 a percussive hammer deployed with the casing joints such that the percussive hammer is capable of transmitting a force to the shoe tip;

a gripping device coupled to the percussive hammer and coupled to the casing joints; and

a portion of drill pipe coupled to the plurality of casing joints via the gripping device and capable of deploying the casing joints beneath the surface of a body of water.

15 39. The apparatus of claim 38, further comprising a portion of drill pipe having a lockable telescoping section deployed in the plurality of casing joints.

40. The apparatus of claim 38, wherein the first one of the plurality of casing joints is a shoe joint capable of receiving the force from the percussive hammer and transmitting said force to the shoe tip.

41. The apparatus of claim 38, wherein the percussive hammer comprises a hydraulic percussive hammer.

20 42. The apparatus of claim 38, wherein the percussive hammer comprises a rotary percussive hammer.

43. The apparatus of claim 38, further comprising a valve system to direct a fluid to at least one of the shoe tip and the plurality of casing joints.

44. The apparatus of claim 38, wherein the percussive hammer is capable of transmitting a force directly to the shoe tip

25 45. The apparatus of claim 38, wherein the percussive hammer is capable of transmitting a force indirectly to the shoe tip

46. A method, comprising:

positioning a percussive hammer in a first one of a plurality of casing joints such that the percussive hammer is capable of transmitting a force to a shoe tip;

30 positioning, in the plurality of casing joints, a portion of drill pipe having a gripping device to engage the casing joints; and

deploying the plurality of casing joints beneath the surface of a body of water.

47. The method of claim 46, wherein deploying the plurality of casing joints comprises deploying the casing joints such that the shoe tip is in contact with a first selected location on a floor of the body of water.

35 48. The method of claim 46, wherein positioning the percussive hammer includes positioning the percussive hammer such that the percussive hammer is capable of transmitting a force directly to a shoe tip

49. The method of claim 46, wherein positioning the percussive hammer includes positioning the percussive hammer such that the percussive hammer is capable of transmitting a force indirectly to a shoe tip

50. An apparatus, comprising:

means for positioning a percussive hammer in a first one of a plurality of casing joints such that the percussive hammer is capable of transmitting a force to a shoe tip;
means engaging the percussive hammer to the casing joints; and
means for deploying the plurality of casing joints beneath the surface of a body of water.

- 5 51. The method of claim 50, further comprising means for transmitting a force from the hammer to the shoe tip such that the shoe tip penetrates the floor at the first selected location.
52. The method of claim 50, further comprising means for providing a lubricating fluid proximate the shoe tip.
- 10 53. A pile-driving apparatus, comprising:
a casing string; and
a drill string disposed within the casing string, the drill string comprising:
a gripping device coupling the drill string to the casing string;
a percussive hammer deployed into the casing joints such that the percussive hammer is
capable of transmitting a force to the shoe tip; and
15 a shoe tip deployed at a tip of a first one of the plurality of casing joints.

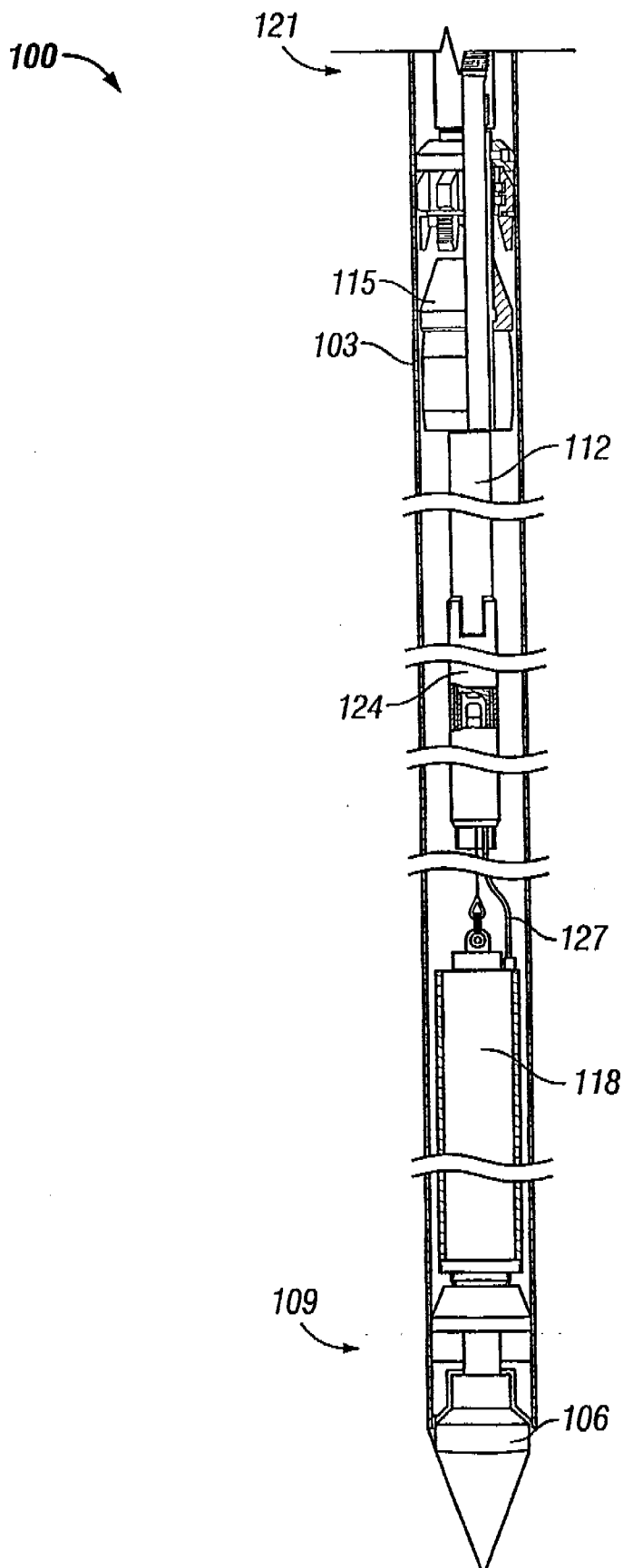
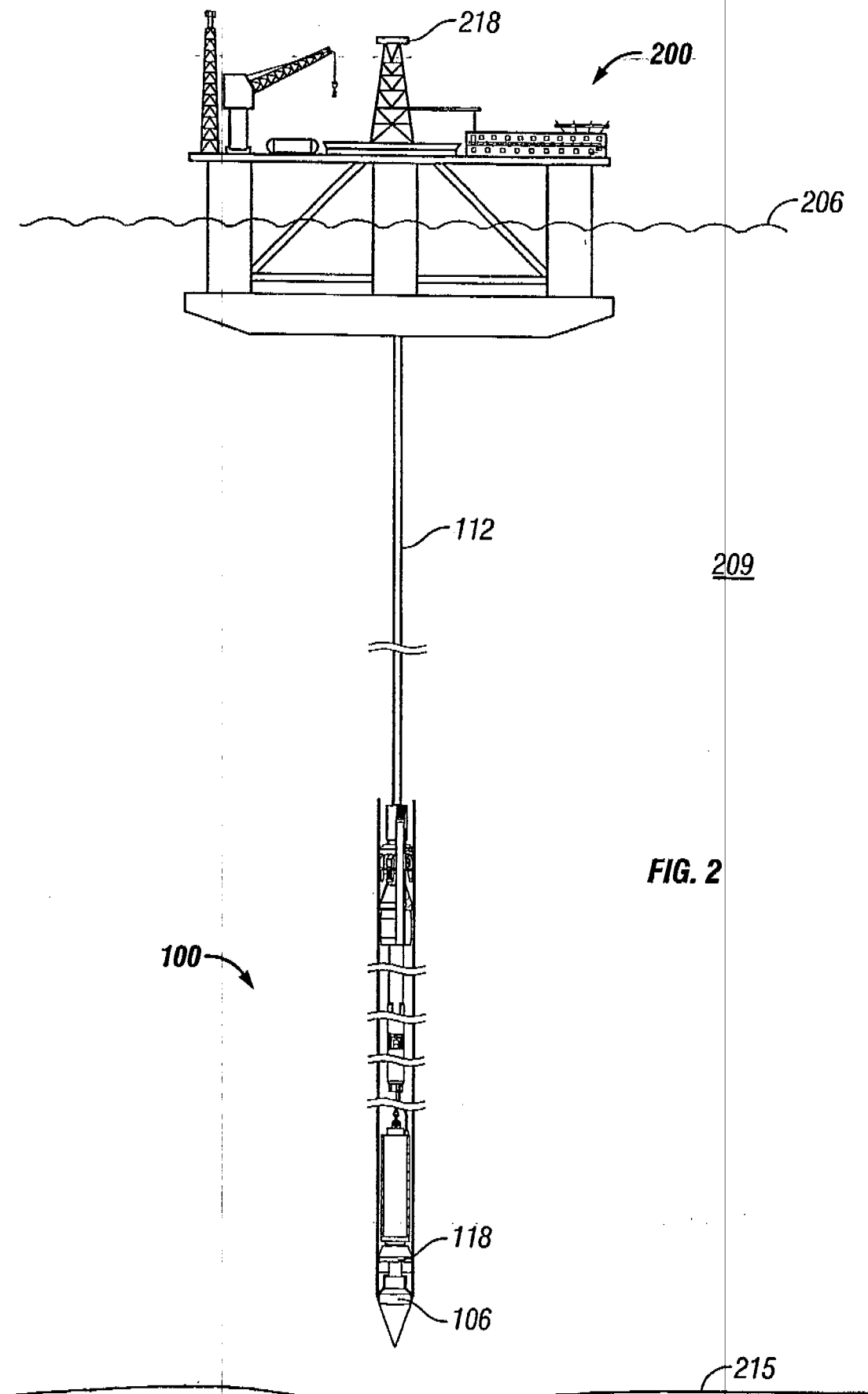


FIG. 1



SUBSTITUTE SHEET (RULE 26)

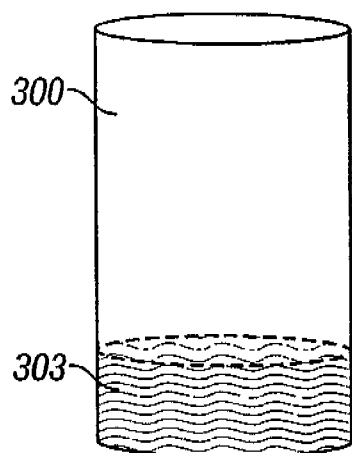


FIG. 3

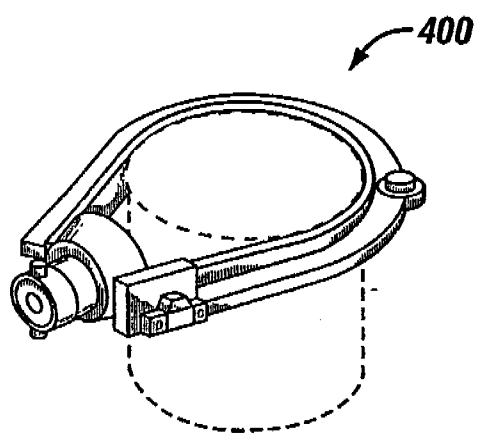


FIG. 4

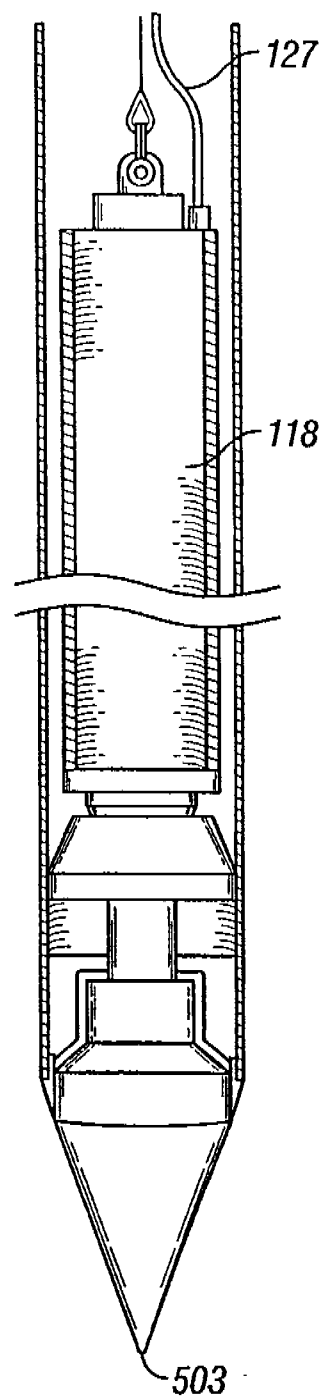


FIG. 5

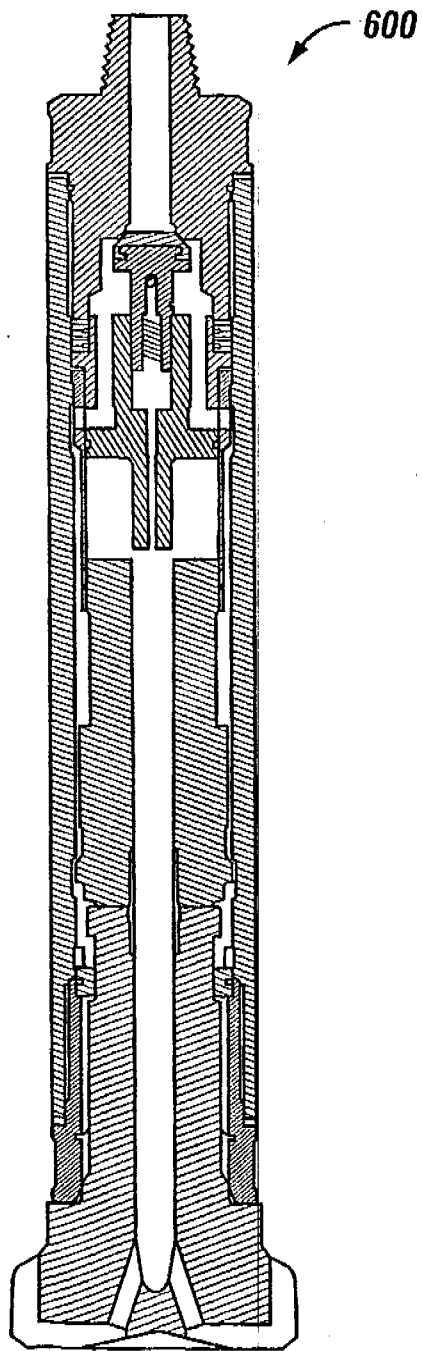


FIG. 6

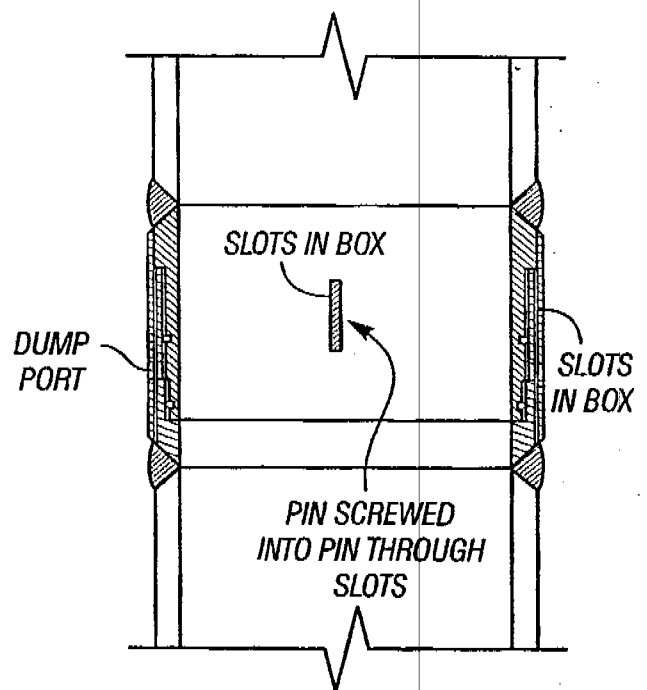


FIG. 7

SUBSTITUTE SHEET (RULE 26)

154



FIG. 8

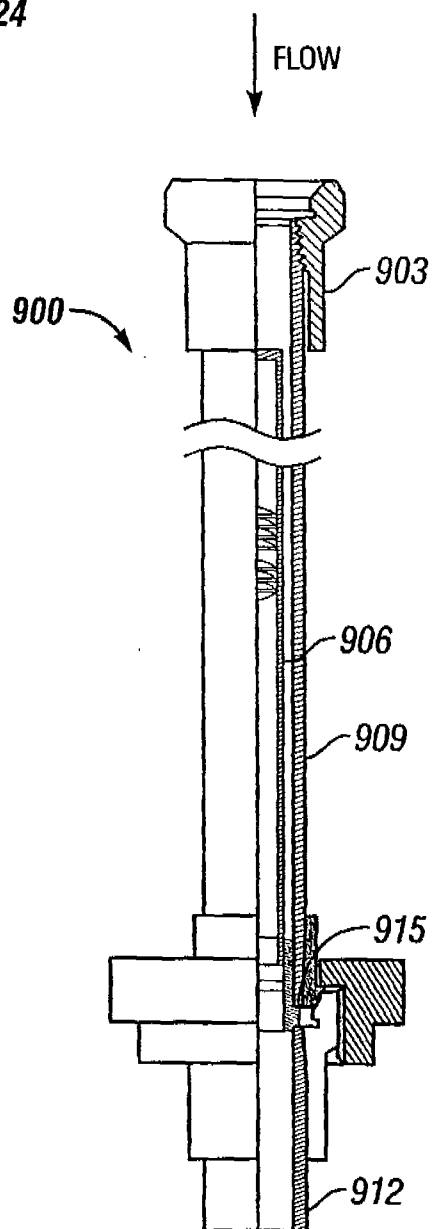


FIG. 9

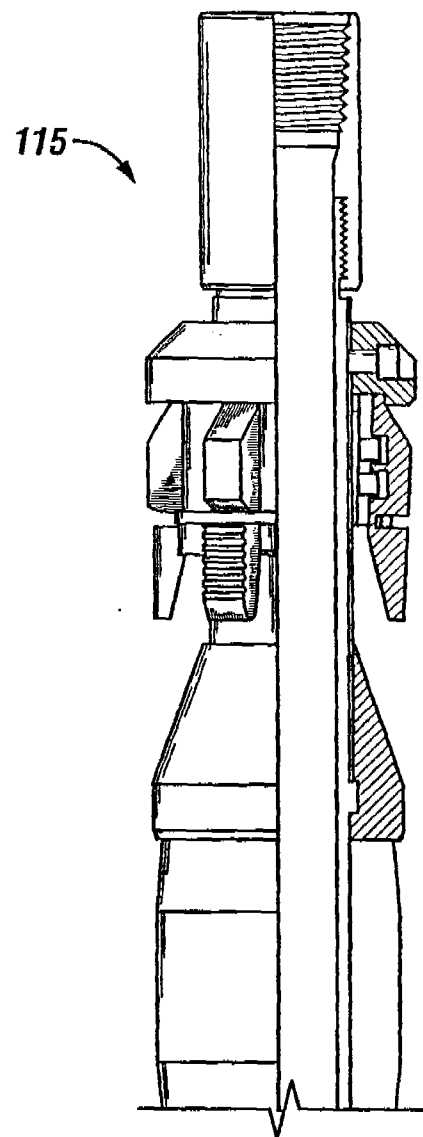


FIG. 10

157

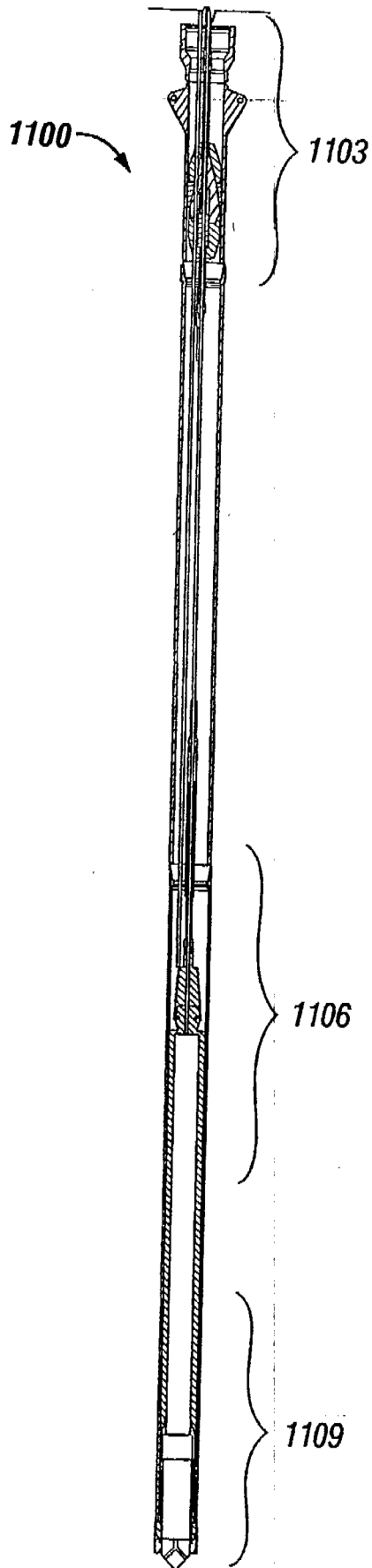


FIG. 11A

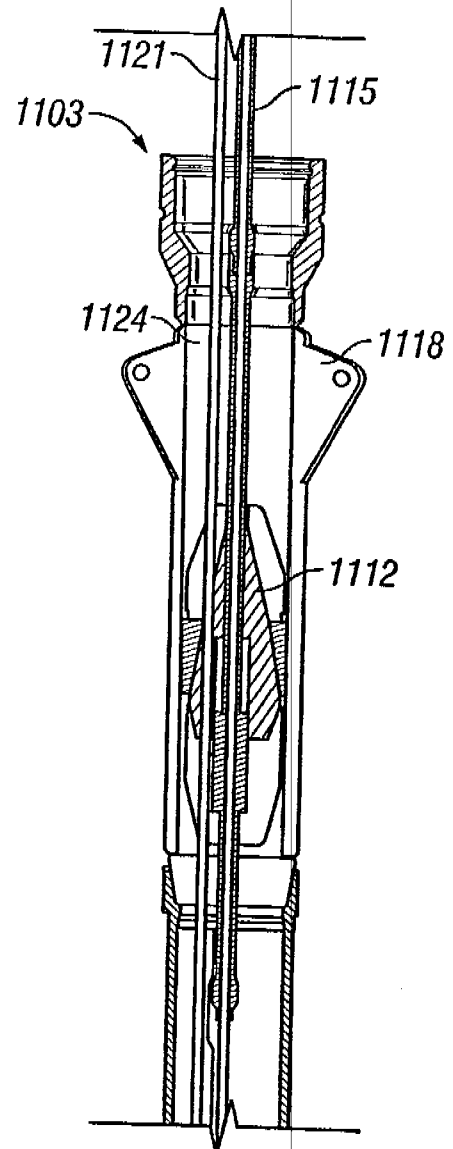


FIG. 11B

SUBSTITUTE SHEET (RULE 26)

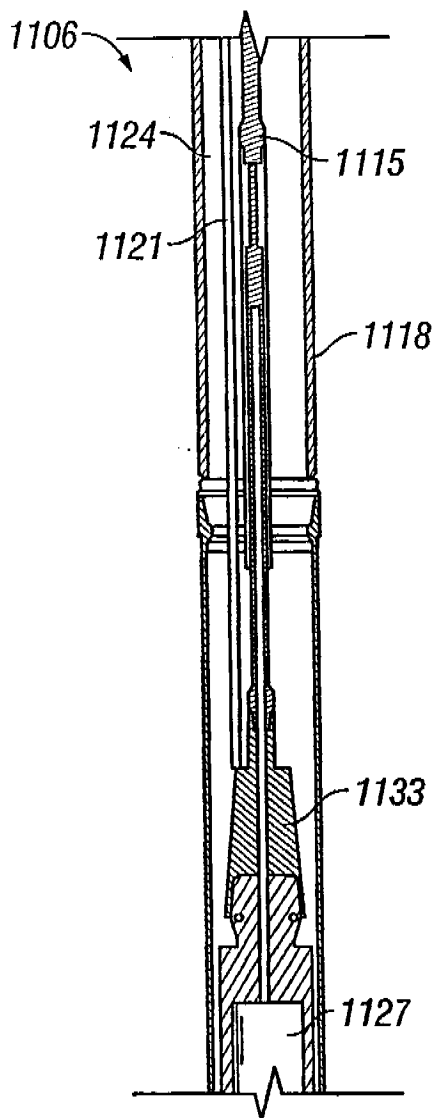


FIG. 11C

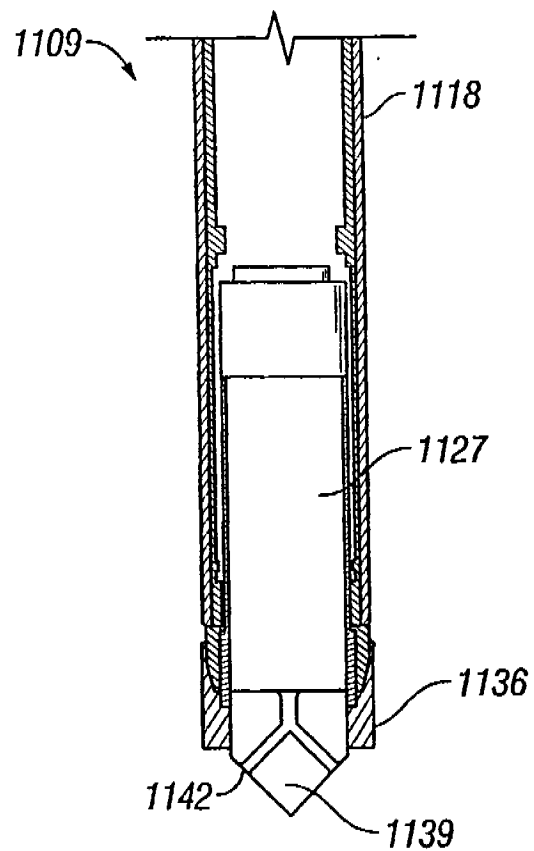


FIG. 11D

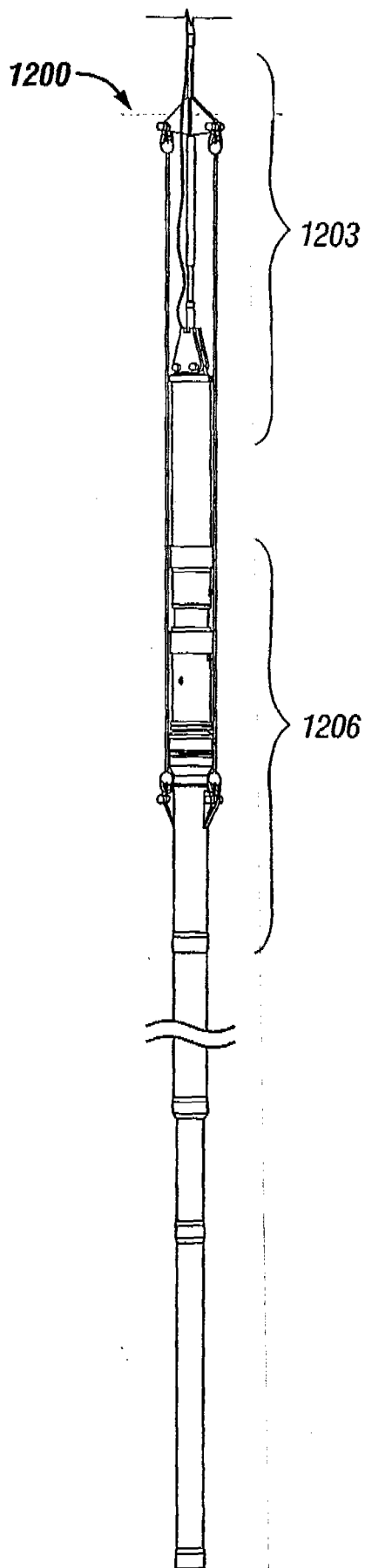


FIG. 12A

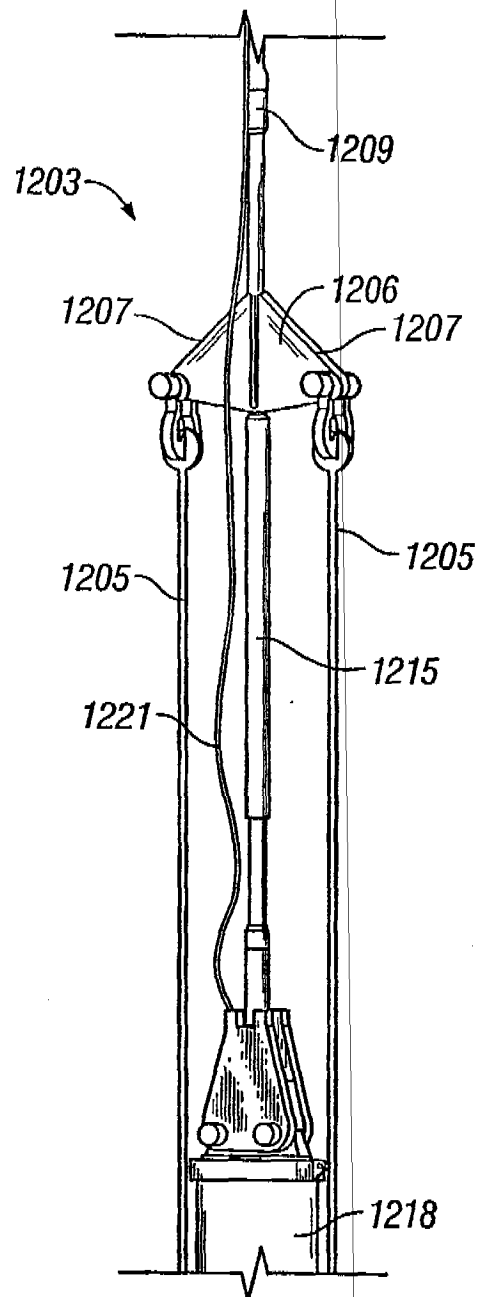


FIG. 12B

SUBSTITUTE SHEET (RULE 26)

156

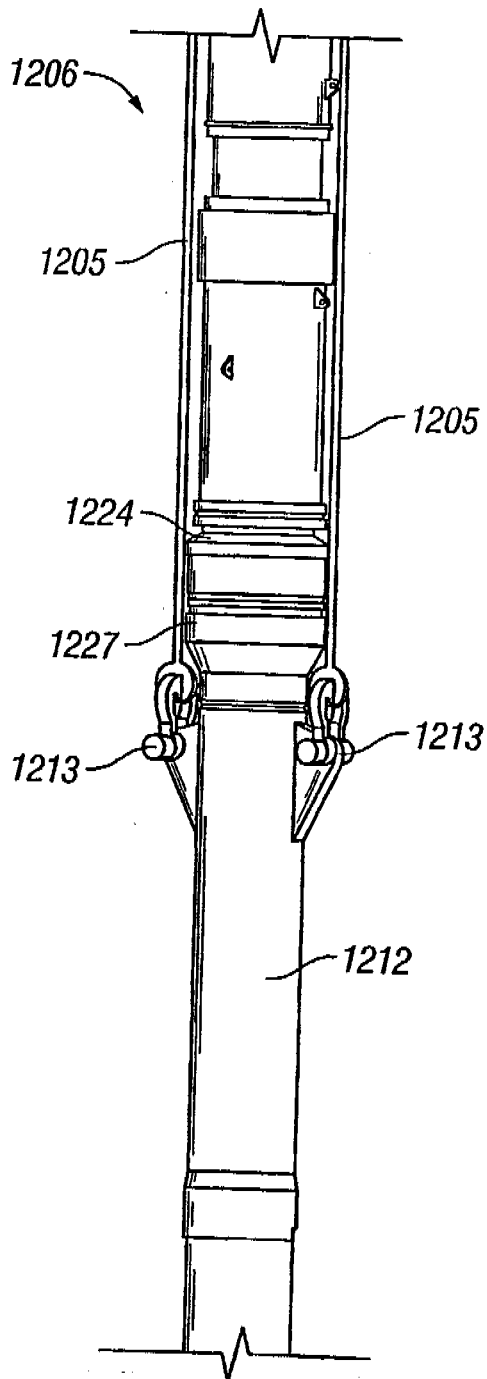


FIG. 12C

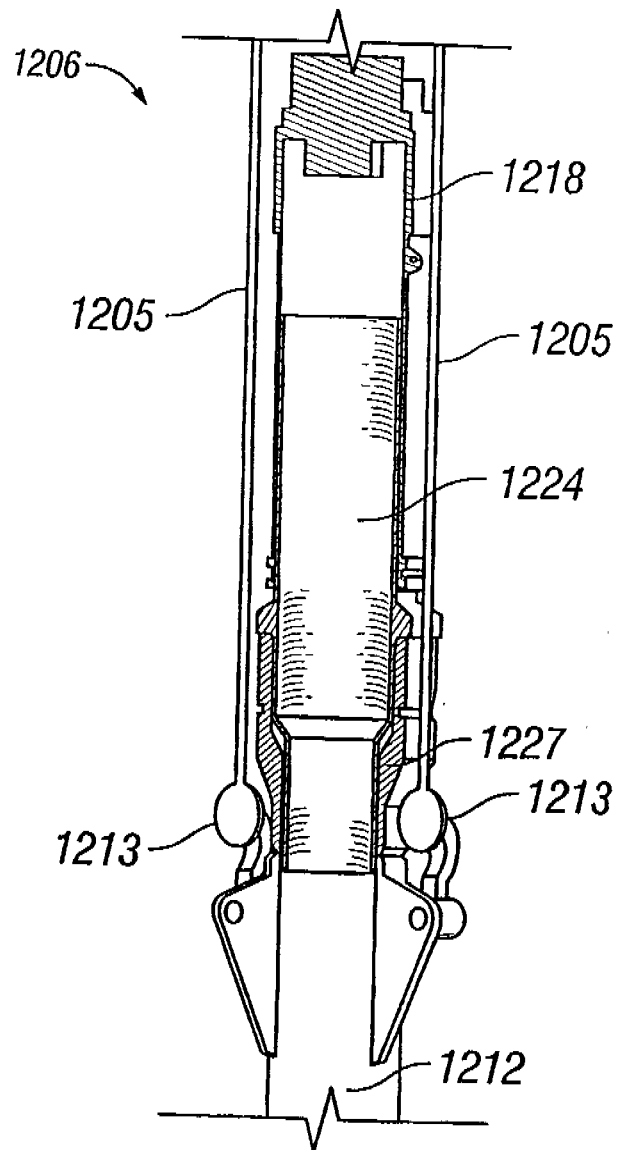


FIG. 12D

SUBSTITUTE SHEET (RULE 26)

156

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
17 June 2004 (17.06.2004)

PCT

(10) International Publication Number
WO 2004/051004 A3

(51) International Patent Classification⁷: **E21B 7/20**,
4/20, 4/06, 4/14, E02D 7/30

(21) International Application Number:
PCT/US2003/038022

(22) International Filing Date: 1 December 2003 (01.12.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/430,195 2 December 2002 (02.12.2002) US
60/437,807 3 January 2003 (03.01.2003) US

(71) Applicant (for all designated States except US): **BJ SERVICES COMPANY** [US/US]; 5500 Northwest Central Drive, Houston, TX 77092 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **BELL, Douglas, B.** [NZ/AE]; Unit B-2-1, Damai Surya Condominium,

32 Jalan U-Thant, Kuala Lumpur, 50400 Malaysia (AE).
MUELLER, Dan, T. [US/US]; 14506 Markhurst Dr., Cypress, TX 77429 (US). **GRAY-STEPHENS, Malcolm** [GB/GB]; 22a Bank Street, Aberdeen, Aberdeenshire AB11 7SX (GB).

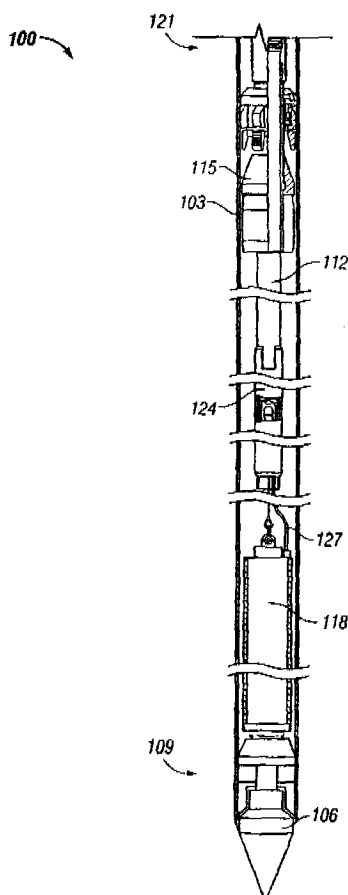
(74) Agent: **PYLE, Jeffrey, A.**; Williams, Morgan & Amerson, Suite 1100, 10333 Richmond Ave., Houston, TX 77042 (US).

(81) Designated States (*national*): AE, AG, AI, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),

[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR SUB-SEA PILE-DRIVING



(57) Abstract: A method and apparatus for driving a pile are disclosed. The pile-driving apparatus comprises a pile, a shoe tip (106) coupled to a toe (109) of the pile, and a drill string disposed within the pile. The drill string comprises a gripping device (115) coupling the drill string to the pile and a hammer (118) deployed into the pile such that the hammer is capable of transmitting a force to the shoe tip. The method, comprises positioning a hammer in a pile such that the hammer is capable of transmitting a force to a shoe tip; positioning, in the pile, a portion of drill pipe having a gripping device to engage the pile; and deploying the pile beneath the surface of a body of water. Some embodiments are "top-driven", others are "toe-driven".

WO 2004/051004 A3



Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE,
SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(88) Date of publication of the international search report:
19 August 2004

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

INTERNATIONAL SEARCH REPORT

In ional Application No
PCT/US 03/38022

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E21B7/20 E21B4/20 E21B4/06 E21B4/14 E02D7/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E21B E02D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 349 401 A (SMITH INTERNATIONAL) 1 November 2000 (2000-11-01) page 19, line 21 - page 20, line 16; figures 1,11,12	1,2,4-9, 14,15, 17,18, 30, 32-34, 36,37
X	WO 00/26576 A (VALISALO JUHANI ; NUMA TOOL CO (US)) 11 May 2000 (2000-05-11) claims 11,12; figure 2	1,15,30, 34
X	DE 35 14 030 A (HUETTE & CO BOHRTECHNIK GMBH) 23 October 1986 (1986-10-23) page 2, paragraph 2; figure 1	1,15,30, 34
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

8 July 2004

Date of mailing of the international search report

15. 07. 2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

van Berlo, A

INTERNATIONAL SEARCH REPORT

In ional Application No
PCT/US 03/38022

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 02/068790 A (FRANK S INTERNATIONAL INC ;SIPOS DAVID L (US); MOSING DONALD E (US) 6 September 2002 (2002-09-06) the whole document	15,30,34
X	US 3 846 991 A (WISOTSKY S) 12 November 1974 (1974-11-12) column 7, line 43 - column 9, line 4; figures 5-7	1,10-13, 23-29, 31,35, 38,40-53
X	US 4 877 353 A (WISOTSKY SR SERGE) 31 October 1989 (1989-10-31) column 6, lines 15-37; figures 1-3	1,10,11, 23-28, 31,35, 38,40-53
X	US 1 908 217 A (MAURICE BLUMENTHAL) 9 May 1933 (1933-05-09) the whole document	1,10,11, 23-28, 31,35, 38,40-53
X	US 4 415 047 A (ADCOCK GERALD L) 15 November 1983 (1983-11-15) column 2, lines 3-14; figures 9-12 column 5, lines 22-65	1,10,11
X	US 4 362 439 A (VAYNKOF PETER P) 7 December 1982 (1982-12-07) figures 1-4	1,12,13
X	US 3 646 598 A (CHELMINSKI STEPHEN V) 29 February 1972 (1972-02-29) figures 2-10	1,12,13

INTERNATIONAL SEARCH REPORT

national application No.
PCT/US 03/38022

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☒ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
1-15, 17, 18, 20-53
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-9,14,15,17,18,30,32-34,36,37

Pile-driving

2. claims: 10,11,23-26,31,35,46-49,53

Coupling drill string to pile

3. claims: 12,13,20-22,27-29,38-45,50-52

Coupling hammer to pile

4. claim: 16

Lockable telescoping section

5. claim: 19

Valve system

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 03/38022

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 2349401	A	01-11-2000	AU 3915200 A	09-10-2000
			CN 1371544 T	25-09-2002
			EP 1171946 A1	16-01-2002
			US 2002060914 A1	23-05-2002
			WO 0057543 A1	28-09-2000
			US 2003007372 A1	09-01-2003
			US 6626248 B1	30-09-2003
			US 6307757 B1	23-10-2001
			US 2004085790 A1	06-05-2004
WO 0026576	A	11-05-2000	FI 982386 A	05-05-2000
			AU 1326300 A	22-05-2000
			EP 1127477 A1	29-08-2001
			WO 0026576 A1	11-05-2000
DE 3514030	A	23-10-1986	DE 3514030 A1	23-10-1986
WO 02068790	A	06-09-2002	WO 02068790 A1	06-09-2002
			EP 1362159 A1	19-11-2003
US 3846991	A	12-11-1974	CA 963278 A1	25-02-1975
			GB 1397137 A	11-06-1975
			NO 138775 B	31-07-1978
			US 3820346 A	28-06-1974
			US 3842917 A	22-10-1974
			US 3824797 A	23-07-1974
US 4877353	A	31-10-1989	NONE	
US 1908217	A	09-05-1933	NONE	
US 4415047	A	15-11-1983	NONE	
US 4362439	A	07-12-1982	NONE	
US 3646598	A	29-02-1972	BE 752406 A1	01-12-1970
			CA 922117 A1	06-03-1973
			DE 2031144 A1	07-01-1971
			DK 136544 B	24-10-1977
			FR 2051187 A5	02-04-1971
			GB 1319061 A	31-05-1973
			JP 49048208 B	20-12-1974
			NL 7009303 A	29-12-1970



19 BUNDESREPUBLIK
DEUTSCHLAND



DEUTSCHES
PATENTAMT

12 **Offenlegungsschrift**
10 **DE 42 17 293 A 1**

51 Int. Cl. 5:
E 03 F 3/06
F 16 L 1/00

21 Aktenzeichen: P 42 17 293.4
22 Anmeldetag: 25. 5. 92
43 Offenlegungstag: 26. 11. 92

DE 42 17 293 A 1

30 Innere Priorität: 32 33 31
24.05.91 DE 41 17 043.1

71 Anmelder:
Kipp, Jens-Werner, 4800 Bielefeld, DE

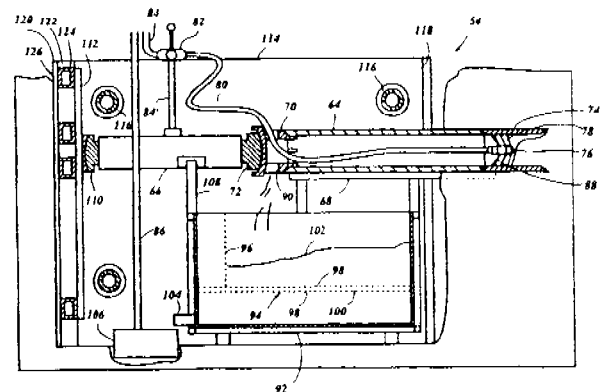
74 Vertreter:
ter Meer, N., Dipl.-Chem. Dr.rer.nat.; Müller, F.,
Dipl.-Ing., 8000 München; Steinmeister, H.,
Dipl.-Ing.; Wiebusch, M., 4800 Bielefeld; Urner, P.,
Dipl.-Phys. Ing.(grad.), Pat.-Anwälte, 8000 München

72 Erfinder:
gleich Anmelder

Prüfungsantrag gem. § 44 PatG ist gestellt

54 Vorrichtung zum grabenlosen Verlegen von Kanalrohren

57 Verfahren zum grabenlosen Verlegen von Kanalrohren (64), bei dem man den Rohrstrang von einem Anfahrtschacht (54) aus axial im Erdreich vortreibt und das Kernmaterial mit Hilfe einer Spülflüssigkeit durch das Rohrinne abfördert, dadurch gekennzeichnet, daß man die Spülflüssigkeit unter Druck zu einer Düse (76) im Bereich des vorderen Rohrendes fördert und derart in Form eines oder mehrerer Flüssigkeitsstrahlen (88) aus der Düse austreten läßt, daß die Flüssigkeitsstrahlen schräg nach rückwärts auf die Rohrwand gerichtet sind.



DE 42 17 293 A 1

3
 dung des Verfahrens wird die aus dem hinteren Rohrende austretende schlammführende Spülflüssigkeit unmittelbar im Anfahrtschacht gefiltert und wieder der Düse zugeleitet. Es hat sich gezeigt, daß eine ausreichende Filterleistung bereits mit einem relativ kleinen Filterbecken erzielt werden kann, das sich problemlos in einem für die Aufnahme einer leichten Vortriebspresse dimensionierten Schacht unterbringen läßt. Somit erübrigen sich aufwendige Installationen wie eine Dickstoffpumpe, überirdische Absetzbecken und dergleichen.

Das erfindungsgemäße Verfahren und die zu seiner Durchführung vorgesehenen Vorrichtungen zeichnen sich durch einen einfachen Aufbau und eine einfache Handhabung und eine entsprechende Störungsunanfälligkeit aus und bieten die Möglichkeit, Kanalrohre mit kleineren Durchmessern auch über kürzere Verlegungsstrecken grabenlos zu verlegen, ohne daß die Vorteile dieses Verfahrens durch unverhältnismäßig lange Rüstzeiten und hohe Anlagekosten zunichte gemacht werden.

Vorteilhafte Ausgestaltungen der Erfindung ergeben sich aus den Unteransprüchen.

Im folgenden werden bevorzugte Ausführungsbeispiele der Erfindung anhand der Zeichnungen näher erläutert.

Es zeigen:

Fig. 1 einen schematischen Längsschnitt durch einen Vortriebskopf;

Fig. 2 einen Schnitt längs der Linie II-II in Fig. 1;

Fig. 3 einen schematischen Teilschnitt durch einen Vortriebskopf gemäß einem anderen Ausführungsbeispiel;

Fig. 4 eine Skizze der gesamten Vortriebsanlage; und

Fig. 5 eine Skizze einer Vortriebsanlage gemäß einem anderen Ausführungsbeispiel.

Gemäß Fig. 1 ist auf die vordere Endmuffe 10 eines PVC-Kanalrohres 12 ein Vortriebskopf 14 aufgesteckt. Der Vortriebskopf 14 weist ein zylindrisches Gehäuse 16 auf, dessen Durchmesser geringfügig größer ist als der des Kanalrohres 12. Am vorderen Ende des Vortriebskopfes 14, rechts in Fig. 1, ist ein ringförmiger Schneidkopf 18 angeordnet. Der Schneidkopf ist mit Hilfe eines Rollen- oder Kugellagers 20 unmittelbar in der zylindrischen Wand des Gehäuses 16 gelagert und bildet eine ringförmige, mit Sägezähnen 22 versehene Schneidkante 24, deren Durchmesser mit dem Außendurchmesser des Gehäuses 16 übereinstimmt.

In der rückwärtigen Stirnfläche des Schneidkopfes 18 ist ein Kranz von Turbinenschaufeln 26 ausgebildet, die schräg, beispielsweise unter einem Winkel von etwa 30°, zum Axialrichtung angestellt sind und im Längsschnitt gemäß Fig. 1 napfförmig ausgebildet sind.

Eine Düse 28 ist mit Hilfe einzelner radialer Stege 30 koaxial in dem Gehäuse 16 gehalten. Die Düse 28 ist über einen Schlauch 32 mit einer nicht gezeigten Pumpe verbunden und gibt über Austrittsöffnungen 34 Wasserstrahlen 36 ab, die schräg nach vorn und radial nach außen auf die Turbinenschaufeln 26 gerichtet sind. Der Wasserdruck liegt etwa in der Größenordnung von 8 bis 35 MPa. Durch die auf die Turbinenschaufeln auftreffenden Wasserstrahlen 36 wird der Schneidkopf 18 in rasche Drehung versetzt, so daß er sich leicht in das Erdreich einschneidet und Hindernisse wie Baumwurzeln oder dergleichen durchsägt. Das Wasser wird an den napfförmigen Turbinenschaufeln 26 zur Innenwand des Gehäuses 16 umgelenkt, so daß es nicht nach vorn aus dem Gehäuse 16 austritt, sondern zum rückwärtigen Ende des Kanalrohres 12 zurückströmt.

Ein Steg 38 ist diametral in dem Schneidkopf 18 angeordnet und bildet zwei schräg angestellte Flügel 40, mit denen der durch den Schneidkopf 18 ausgeschnittene Erdkern in das Innere des Gehäuses 16 befördert wird.

Die Innenfläche des Schneidkopfes 18 ist im Übergangsbereich zwischen der Schneidkante 24 und dem Schaufelkranz konisch gestaltet, so daß das zerbröckelnde Erdreich nahezu ungehindert in das Innere des Gehäuses eintreten kann. Dort wird das Erdreich durch das in der Turbine verwirbelte und zum rückwärtigen Rohrende zurückströmende Wasser mitgenommen und zum rückwärtigen Rohrende mitgenommen. Im gezeigten Beispiel sind die Flügel 40 an den äußeren Enden leicht abgewinkelt, so daß das Erdreich in den äußeren Umfangsbereich in etwa parallel zu der konischen Innenfläche des Schneidkopfes 18 gefördert wird.

Zur Befestigung des Vortriebskopfes 14 an dem Kanalrohr 12 sind an dem hinteren Steg 30 ein oder mehrere Klemmteile 42 vorgesehen, mit Hilfe von Spannschrauben 44 radial nach außen spannbar sind, so daß sie von innen in die Muffe 10 des Kanalrohres 12 eingreifen und die Rohrwand am Mantel des Gehäuses 16 festspannen.

Fig. 3 zeigt eine abgewandelte Ausführungsform des Vortriebskopfes 14, die besonders für Rohre 12 mit größerer Nennweite geeignet ist. Die Klemmteile 42 zur Befestigung des Gehäuses 16 greifen in diesem Fall von außen über die Muffe 10. Der Schneidkopf 18 weist bei dieser Ausführungsform eine axiale Welle 46 auf, die über die radialen Flügel 40 mit der ringförmigen Schneidkante 24 verbunden ist. Der durch die Leitschaukeln 26 gebildete Turbinenkranz ist am rückwärtigen Ende der Welle 46 ausgebildet. Der mittlere Teil der Welle 46 ist mit Hilfe eines Lagers 48 in einen ringförmigen Halter 50 gelagert, der koaxial zur Wand des Gehäuses 16 an den radialen Stegen 30 befestigt ist und mit der Wand des Gehäuses 16 einen ringförmigen Zwischenraum für den Durchtritt des Erdreiches bildet.

Die Düse 28 ist bei dieser Ausführungsform einfach als am vorderen Ende offenes Rohr ausgebildet, dessen Querschnitt teilweise mit den Turbinenschaufeln 26 überlappt. Das Wasser wird axial nach vorn aus der Düse 28 abgegeben und wird durch die Turbinenschaufeln 26 in einen ringförmigen Zwischenraum zwischen der Düse 28 und dem Halter 50 umgelenkt. Das Wasser tritt dann durch die Zwischenräume zwischen den radialen Stegen 30 in die Muffe 10 des Kanalrohres 12 ein und nimmt das Erdreich mit, das durch den Zwischenraum zwischen dem Halter 50 und der Außenwand des Gehäuses 16 in die Muffe 10 gelangt ist. Da das Gehäuse 16 nur eine geringe axiale Länge aufweist, kann das Erdreich diesen Zwischenraum aufgrund der Förderwirkung der schräggestellten Flügel 40 durchqueren, ohne daß ein allzu großer Reibungswiderstand auftritt.

Im gezeigten Ausführungsbeispiel ist die Welle 46 als Hohlwelle ausgebildet, durch die ein Teil des aus der Düse 28 austretenden Wassers axial nach vorn aus dem Schneidkopf 18 austritt. Auf diese Weise wird eine gewisse Lockerung des Erdreiches erreicht, bevor es von dem Schneidkopf 18 erfaßt wird. Durch geeignete Dimensionierung der Bohrung 52 der Hohlwelle 46 läßt sich verhindern, daß vor dem Schneidkopf 18 übermäßig große Hohlräume gebildet werden.

Abweichend von den oben beschriebenen Ausführungsbeispielen ist es auch möglich, statt der Düse 28 oder zusätzlich zu dieser eine oder mehrere Düsen an der Innenwand des Gehäuses 16 anzuordnen. Durch mehrere einzeln abschaltbare Düsen kann so eine

Vortriebskopfes keine Hohlräume ausgespült werden. Die zur Fixierung der Rotationsdüse 76 dienenden Stege 78 sind nicht zwingend erforderlich, da die Düse durch den Rückstoß in Vorwärtsrichtung angetrieben wird. Es genügt deshalb, den Schlauch 80 mit der Rotationsdüse 76 lose in den Rohrstrang einzulegen und die Position der Düse dadurch zu steuern, daß man den Schlauch 80 entsprechend der Vortriebsbewegung nachläßt.

Im gezeigten Ausführungsbeispiel bildet das von der Druckpumpe geförderte Wasser zugleich das Druckmittel für die Vortriebspresse 66. Das Verteilerventil 82 ist so angeordnet, daß es von außerhalb des Anfahrschachtes 54 betätigt werden kann, und ist über eine Leitung 84' mit der Vortriebspresse 66 verbunden. Mit Hilfe dieses Verteilerventils wird die Aufteilung des Druckmittels zwischen dem Pressenzylinder und der Düse 76 gesteuert. Wenn sich während des Rohrvortriebs die Bodenbeschaffenheit ändert und sich der Eindringwiderstand erhöht, weil das Kernmaterial mit Hilfe der Rotationsdüse 76 nicht ausreichend abgebaut werden kann, so wird die Druckzufuhr zu der Vortriebspresse 66 gedrosselt und statt dessen die Wasserzufuhr zur Düse erhöht. Wenn der Stau des Kernmaterials beseitigt ist, kann die Druckzufuhr zur Vortriebspresse wieder erhöht werden. Alternativ zu der Handsteuerung ist auch eine automatische Regelung anhand des Vortriebswiderstands möglich.

Die Vortriebspresse 66 ist mit Hilfe einer Stütze 108 auf dem Filterbehälter 92 montiert und ist somit stets korrekt in bezug auf die Lafette 68 ausgerichtet. Die Lafette 68 wird durch lösbare Schienen gebildet, die beispielsweise durch Unterlegen von Paßstücken an den jeweiligen Rohrdurchmesser angepaßt werden können. Außerdem sind diese Schienen der Lafette 68 so gestaltet, daß sie sich axial ein Stück in das Erdreich einschieben lassen, um dem Vortriebskopf 74 beim Beginn des Preßvorgangs so lange Führung zu geben, bis er vollständig in das Erdreich eingedrungen ist. Hierdurch wird die Zielgenauigkeit der Vorrichtung wesentlich verbessert.

Die Abstützung der — vorzugsweise zweistufigen — Vortriebspresse 76 erfolgt mit Hilfe eines Stempels 110 unmittelbar am rückwärtigen Ende des Pressenzylinders. Hierdurch wird eine leichte und kompakte Konstruktion ermöglicht. Der Stempel 110 ist gelenkig mit einer zur Druckverteilung dienenden Stützplatte 112 verbunden. Aufgrund dieser gelenkigen Verbindung kann die Vortriebspresse 66 auch dann ihre ursprüngliche Richtung beibehalten, wenn die Stützplatte 112 nicht genau rechtwinklig zur Pressenachse orientiert ist.

Die Längswände des Anfahrschachtes 54 sind in üblicher Weise mit zwei annähernd parallelen Verbauplatten 114 ausgekleidet, die durch waagerechte Stützen 116 auf Abstand gehalten werden. Die Verbauplatten 114 weisen an ihren senkrechten Kanten einen Falz 118 auf, wie auf der rechten Seite in Figur 5 zu erkennen ist. Am entgegengesetzten Ende der Verbauplatte 114 wird durch eine in den Falz eingelegte Winkelleiste 120, die sich mit ihrem freien Schenkel am Erdreich abstützt, eine senkrechte Führungsnut 122 gebildet. Die Stützplatte 112 ist Teil einer durch waagerechte Streben 124 versteiften und an der Rückseite durch ein Blech verkleideten Abschlußwand 126, die mit ihren senkrechten Rändern in die Führungsnuten 122 der Verbauplatten 114 eingeschoben ist. Auf diese Weise wird eine saubere Auskleidung des Anfahrschachtes und zugleich eine stabile Abstützung der Vortriebspresse 66 ermöglicht. Da

die Verbauplatten 114 durch die Stützen 116 nicht völlig starr miteinander verbunden sind, sind die Führungsnuten 122 so bemessen, daß die Abschlußwand 126 ein ausreichendes Spiel aufweist. Wahlweise können die Fugen zwischen der Abschlußwand 126 und den Verbauplatten 114 jedoch durch Moosgummidichtungen oder dergleichen abgedichtet sein, so daß die Wasserhaltung in dem Anfahrschacht 54 wesentlich erleichtert wird.

Patentansprüche

1. Verfahren zum grabenlosen Verlegen von Kanälen (64), bei dem man den Rohrstrang von einem Anfahrschacht (54) aus axial im Erdreich vortreibt und das Kernmaterial mit Hilfe einer Spülflüssigkeit durch das Rohrinne abfördert, dadurch gekennzeichnet, daß man die Spülflüssigkeit unter Druck zu einer Düse (76) im Bereich des vorderen Rohrendes fördert und derart in Form eines oder mehrerer Flüssigkeitsstrahlen (88) aus der Düse austreten läßt, daß die Flüssigkeitsstrahlen schräg nach rückwärts auf die Rohrwand gerichtet sind.
2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß man auf das vordere Rohrende einen rohrförmigen Vortriebskopf (74) aufsetzt, in dem die Düse (76) in einer gegenüber dem vorderen Ende des Vortriebskopfes zurückliegenden Position gehalten ist.
3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß man den Abstand der Düse (76) zum vorderen Ende des Rohres (64) bzw. des Vortriebskopfes (74) bei schwereren Böden verringert und bei leichteren Böden vergrößert.
4. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß man als Düse (76) eine rückstoßgetriebene Rotationsdüse verwendet.
5. Verfahren zum grabenlosen Verlegen von Kanälen (12), bei dem man den Rohrstrang von einem Anfahrschacht (54) aus im Erdreich vortreibt und das Kernmaterial mit Hilfe einer Spülflüssigkeit durch das Rohrinne abfördert, dadurch gekennzeichnet, daß man die Spülflüssigkeit unter Druck zu einer Düse (28) im Bereich des vorderen Rohrendes fördert und mit einem oder mehreren aus der Düse austretenden Flüssigkeitsstrahlen (36) einen mit Turbinenschaufeln (26) versehenen drehbaren Schneidkopf (18) antreibt, wobei zumindest der überwiegende Teil der Flüssigkeitsstrahlen durch die Turbinenschaufeln in Richtung auf das hintere Rohrende umgelenkt wird.
6. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß man die aus dem hinteren Rohrende abfließende schlammführende Spülflüssigkeit unmittelbar im Anfahrschacht (54) filtert und erneut der Düse (12; 76) zuführt.
7. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß die Rohre (64) hydraulisch vorgepreßt werden und daß man Wasser als hydraulisches Druckmittel benutzt.
8. Verfahren nach Anspruch 7, dadurch gekennzeichnet, daß die hydraulische Vortriebspresse (66) und die Düse (76) von einer gemeinsamen Druckquelle gespeist werden.
9. Verfahren nach Anspruch 7 oder 8, dadurch gekennzeichnet, daß man bei einem erhöhten Vortriebswiderstand zeitweise die Vortriebskraft ver-

Fig. 3

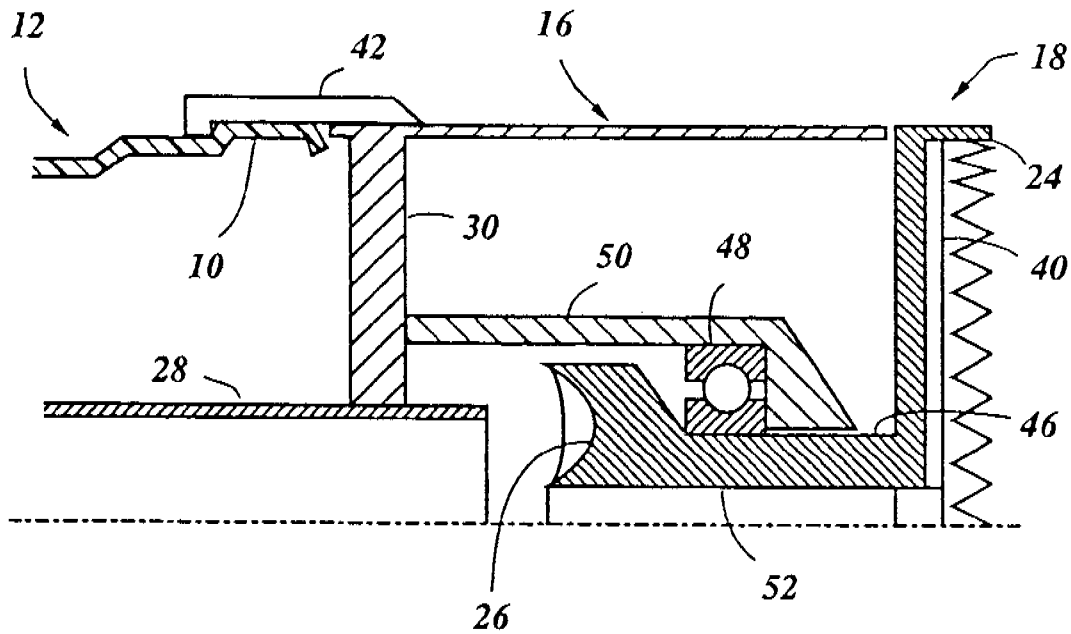
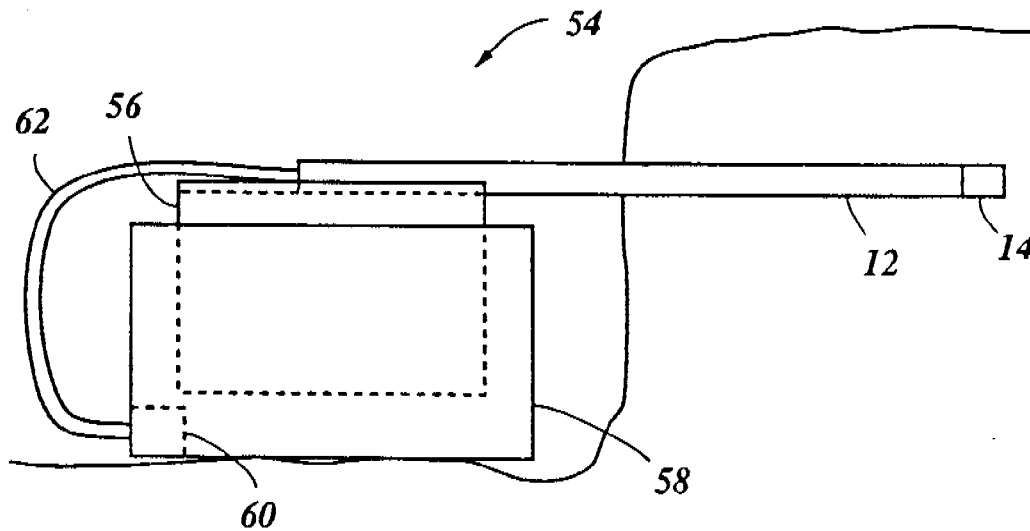


Fig. 4



(12) DEMANDE INTERNATIONALE PUBLIÉE EN VERTU DU TRAITÉ DE COOPÉRATION
EN MATIÈRE DE BREVETS (PCT)

(19) Organisation Mondiale de la Propriété
Intellectuelle
Bureau international



(43) Date de la publication internationale
31 décembre 2003 (31.12.2003)

PCT

(10) Numéro de publication internationale
WO 2004/001180 A1

(51) Classification internationale des brevets⁷ : E21B 7/20,
43/10, 7/04, 7/128

(21) Numéro de la demande internationale :
PCT/FR2003/001867

(22) Date de dépôt international : 18 juin 2003 (18.06.2003)

(25) Langue de dépôt : français

(26) Langue de publication : français

(30) Données relatives à la priorité :
02/07537 19 juin 2002 (19.06.2002) FR

(71) Déposant (pour tous les États désignés sauf US) :
SAIPEM S.A. [FR/FR]; 1/7, avenue San Fernando,
F-78180 Montigny Le Bretonneux (FR).

(72) Inventeurs; et

(75) Inventeurs/Déposants (pour US seulement) : ANRES,
Stéphane [FR/FR]; 1 bis, rue de l'Assemblée Nationale,
F-78000 Versailles (FR). HOPPER, Hans, P. [GB/GB];
Hillhouse, Whiterashes, Aberdeenshire AB21 0QL (GB).

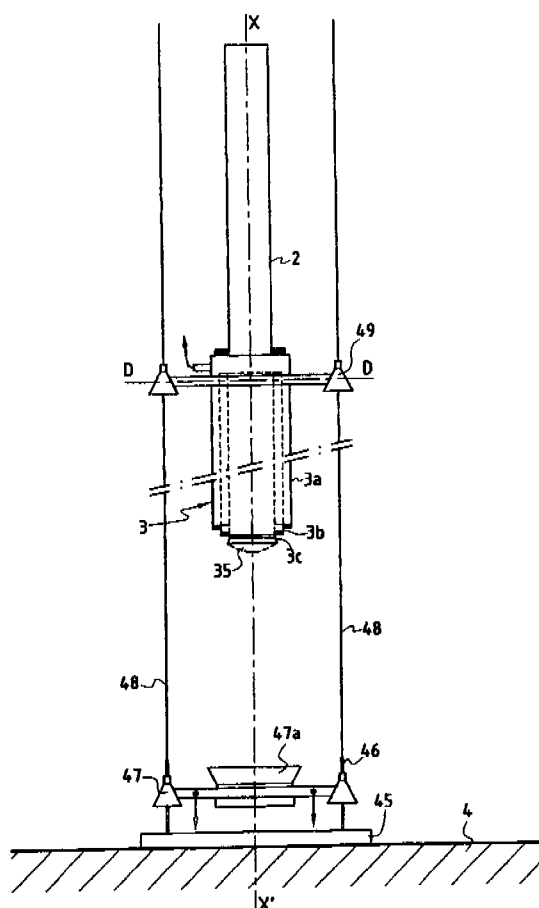
(74) Mandataire : DOMANGE, Maxime; Cabinet Beau de
Loménie, 232, avenue du Prado, F-13295 Marseille Cedex
08 (FR).

(81) États désignés (national) : AE, AG, AL, AM, AT, AU, AZ,
BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ,
DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM,
HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK,
LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX,
MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD,

[Suite sur la page suivante]

(54) Title: TELESCOPIC GUIDE LINE FOR OFFSHORE DRILLING

(54) Titre : CONDUITE DE GUIDAGE TÉLESCOPIQUE DE FORAGE EN MER



(57) Abstract: The invention relates to a guide device (3) for an offshore drilling installation comprising at least one drilling riser (2) which extends from a floating support to the aforementioned guide device (3) at the bottom of the sea (4), whereby the drilling can be performed from said floating support via the drilling riser (2) by means of a drill string which is equipped with drilling tools at the end thereof. According to the invention, the telescopic guide device (3) comprises a telescopic guide line (3) consisting of coaxial (xx') telescopic line elements (3a, 3b, 3c), the end of the inner telescopic line element (3c) having the smallest diameter being equipped with a means of breaking up the sea floor in order to drive said telescopic guide line (3) progressively into the ground so that a drilling tool can be guided deeper therein.

(57) Abrégé : La présente invention concerne un dispositif de guidage (3) d'une installation de forage en mer comprenant au moins un riser de forage (2) s'étendant depuis un support flottant jusqu'au dit dispositif de guidage (3) au fond de la mer (4), ledit forage pouvant être réalisé depuis ledit support flottant à travers ledit riser de forage (2) à l'aide d'un train de tige de forage équipé à son extrémité d'outils de forage. Selon l'invention ledit dispositif de guidage télescopique (3) comprend une conduite de guidage télescopique (3) comprenant des éléments de conduite télescopiques (3a, 3b, 3c) coaxiaux (xx'), l'élément de conduite télescopique interne (3c) de plus petit diamètre étant équipé à son extrémité d'un moyen de décohérence du sol apte à créer un enfoncement progressif dans le sol de ladite conduite de guidage télescopique (3) pour permettre ainsi de guider plus profondément dans le sol un outil de forage.

WO 2004/001180 A1



SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

- (84) États désignés (régional) : brevet ARIPO (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), brevet eurasien (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), brevet européen (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), brevet OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Déclaration en vertu de la règle 4.17 :

- relative au droit du déposant de revendiquer la priorité de la demande antérieure (règle 4.17.iii) pour toutes les désignations

Publiée :

- avec rapport de recherche internationale
— avant l'expiration du délai prévu pour la modification des revendications, sera republiée si des modifications sont reçues

En ce qui concerne les codes à deux lettres et autres abréviations, se référer aux "Notes explicatives relatives aux codes et abréviations" figurant au début de chaque numéro ordinaire de la Gazette du PCT.

CONDUITE DE GUIDAGE TELESCOPIQUE DE FORAGE EN MER

La présente invention concerne le domaine connu du forage en mer à partir d'un support flottant ancré en surface et plus particulièrement des dispositifs de guidage des trains de tiges de forage installés au niveau du fond de la mer.

Elle concerne plus particulièrement le forage dévié en eau profondes, de manière à atteindre des points éloignés de la verticale de l'axe de l'engin de forage en surface.

Dès que la profondeur d'eau devient importante l'exploration et l'exploitation des champs de production notamment des champs pétroliers s'effectue en général à partir d'un support flottant. Ce support flottant comporte en général des moyens d'ancrage pour rester en position malgré les effets des courants, des vents et de la houle.

Dans le cas des opérations de forage, il comporte aussi en général des moyens de manutention des trains de tiges, ainsi que des équipements de guidage associés à des systèmes de sécurité installés au niveau du fond de la mer.

Les forages sont habituellement réalisés à la verticale de l'engin de forage, puis pénètrent le sol verticalement sur des hauteurs de plusieurs centaines de mètres. Ensuite, lesdits forages sont poursuivis jusqu'à la nappe de pétrole appelée "réservoir", soit selon la verticale, soit avec une déviation angulaire progressive, de manière à atteindre des points dudit réservoir, plus ou moins éloignés.

La phase de démarrage du puits est en général effectuée en descendant depuis la surface une embase de forage reposant sur le fond marin munie de lignes guides jusqu'en surface, puis on descend une longueur de conduite, appelée "casing" ou cuvelage, de fort diamètre, en général 0,914 m (36") et mesurant de 50 à 60m de long au total. Ledit casing est réalisé à partir de longueurs unitaires de conduite mesurant environ 12 m de long assemblées par vissage à bord de la plateforme de forage, au niveau du plancher du derrick. Pour résister aux efforts, chaque longueur unitaire de casing comporte à chaque extrémité une zone

renforcée sur une longueur de 0.5m à 1m, constituée d'une surépaisseur correspondant à environ 0.5 à 2 fois l'épaisseur courante de la paroi dudit casing, épaisseur dans laquelle est usinée ledit filetage. Ledit casing, une fois assemblé, passant à travers ladite embase, est alors simplement planté

5 dans le sol, en général peu consolidé et l'enfoncement est souvent effectué par lançage (c'est à dire par envoi d'eau sous pression). Ce premier casing sert à consolider les parois du puit dans la zone proche du fond de la mer, et fait donc office de dispositif de guidage d'un second casing, de diamètre inférieur et, en général, d'une longueur totale de 150 à 200m, ledit second

10 casing étant lui aussi réalisé par assemblage de conduite de 12m de longueur unitaire comportant des zones renforcées aux extrémités, présente un diamètre extérieur, y compris les zones de filetage renforcées, largement inférieur au diamètre interne du casing externe, pour qu'il puisse y coulisser librement lors de l'installation et pour que le cheminement du

15 coulis de cimentation puisse se faire dans les meilleures conditions. Ledit second casing est alors soit vibrofoncé, soit foré si le terrain l'exige, puis on cimente depuis la surface l'interstice entre lesdits casings et le sol, ainsi que entre les deux dits casings. Durant ces phases, on travaille à trou ouvert (« open hole ») et l'on risque d'être exposé à des instabilités de

20 terrain, ou encore à des arrivées d'eau intempestives survenant à faible profondeur sous le fond de la mer (« shallow water flow »), perturbant gravement la phase de démarrage du puits.

Selon la nature du sol, on peut être amené à considérer un troisième casing, voire un quatrième, de manière à atteindre une profondeur

25 suffisante pour initier le forage proprement dit.

Ainsi, les casings multiples présentent des espaces importants entre chaque dit casing et le suivant et, de plus, du fait que chacun desdits casings s'étend depuis le niveau du sol marin jusqu'à son extrémité la plus basse, ceci implique qu'au niveau du sol marin et sur toute la hauteur du

30 premier casing et des suivants, on observe radialement deux, trois, voire quatre ou plus, épaisseurs successives de casing, qui seront en fait inutiles dans la poursuites des opérations, car dans la phase principale de forage et d'exploitation du puits, une seule épaisseur de casing est nécessaire pour

assurer le supportage des équipements de fond ainsi que l'étanchéité de l'ensemble. Ces multiples casings, redondants dans la zone proche du fond marin, sont rendus nécessaires en raison de la manière de procéder pour le démarrage d'un forage de puits selon l'art antérieur, redondance qui
5 représente une quantité d'acier considérable, et donc un coût très important.

On connaît le brevet GB-2,338,009 qui décrit un mode d'installation de multiples éléments de casings indépendants installés successivement les uns dans les autres avec un jeu réduit. Lesdits casings étant installés en
10 séquence, l'un après l'autre, ceci permet, en raison dudit jeu réduit, de minimiser le diamètre maximal du trou à forer, tant pour le casing extérieur que les casings intermédiaires, ce qui réduit d'autant la quantité de gravats à évacuer ainsi que les besoins en puissance de l'engin de forage et par là même, sont coût horaire.

15 On connaît le brevet US-5,307,886 qui décrit un système et ou mode d'installation permettant de réaliser de multiples casings à jeu réduit, et minimisant l'espace entre ledit casing et la paroi du trou foré dans le sol.

Un premier problème à la base de l'invention est de fournir un dispositif de guidage permettant de guider le train de tige de forage et
20 l'outil de forage le plus profondément possible dans le sous sol au fond de la mer, de manière à éviter ces incidents d'arrivée d'eau intempestive survenant à faible profondeur lors de l'installation des casings.

Un autre problème est de réduire les phases de manipulation et d'assemblage à bord de la plateforme de forage, des conduites unitaires
25 servant à réaliser lesdits casings afin de réduire la difficulté, la durée et donc le coût de l'installation des casings, particulièrement dans le cas d'une installation en Ultra Grands Fonds c'est à dire pour des profondeurs de 2000 à 3000 mètres voire plus. En effet, ces manipulations étant réalisées en séquences successives et indépendante, si le temps proprement dit de
30 mise en place, c'est à dire l'enfoncement dans le sol, du premier casing, du second casing ou des suivants reste acceptable, les manipulations intermédiaires consistant à ramener en surface des outils de préhension, puis à redescendre à nouveau le casing suivant, représentent alors un temps

considérable, donc un coût d'immobilisation de l'engin de forage extrêmement élevé, lorsque la hauteur d'eau atteint 2000, 3000 voire 4000 à 5000m ou plus. De plus, les phases de cimentation de l'interstice entre deux risers nécessitent un temps très important qui augmente d'autant le
5 coût de l'opération.

Un autre problème est de réduire radicalement la quantité d'acier nécessaire à la réalisation de ces casings en minimisant les redondances ainsi que les jeux entre lesdits casings successifs.

D'autre part dans le cas de forage de plusieurs puits déviés, il est
10 possible de constituer un réseau de puits en forme de parapluie issus d'une même position du support flottant en surface, ce qui permet de regrouper, pendant toute l'exploitation du champ, l'ensemble des équipements de surface en un même lieu. De telles installations sont appelées DTU (Dry Tree Units), c'est à dire unités à têtes de puits sèches, car dans ce cas les
15 têtes de puits sont rassemblées en surface, hors d'eau. L'exploitation est ainsi grandement facilitée, car il est possible d'avoir accès à l'un quelconque des puits depuis le DTU, pour effectuer toutes les opérations de contrôle et de maintenance sur les puits, et ce pendant toute la durée de vie des installations qui atteint 20 à 25 ans et voire même plus.

20 De tels forages déviés ne sont possibles que si les réservoirs sont à grande profondeur, par exemple 2000 à 2500 m, car il est impératif d'avoir une longueur verticale de plusieurs centaines de mètres dans le fond marin, avant d'initier la déviation du puits dont le rayons de courbure des conduites constitutives du puits sont de l'ordre de 500 à 1000 m.

25 On connaît les brevets EP 0952300 et EP 0952301 qui décrivent des méthodes et dispositifs permettant d'effectuer des forages déviés en tirant profit de la tranche d'eau pour s'écarter au maximum de la verticale de l'engin de forage et pour reposer dans le fond marin de manière sensiblement tangentielle à l'horizontale.

30 Dans ces brevets, les dispositifs de guidage installés au fond de la mer pénètrent dans le sol et permettent d'assurer l'amorçage du puits de forage dans le fond marin selon une inclinaison d'un angle donnée par rapport à la verticale. Le dispositif de guidage est relié à l'engin de forage

par une conduite appelée "riser de forage" qui guide le train de tiges de forage qui les traverse et assure la remontée des boues et des débris de forage.

Cet élément de guidage installé au fond de la mer doit permettre de
5 respecter des rayons de courbure importants de 500 à 1000 m et par conséquent doit être de grandes dimensions, tout en restant très résistant pour absorber les efforts considérables engendrés par le train de tige de forage qui sera lui aussi contraint à épouser le même rayon de courbure, ce qui induit des frottement très importants et des risques de déstabilisation
10 de l'ensemble au cours du forage.

De plus cet élément de guidage de dimensions et de masse considérable doit être préinstallé dans les ultra grands fonds, c'est à dire dans des profondeurs d'eau de 1000 à 2500 m, voire plus.

Plus précisément dans EP-0,952,301, le dispositif de guidage
15 comprend un élément de conduite appelé "conducteur" qui est en fait le tube guide du puits de forage déployé à partir du support flottant à travers le riser de forage jusqu'à une structure appelée "skid" reposant sur le fond de la mer. Cette structure – skid maintient et guide le tube conducteur horizontalement au dessus du fond de la mer à une certaine hauteur. Puis
20 ce conducteur adopte une courbure en direction du fond de la mer sous l'effet de sa propre gravité. Le conducteur lors de son déploiement coopère avec des outils de forage pour qu'il s'enfonce partiellement dans le fond de la mer. La mise en place d'un tel dispositif de guidage et notamment du conducteur depuis le support flottant représente une contrainte
25 opérationnelle importante. En outre ce dispositif de guidage ne permet aucun contrôle de la courbure du conducteur. D'autre part, pour respecter un grand rayon de courbure, notamment supérieur à 500 m, il est nécessaire que le conducteur se déploie tangentiellement à l'horizontale sur plusieurs dizaines de mètres au delà du point d'appui qui assure son
30 guidage sur la structure skid.

Enfin, aucun moyen n'est décrit dans ces brevets pour permettre la réalisation de la mise en place dudit conducteur selon un grand rayon de courbure comme cela est nécessaire pour que le train de tiges, et surtout

les éléments de cuvelage puissent opérer avec un minimum de frottement latéral à l'intérieur de la conduite.

Pour un rayon de 600 m, si la tête de puit est à 2 m au dessus du sol, le conducteur n'atteindra le sol que 50 m plus loin ce qui signifie une
5 portion de conducteur de 50 m, en porte-à-faux, libre et non maintenu, ce qui est inacceptable car le conducteur risque de casser ou de plier en raison d'une courbure locale trop forte, car incontrôlée. De plus, le porte-à-faux ainsi créé risque d'être préjudiciable à un bon fonctionnement lors des opérations de forage ainsi que pendant toute la durée de vie qui peut
10 dépasser 25 ans.

Un autre problème selon la présente invention est donc de fournir un dispositif de guidage dans une application en forage dévié dans la hauteur de la tranche d'eau, qui puisse être mis en place selon un grand rayon de courbure de façon fiable, c'est à dire en pouvant contrôler la
15 courbure selon un grand rayon de courbure notamment supérieur à 500 m et dont la réalisation et la mise en place soient faciles à réaliser.

Selon un premier aspect apportant une solution au problème de guidage du train de tige et de l'outil de forage le plus profondément possible, la présente invention fournit un dispositif de guidage d'une
20 installation de forage en mer comprenant au moins un riser de forage s'étendant depuis un support flottant jusqu'au dit dispositif de guidage au fond de la mer, ledit forage pouvant être réalisé depuis ledit support flottant à travers ledit riser de forage à l'aide d'un train de tige de forage équipé à son extrémité d'outils de forage passant à travers ledit riser de
25 forage et ledit dispositif de guidage, ledit dispositif de guidage étant caractérisé en ce qu'il comprend une conduite de guidage télescopique comprenant des éléments de conduite télescopiques coaxiaux (XX') et de diamètres décroissants, préassemblés les uns aux autres, de manière à ce que lesdits éléments de conduite télescopiques soient aptes à coulisser dans
30 la direction axiale (XX') les autres, l'élément de conduite télescopique interne de plus petit diamètre étant équipé à son extrémité d'un moyen de décohésion du sol apte à créer un enfoncement progressif dans le sol de ladite conduite de guidage télescopique par coulisement vers l'extérieur

desdits éléments de conduite télescopiques pour permettre ainsi de guider plus profondément dans le sol un outil de forage à l'extrémité dudit train de tige.

On comprend que l'enfoncement progressif dans le sol de la
5 conduite de guidage se fait à partir d'une position initiale rétractée dans laquelle l'élément de conduite télescopique interne de plus petit diamètre est rentré à l'intérieur des éléments de conduite télescopique de plus grand diamètre. Donc tous les éléments de conduite télescopiques sont positionnés à l'intérieur d'un élément de conduite télescopique externe de
10 plus grand diamètre. L'enfoncement progressif dudit moyen de décohesion se produit par coulisement progressif vers l'extérieur des éléments de plus petit diamètre dans ceux de plus grand diamètre, et donc tout d'abord de l'élément de conduite interne télescopique interne de plus petit diamètre puis progressivement des éléments de conduite télescopiques de diamètres
15 croissants, et jusqu'à complet déploiement de tous les éléments de conduite télescopiques en extension vers l'extérieur.

En procédant ainsi, dans le cas du forage vertical conventionnel, on descend depuis la surface un unique dispositif de guidage, au lieu de deux, voire trois dans l'art antérieur, ce qui représente un gain de temps
20 considérable dans le cas de forage en mer profonde, par exemple par 2 000, 3 000m, voire plus, car ils doivent être descendus successivement. De plus, en cas d'instabilité de terrain, ou encore en cas d'arrivée d'eau intempestives survenant à faible profondeur sous le fond de la mer, le casing étant continu sur toute sa longueur, les risques d'effondrement sont
25 considérablement réduits, voire même radicalement supprimés. Enfin, les opérations de cimentation du dispositif selon l'invention sont réduites au minimum, car il n'est plus nécessaire de l'effectuer après chaque mise en place d'un casing dans le casing précédent, comme c'est le cas dans les casings de la technique antérieure. En effet, la cimentation est effectuée en
30 une seule fois après déploiement complet du dispositif télescopique.

Dans un mode préféré de réalisation ledit élément de conduite interne de plus petit diamètre présente un diamètre sensiblement identique à celui dudit riser de forage.

Dans un mode particulier de réalisation lesdits moyens de décohesion du sol sont constitués par un opercule multiperforé permettant de réaliser un lançage d'eau ou de boue par injection sous forte pression.

Plus particulièrement, ladite conduite de guidage télescopique
5 comprend au moins 3 éléments, de conduite télescopique coaxiaux.

Plus particulièrement encore, chacun desdits éléments de conduite coaxiaux-télescopiques présentent une longueur de 50 à 300 mètres, de préférence 100 à 200 mètres et ladite conduite de guidage déployée présente une longueur de 150 à 600 mètres de préférence 200 à 300 mètres.

10 Le dispositif de guidage selon l'invention est dans un premier temps préfabriqué à terre, puis mis en configuration rétractée par introduction des conduites les unes dans les autres de manière à réduire la longueur totale au minimum, puis mis à l'eau et équipé d'éléments de flottaison, puis remorqué sur site jusqu'à l'axe du derrick de forage, et enfin cabané de
15 telle manière que la partie supérieure de ladite conduite télescopique puisse être saisie par l'outil de manipulation installé en extrémité du train de tiges manutentionné par le derrick, l'ensemble étant alors descendu en une seule fois, en configuration verticale vers l'embase de guidage reposant sur le fond de la mer.

20 Etant préfabriqués à terre, chacun desdits éléments de conduite télescopique sera réalisé par assemblage de longueurs successives de conduites, lesdites conduites étant simplement soudées bout à bout de manière conventionnelle comme dans le cas de la fabrication des pipelines. Il n'est ainsi pas nécessaire de renforcer les extrémités de chacune
25 des longueur unitaire de 12m, car aucun filetage n'y est usiné, et l'ensemble présente alors un diamètre optimal et nettement réduit par rapport à l'art antérieur.

On entend par « conduite de guidage télescopique rétractée » que les différents éléments de conduite télescopique préassemblés sont tels que
30 ceux de petits diamètres sont rentrés à l'intérieur de ceux de plus grands diamètres.

Selon un second aspect permettant de résoudre le problème de la mise en place de dispositif de guidage dans une application en forage dévié

dans la hauteur de la tranche d'eau, la présente invention fournit un dispositif de guidage utile dans une installation de forage en mer, installation dans laquelle au moins un riser de forage s'étend depuis un support flottant jusqu'audit dispositif de guidage au fond de la mer, ledit riser de forage déviant progressivement depuis une position sensiblement verticale au niveau dudit support flottant jusqu'à une position sensiblement horizontale ou tangentielle à l'horizontale au fond de la mer, ledit forage pouvant être réalisé depuis ledit support flottant à travers ledit riser de forage et ledit dispositif de guidage de manière à ce que le puits de forage dans le fond de la mer soit amorcé selon une inclinaison donnée α par rapport à l'horizontale de préférence de 5 à 60°, de préférence encore 25 à 45°, ledit dispositif de guidage étant caractérisé en ce qu'il comprend une dite conduite de guidage télescopique dans une position enfoncée dans le sol dans laquelle ladite conduite de guidage télescopique rétractée ou ledit élément de conduite télescopique externe lorsque ladite conduite télescopique est complètement déployée comprennent successivement :

- . une extrémité avant reposant sensiblement horizontalement sur le fond de la mer,
- . une portion intermédiaire courbe de enfoncée dans le sous-sol du fond de la mer selon un grand rayon de courbure, de préférence un rayon de courbure supérieur à 500 m, et
- . une portion arrière sensiblement linéaire enfoncée dans le sous-sol du fond de la mer selon une dite inclinaison donnée α ,

ladite conduite de guidage télescopique ou ledit élément télescopique externe coopérant avec des moyens d'enfoncement contrôlé permettant l'enfoncement de ladite conduite de guidage télescopique rétractée dans le fond de la mer lorsque ladite conduite de guidage télescopique rétractée est tractée au fond de la mer à son extrémité avant, depuis une position initiale où ladite conduite de guidage télescopique rétractée repose entièrement par-dessus le fond de la mer dans une position sensiblement horizontale, jusqu'à une dite position enfoncée dans le sous-sol du fond de la mer.

La courbure de la conduite de guidage télescopique est donc formée par l'enfoncement contrôlé de la conduite de guidage. En raison de la

longueur importante de ladite conduite de guidage en position rétractée, chacun des tronçon rétracté prendra la même courbure, sans engendrer d'efforts significatifs au sein de l'ensemble.

Les moyens d'enfoncement de la conduite de guidage télescopique
5 rétractée permettent d'obtenir par enfoncement de la conduite, une courbure de la conduite avec un grand rayon de courbure à une valeur voulue et contrôlée, le rayon de courbure étant en effet dépendant des caractéristiques et de l'agencement desdits moyens d'enfoncement.

On comprend que ladite portion linéaire inclinée se trouve dans le
10 prolongement tangentiel de ladite portion courbe et, c'est l'inclinaison de cette portion linéaire qui détermine ledit angle α d'amorçage du puits de forage.

On comprend également qu'on entend par "horizontal au fond de la mer", une position sensiblement horizontale en fonction du relief du fond
15 de la mer.

Dans un mode particulier de réalisation, ladite conduite de guidage présente une longueur de 100 à 600 m, de préférence 250 à 450 m avec une dite inclinaison donnée α de la conduite de guidage d'environ 10 à 60°, de préférence 25 à 45°. La courbure recherchée de la conduite de guidage
20 correspond alors à une augmentation d'inclinaison d'environ 1° par portion de longueur de conduite de guidage de 10 m, soit un rayon de courbure d'environ 560 m.

Dans un mode préféré de réalisation, ladite extrémité avant de la conduite de guidage télescopique rétractée est encastrée dans une embase
25 comprenant une charge reposant sur une semelle avant de sorte que ladite embase maintient ladite extrémité avant de ladite conduite de guidage sensiblement horizontalement sur le fond de la mer lorsque celle-ci est tractée. Ladite embase empêche l'enfoncement de l'extrémité avant de ladite conduite de guidage télescopique rétractée, ainsi que sa rotation
30 autour d'un axe sensiblement horizontal perpendiculaire à l'axe de traction.

La présente invention fournit également un procédé de réalisation d'un dispositif de guidage selon l'invention, caractérisé en ce qu'on réalise des étapes dans lesquelles :

- 5 - on met en place une dite conduite de guidage télescopique rétractée dans une dite position initiale reposant sensiblement horizontalement et de façon rectiligne sur le fond de la mer, ladite conduite de guidage télescopique rétractée coopérant avec desdits moyens d'enfoncement contrôlé, et
- 10 - on réalise une traction au fond de la mer de ladite extrémité avant de ladite conduite de guidage télescopique, de préférence dans la direction longitudinale axiale de ladite conduite de guidage télescopique, depuis ladite position initiale jusqu'à une dite position enfoncée.

La présente invention a également pour objet une installation de forage en mer comprenant un riser de forage s'étendant depuis un support flottant jusqu'à un dispositif de guidage selon l'invention auquel ledit riser de forage est connecté.

- 15 Dans le cas de forage dévié dans la hauteur de la tranche d'eau, ledit riser de forage dévie progressivement depuis une position sensiblement verticale au niveau dudit support flottant jusqu'à une position sensiblement horizontale ou tangentielle à l'horizontale au fond de la mer, le forage pouvant être réalisé depuis ledit support flottant à travers ledit riser de
- 20 forage et ledit dispositif de guidage de manière à ce que le puit de forage s'amorce dans le fond de la mer selon une inclinaison donnée α par rapport à la verticale, de préférence de 10 à 80°.

- La présente invention a également pour objet un procédé de réalisation d'une installation de forage selon l'invention caractérisé en ce
- 25 qu'on réalise des étapes dans lesquelles:

- on réalise un dispositif de guidage télescopique selon un procédé selon l'invention, et
- on réalise la connexion d'au moins dudit riser de forage à ladite extrémité avant de la conduite de guidage télescopique reposant
- 30 sur le fond de la mer.

La présente invention a enfin pour objet un procédé de forage à l'aide d'une installation de forage selon l'invention caractérisé en ce qu'on réalise des opérations de forage et on construit un puits de forage en

déployant des trains de tiges coopérant avec des outils de forage et des colonnes de tubes ou cuvelages, à travers un dit riser de forage et un dit dispositif de guidage télescopique selon l'invention enfoncé dans le fond de la mer.

5 On comprend plus précisément que le train de tiges permet dans un premier temps de déployer les outils de forage, puis de déployer les éléments de tubes, appelés "colonnes de tubes ou cuvelages" qui constituent le puits de forage au fur et à mesure du forage et de leur mise en place dans le fond de la mer.

10 D'autres caractéristiques et avantages de la présente invention apparaîtront à la lumière de la description de plusieurs exemples de réalisation préférés qui vont suivre, en référence aux figures suivantes dans lesquelles :

- la figure 1 représente un dispositif de guidage télescopique constitué
15 d'éléments de conduites coaxiaux télescopiques représentés en position rétractée, dans le cas d'un forage vertical conventionnel,
- les figures 2, 3 et 4 sont des coupes en vue de côté détaillant le dispositif de guidage télescopique en position rétractée, représenté en ligne droite, respectivement au moment de sa dépose au fond de la mer,
20 au début de l'opération de forage par lançage et en cours de forage à l'outil rotatif,
- la figure 5 est une coupe en vue de côté du dispositif de guidage télescopique partiellement déployée, représentée en ligne droite, détaillant les forces de poussée s'exerçant sur les divers éléments
25 télescopiques et sur l'outil de forage, dans le cas d'un forage vertical conventionnel,
- la figure 6A est une vue de côté d'un support de surface de type DTU équipé d'un riser de forage connecté à un dispositif de guidage préinstallé sur le fond de la mer pour un forage en eau profonde dévié dans la hauteur de la tranche d'eau,
30
- la figure 6B représente un dispositif de guidage télescopique constitué de 3 éléments de conduites coaxiaux télescopiques déployés, dans le cas d'un forage dévié dans la hauteur de la tranche d'eau,

- les figures 7 et 8 sont des vues de côté d'un dispositif de guidage associé à une ancre assurant la pénétration dans le sol, représenté respectivement avant et après pénétration dans le fond marin,
- les figures 9 et 10 sont des coupes en vue de côté selon les plans de coupe respectifs AA et BB du dispositif de guidage,
- les figures 11 et 12 sont des vues de côté d'un dispositif de guidage équipé d'ailerons latéraux assurant une pénétration variable dans le sol, représenté respectivement avant et après pénétration dans le fond marin,
- 10 • la figure 13 est une vue de gauche du dispositif de guidage selon la figure 6 détaillant les ailerons latéraux,
- la figure 14 est une vue de côté d'un dispositif de guidage équipé de conduites secondaires de lancement facilitant la dé-cohésion du sol lors de la phase de pénétration dans le fond marin,
- 15 • la figure 15 est la vue en coupe de la section courante relative à la figure 14,
- les figures 16 et 12 sont des vues de côté d'une structure associée au dispositif de guidage selon les figures 7 et 8, limitant l'enfoncement lors de la pénétration dans le sol, représenté respectivement avant et après ladite pénétration dans le fond marin,
- 20 • les figures 18 et 19 sont les sections selon les plans CC et DD relatifs à la figure 16.
- la figure 20 est une vue de côté d'une plateforme de forage installée à la verticale de l'embase de forage d'un futur puits, détaillant la séquence d'installation d'un dispositif de guidage télescopique en position rétractée, lequel a été successivement préfabriqué à terre, puis équipé de flotteurs et remorqué sur site, puis cabané en position verticale, puis enfin repris en suspension par la plateforme de forage, au moyen d'un préhenseur installé à l'extrémité d'un train de tiges, l'ensemble étant
- 25 alors prêt à être descendu le long de lignes guides vers ladite embase de forage.
- 30

Pour la clarté des explications, le jeu entre deux éléments de conduite télescopique adjacents a été considérablement amplifié sur les

figures, de manière à faciliter la compréhension du fonctionnement des moyens de glissement, de guidage et d'étanchéité.

Dans la figure 1 on a représenté un dispositif de guidage constitué de 3 éléments de conduite télescopique 3a, 3b, 3c en position rectiligne, mis en œuvre dans le cadre d'un forage vertical conventionnel. Ledit dispositif de guidage 3, constitué de trois éléments de conduite télescopiques 3a, 3b et 3c, est suspendu à un riser de forage 2 manutentionné par le derrick en surface, et descendu vers une embase de forage 45 reposant sur le fond de la mer 4. Un premier moyen de guidage 47 a été descendu au préalable le long des câbles guides 48, pour venir se centrer sur des poteaux guides 46, et reposer enfin directement sur l'embase. Pour la clarté du dessin le dispositif de guidage 3 a été représenté dans une position légèrement au dessus de ladite embase 45, juste avant d'être déposée sur cette dernière. Ce premier moyen de guidage 47 comporte une forme d'entonnoir d'un diamètre légèrement supérieur au diamètre extérieur de la portion 3a du dispositif de guidage 3 et qui, collaborant avec ce dernier, permet ainsi de le guider lors de sa descente vers l'embase 45. Lors de la descente, le dispositif de guidage 3 est solidaire d'un second moyen de guidage 49 encastré dans ce dernier au niveau du plan DD et lui-même guidé le long des lignes guides 48.

Comme montré sur la figure 20, le dispositif de guidage 3 a été préfabriqué à terre, puis les divers éléments ont été rentrés les uns dans les autres, de manière à ce que la longueur de l'ensemble ainsi rétracté soit la plus faible possible, puis le dispositif de guidage est mis à l'eau et équipé de flotteurs 50. Il est alors remorqué sur site et, à proximité de la plateforme de forage 1, ledit dispositif de guidage est cabané par suppression des flotteurs avant, puis transféré à la verticale de l'axe du derrick où il est repris par le train de tige 2 équipé à son extrémité d'un outil préhenseur.

Dans une variante préférée de l'invention, la plateforme de forage 1 est remplacée par un simple navire de surface, de préférence à positionnement dynamique, le dispositif de guidage 3 une fois cabané est alors repris en suspension par un câble relié à un treuil installé à bord du

navire. Le dispositif de guidage est alors descendu au câble en simple pendule, de préférence sans lignes guides, puis inséré dans l'embase de forage. Le début de pénétration est effectué par lançage, la puissance hydraulique étant fournie par le navire de surface et transmise au fond, par exemple par une conduite flexible. Lorsque le lançage n'est plus efficace, le navire de surface suspend son opération, l'installation sera alors terminée par la plateforme de forage dès son arrivée sur site, à la verticale dudit puits à forer. En procédant ainsi, on réduit radicalement le coût de l'opération de la mise en place du casing, car le coût journalier du navire de surface requis représente une petite fraction du coût d'une plateforme de forage capable de forer dans des profondeurs d'eau de 3000m, 4000m, voire plus. De plus, l'engin de forage requis sera de plus faible puissance, donc d'un coût plus faible, car il n'aura pas à manipuler le dispositif de guidage télescopique selon l'invention, ni même les éléments unitaires d'un casing conventionnel selon l'art antérieur.

La figure 2 représente le dispositif de guidage télescopique 3 en position rétractée ou repliée avec un orifice 31 permettant aux boues et aux débris de forage d'être évacués au niveau du fond de la mer. Les éléments de conduite télescopique de ladite conduite télescopique de guidage 3 sont tubulaires et de diamètre de tailles décroissantes de manière à pouvoir coulisser les uns dans les autres. L'élément de conduite télescopique intermédiaire 3b du dispositif de guidage télescopique 3 est muni sur sa partie avant d'une bague de coulissement étanche 32b assurant le guidage à frottement réduit de l'élément de conduite interne télescopique terminal 3c du dispositif de guidage télescopique 3 et sur sa partie arrière, une bague de coulissement non étanche 33b assurant le guidage à frottement réduit de l'élément de conduite télescopique externe 3a dudit dispositif de guidage télescopique 3.

La portion 3a dudit dispositif de guidage est équipé sur l'avant d'une bague de coulissement étanche 32a assurant le guidage à frottement réduit de la portion 3b et est solidaire sur l'arrière du riser de forage en configuration de chaînette 2.

La portion 3c dudit dispositif de guidage est équipée sur l'avant d'un opercule 35 percé de multiples orifices, ou encore équipé d'une série de duses, permettant, par simple injection d'eau ou de boue sous très forte pression, de détruire la cohésion du sol et de permettre ainsi le démarrage du puits par simple lançage, et sur l'arrière, d'une bague de coulissement non étanche 33c.

Des bagues de coulissemements complémentaires 34 sont avantageusement installés, à intervalles réguliers ou non, respectivement entre les portions 3a-3b et 3b-3c de manière à éviter que, lorsque les portions de dispositif de guidage sont fortement courbés, comme indiqué sur la figure 1, la paroi externe du guidage intérieur, par exemple 3b, ne vienne frotter directement sur la paroi interne de la portion 3a. Dans le cas de la portion 3b, ces bagues de coulissement 34 sont solidarisés à ladite portion télescopique 3b de manière à présenter un frottement élevés vis à vis de cette portion 3b, c'est à dire qu'elles ont la possibilité de glisser lorsqu'ils sont soumis à un effort important s'appliquant parallèlement à l'axe longitudinal de ladite portion 3b. Ainsi, lorsque la portion 3b coulisse vers l'extérieur de 3a, la bague de coulissement 34 vient buter contre la bague de coulissement étanche 32a et du fait qu'elle peut glisser sous effort important, le coulissement vers l'extérieur de 3b dans 3a n'est pas empêché. En fin de coulissement, toutes les bagues de coulissement 34 seront en contact avec ladite bague de coulissement 32a, la bague de coulissement 33b étant elle-même en contact avec lesdits bagues de coulissement 34. Chacune des bagues de coulissement 34 est avantageusement munie dans sa partie externe d'un élément 34₁ à frottement réduit, de manière à minimiser les efforts longitudinaux de contact entre les parois des diverses portions du dispositif de guidage 3, lorsque ce dernier présente une courbure importante.

La figure 4 représente la phase de démarrage du forage, le dispositif de guidage étant installé au fond de la mer, les portions 3a, 3b et 3c étant en position rétractée.

L'outil de forage 36 est solidaire de l'extrémité inférieure du train de tiges de forage 38 actionné depuis le derrick installé en surface sur le

support flottant. Ledit outil de forage 36 est constitué d'une turbine 36₁, actionnée par un fluide sous pression, en général une boue de forage amenée par le train de tige 38, actionnant un porte outils 36₂ sur la face avant duquel sont solidarités les outils de coupe 36₃, et sur le fût duquel
5 sont installés des outils de coupe rétractables 36₄, représentés en position rétractée sur la figure 3 et en position de travail sur la figure 4. Un piston 40, représenté sur la figure 5 est solidaire du train de tiges 38 et coulisse à l'intérieur du riser 2 de manière à réaliser une étanchéité entre l'amont et l'aval dudit piston 40.

10 Ainsi, en début d'opération de fonçage-forage, on descend depuis la surface l'outil de forage 36 solidaire de l'extrémité du train de tiges 38, de manière à atteindre la position décrite sur la figure 3. On obture l'orifice 31 par une vanne non représentée et l'on envoie à travers le train de tiges 38 un fluide sous forte pression. La turbine 36₁ tourne dans le vide et le
15 fluide ne peut ressortir que par l'opercule 35 percé d'une multitude de petits trous. Le lançage ainsi créé à l'avant de la portion 3c du dispositif de guidage, assure la décohesion du sol et l'effet de piston dû à la surpression interne, pousse vers l'avant la portion 3c, entraînant éventuellement la portion 3b dudit dispositif de guidage.

20 Lorsque l'effet de lançage n'est plus suffisant pour engendrer l'avancement de la section frontale, le lançage est stoppé et l'outil de forage 36 est déplacé vers l'avant en poussant depuis la surface la longueur de train de tige 38 nécessaire. Un collier de centrage 37a solidaire de la turbine 36₁, coulisse librement à l'intérieur de la portion 3c du dispositif
25 de guidage 3 ; ledit collier laisse passer librement les boues et les débris de forage, dans les deux sens, de l'aval vers l'amont. En fin de phase d'avancement, le collier 37a vient en butée avec une bague 37b solidaire de la portion 3c de dispositif de guidage, à l'intérieur de cette dernière. Les collier 37a et bague 37b présentent des portions filetées correspondantes,
30 non représentées, ce qui, par simple rotation du train de tige depuis la surface, permet de solidariser mécaniquement le corps de la turbine 36₁ à la portion 3c du dispositif de guidage télescopique, tel que représenté sur la figure 4. Au cours de cette opération d'avance du train de tiges 38, on

continue à injecter du fluide sous pression, ce qui permet de détruire à l'aide de l'outil de forage en rotation, l'opercule 35 de lançage, mais on aura pris soin de rouvrir l'orifice 31, de manière à ce que les boues et résidus de forage ressortent au niveau du fond de la mer.

- 5 Pour faciliter la progression de l'outil 36 à l'intérieur du riser puis de la portion 3c du dispositif de guidage télescopique 3, ledit riser ainsi que ladite portion de guidage ont une section intérieure sensiblement identique et l'on installe avantageusement des centraliseurs 38a solidaires du train de tige et coulissant librement dans ledit riser. De tels centraliseurs étant
10 connue de l'homme de l'art dans le domaine du forage, ne seront pas développés plus en détails ici.

- Dans la figure 4, le forage a commencé et les bras extensibles de l'outil de forage 36₄ sont déployés et agrandissent le forage à un diamètre correspondant au moins au diamètre de la portion 3b du dispositif de
15 guidage 3. On contrôle avantageusement l'avancement de l'outil en ajustant depuis la surface, au moyen du derrick, la longueur du train de tige. Pour augmenter la force de poussée, on pressurise avantageusement depuis la surface l'annulaire compris entre le riser de forage et le train de tige 38. Ainsi, la pression P créée en amont du piston 40 étanche, crée une
20 poussée F qui, par l'intermédiaire du train de tiges 38, pousse l'outil en avant, entraînant de ce fait les portions 3c puis 3b du dispositif de guidage télescopique jusqu'à complet déploiement comme illustré sur la figure 1.

- En position finale, le train de tiges est manœuvré depuis la surface en rotation dans le sens du dévissage, de manière à libérer le corps de la
25 turbine 36₁ de la bague 37_b, donc de la portion 3c du dispositif de guidage télescopique 3.

- Après changement d'outil, le forage est ensuite effectué de manière conventionnelle, après avoir pris soin de fermer l'orifice 31 au moyen d'une vanne non représentée, de manière à récupérer en surface les boues de
30 forage en vue de leur recyclage dans le processus de forage.

Pour éviter que les diverses portions 3b et 3c ne soient entraînées en rotation lors du vissage-dévissage du corps de la turbine sur l'extrémité avant de la portion 3c, lesdites portions 3a, 3b et 3c, peuvent être

avantageusement des formes tubulaires carrées ou hexagonales. Dans le cas de forme tubulaire circulaires, un indexage sera avantageusement intégré au niveau des paliers de coulissement 33.

La conduite de guidage télescopique 3a, 3b, 3c a été décrite ci-dessus
5 dans une application liée au forage vertical, mais elle s'applique aussi en forage dévié conformément à la figure 6A. Les équipements et opérations restent sensiblement les mêmes, étant entendu toutefois que la conduite de guidage télescopique 3 présente une courbure de par sa position inclinée, conformément à la représentation de la figure 6B, le dispositif de guidage 3
10 étant rendu solidaire de l'embase de forage au niveau du plan AA.

Dans la figure 6B on a représenté, en vue de côté, un dispositif de guidage 3 courbé, constitué de trois éléments de conduite télescopiques 3a, 3b et 3c. L'élément de conduite télescopique 3a est encastrée au niveau du plan AA dans une structure supérieure externe rigide 20 décrite plus loin
15 en liaison avec la figure 17.

Dans les figures 7 à 19 on a représenté la conduite de guidage télescopique 3 dans le cadre d'un forage dévié c'est à dire en position inclinée et courbe d'une part, et d'autre part en position rétractée, c'est à dire avec les différents éléments de conduite télescopique 3a, 3b, 3c, les
20 plus petits à l'intérieur des plus grands. C'est pourquoi dans la suite de la description lorsque l'on se réfère à ladite conduite de guidage, il s'agit d'une conduite de guidage télescopique en position rétractée, c'est à dire les éléments de conduite télescopique de plus petits diamètres étant tous coulés à l'intérieur de l'élément de conduite télescopique externe.
25 Lorsque l'on se réfère à des éléments coopérants avec ladite conduite de guidage télescopique, il s'agit de l'élément coopérant avec l'élément de conduite télescopique externe 3a, des figures 1 à 5.

La figure 6A est une vue de côté d'un support de surface 1 de type DTU équipé d'un engin de forage et d'équipements de traitement. Un riser
30 de forage 2 en configuration de chaînette, est connecté à une conduite de guidage 3 au moyen d'un connecteur automatique sous marin 2₁. La structure 3₄ schématise les moyens d'enfoncement contrôlé. Un ensemble de contrôle de puits sous-marin 2₂ est associé à cette entrée du puits et

permet de fermer le puits en cas d'éruption. Le forage est effectué de manière conventionnelle depuis la surface à travers le riser de forage 2 et à travers le dispositif de guidage 3-3₄, jusqu'à atteindre le réservoir.

Ledit riser de forage 2 dévie progressivement depuis une position
5 sensiblement verticale 2a au niveau dudit support flottant 1 jusqu'à une position sensiblement horizontale ou tangentielle à l'horizontale 2b au fond de la mer, le forage pouvant être réalisé depuis ledit support flottant 1 à travers ledit riser de forage 2 et ledit dispositif de guidage télescopique rétracté 3 de manière à ce que le puit de forage s'amorce dans le fond de la
10 mer selon une inclinaison donnée α par rapport à l'horizontale, de préférence de 10 à 80°.

Les moyens d'enfoncement contrôlé 3₄, 5₁-5₃, 7₁-7₃, 8-9, 13 décrits dans les figures 7 à 19 permettent l'enfoncement de ladite conduite de guidage télescopique rétractée 3 dans le fond de la mer lorsque ladite conduite de
15 guidage 3 télescopique rétractée est tractée T au fond de la mer à son extrémité avant 3₁,

- depuis une position initiale A1 où ladite conduite de guidage télescopique rétractée 3 repose entièrement par-dessus le fond de la mer dans une position sensiblement horizontale,
- 20 - jusqu'à une position enfoncée A2 dans le sous-sol du fond de la mer, position enfoncée dans laquelle ladite conduite de guidage télescopique rétractée 3 comprend successivement :

- . une extrémité avant 3₁ reposant sensiblement horizontalement sur le fond de la mer,
- 25 . une portion intermédiaire courbe de conduite de guidage télescopique rétractée enfoncée dans le sous-sol du fond de la mer selon un grand rayon de courbure, de préférence un rayon de courbure supérieur à 500 m et,
- 30 . une portion arrière sensiblement linéaire inclinée 3₃ à l'extrémité arrière de ladite conduite de guidage télescopique rétractée 3 enfoncée dans le sous-sol du fond de la mer selon une dite inclinaison donnée α .

Dans un premier mode préféré de l'invention, lesdits moyens d'enfoncement contrôlé comprennent :

- 5 - une semelle avant 5_1 posée sur le fond de la mer et supportant ladite extrémité avant 3_1 de la conduite de guidage télescopique rétractée et solidaire de celle-ci,
- au moins une semelle intermédiaire 5_2 , 5_3 supportant ladite portion intermédiaire courbe 3_2 et/ou de la portion arrière 3_3 de ladite conduite de guidage télescopique rétractée et solidaire de celle-ci, dont la surface est plus petite que celle de ladite semelle avant 5_1 , de préférence plusieurs dites semelles intermédiaires 5_2 , 5_3 réparties le long desdites portion intermédiaire 3_2 et portion arrière 3_3 de ladite conduite de guidage télescopique rétractée 3 dont la surface est de plus en plus petite par rapport à ladite semelle avant au fur et à mesure qu'elles sont plus proches de ladite extrémité arrière 3_3 de la conduite de guidage, et
- 15 - une ancre 13 reliée 12 à ladite extrémité arrière 3_3 et apte à s'enfoncer dans le sol sous l'effet de ladite traction de ladite extrémité avant 3_1 .

On comprend que dans le premier mode préféré de réalisation décrit ci-dessus, en liaison avec la figure 6B, lesdites semelles supportent en fait l'élément de conduite télescopique externe de plus grand diamètre $3a$.

La figure 7 illustre cette première version du dispositif de guidage selon l'invention, dans laquelle, le dispositif de guidage est remorqué sur site par l'intermédiaire d'un câble 10 relié à l'avant du dispositif de guidage par l'intermédiaire d'une tête de traction 11, l'arrière dudit dispositif de guidage étant relié par un second câble 12 à une ancre à très hautes performances 13 de type Stevpriss® ou Stevmanta® de la Société VRYHOFF (Hollande). La partie avant 3_1 du dispositif de guidage est solidaire d'une semelle 5_1 de surface importante et reposant sur le fond de la mer de manière à limiter la pénétration dans le sol. De la même manière des semelles 5_2 , 5_3 de dimensions plus faibles sont réparties le long de la conduite de guidage télescopique rétractée, leur surface portante diminuant au fur et à mesure que l'on se rapproche de l'arrière 3_3 de ladite conduite

de guidage. L'avant 3₁ est de plus stabilisée par une embase comprenant une charge 6 solidaire de la semelle 5₁ créant ainsi un encastrement du dispositif de guidage dans ladite embase 6, comme illustré dans la figure 8.

En exerçant une traction sur le câble de remorquage 10, l'ensemble 5 entraîne l'ancre qui commence alors à s'enfoncer 25, entraînant 24 de ce fait l'extrémité arrière 3₃ de la conduite de guidage. La forme circulaire de la conduite de guidage ne freine que modérément la pénétration, alors que les semelles 5₂, 5₃ réparties sur la longueur s'opposent à la pénétration avec une force proportionnelle à leur surface. La semelle avant 5₁ étant quant à elle de grandes dimensions, l'avant du dispositif de guidage reste en surface et le corps-mort 6 stabilise l'ensemble de telle manière que l'axe du dispositif de guidage reste sensiblement horizontal, donc parallèle au fond de la mer 4.

Un procédé de réalisation d'un dispositif de guidage de ce type 15 consiste à réaliser une traction de l'extrémité avant 3₁ de ladite conduite de guidage télescopique rétractée 3 jusqu'à ce que lesdites semelle intermédiaires 5₂, 5₃ se retrouvent enfoncées dans le sol de plus en plus profond au fur et à mesure qu'elles sont plus proches de l'extrémité arrière 3₃ de conduite de guidage pour obtenir la courbure recherchée R, de 20 préférence un rayon de courbure supérieur à 500 m de préférence encore entre 500 et 1000 m.

Dans un autre mode de réalisation préféré de l'invention, illustré sur les figures 11, 12 et 13, lesdits moyens d'enfoncement contrôlé comprennent au moins un déflecteur 7₁, 7₂, 7₃ solidaire de l'élément de 25 conduite télescopique externe de ladite conduite de guidage télescopique 3 dans ladite portion intermédiaire 3₂ ou ladite portion arrière 3₃ de l'élément de conduite externe télescopique de guidage comprenant des surfaces planes, de préférence symétriques par rapport au plan axial vertical XX', YY' de ladite conduite de guidage dans la direction longitudinale lorsque 30 celle-ci est en position horizontale rectiligne, et lesdites surfaces planes des déflecteurs étant inclinées par rapport à un plan axial horizontale XX', ZZ' de ladite conduite de guidage lorsque celle-ci est en position horizontale sur le fond de la mer, ledit déflecteur 7₁, 7₂, 7₃ étant incliné

178
d'un angle $\alpha_1, \alpha_2, \alpha_3$ de manière à créer un enfoncement de ladite conduite de guidage lorsque celle-ci est tractée depuis ladite position initiale A1 sensiblement horizontale jusqu'à une dite position enfoncée A2 dans le fond de la mer.

- 5 Ces déflecteurs $7_1, 7_2, 7_3$ permettent de contrôler la courbure de la conduite de guidage télescopique rétractée enfoncée dans le fond de la mer car, une fois que lesdits déflecteurs sont en position horizontale, comme représenté sur la figure 12, ils empêchent l'enfoncement supplémentaire de la conduite et la stabilisent dans la position recherchée A2. On comprend
10 que c'est l'espacement et l'inclinaison des déflecteurs qui déterminent la courbure et plus généralement la forme de la conduite de guidage télescopique rétractée en position enfoncée A2.

De préférence, le dispositif de guidage comprend une pluralité de déflecteurs $7_1, 7_2, 7_3$ répartis le long de l'élément de conduite externe de
15 ladite conduite de guidage télescopique, inclinés selon des angles $\alpha_1, \alpha_2, \alpha_3$, se réduisant au fur et à mesure que ledit déflecteur 7_1-7_3 est plus proche de ladite extrémité avant 3_1 .

La conduite de guidage est donc équipée de plusieurs déflecteurs 7_1-7_3 solidaires de la conduite de guidage et orientés $\alpha_1-\alpha_3$ par rapport à
20 l'axe XX' de cette dernière. Le déflecteur 7_1-7_3 est par exemple une simple tôle plane, de préférence renforcée, de préférence symétrique selon les plans axiaux verticaux XX', YY' et horizontaux XX', ZZ' de la conduite de guidage, soudée sur la conduite de guidage dispositif de guidage comme illustré sur la figure 12. Cet angle est ajusté préalablement lors de la
25 fabrication du dispositif de guidage, de manière à agir comme l'ancre 13 décrite dans les figures 7, 8 c'est à dire à créer un enfoncement de la conduite de guidage télescopique rétractée, cet enfoncement étant limité du fait de l'angle α . En effet, lors de la traction T exercée sur le câble 10 de remorquage, les déflecteurs 7_1-7_3 s'enfoncent, entraînant 24 localement la
30 conduite de guidage, jusqu'à ce que le déflecteur soit sensiblement parallèle à l'effort de traction sur le câble 10, c'est à dire sensiblement parallèle au fond de la mer 4, ou encore sensiblement horizontal, position dans laquelle

178

il n'exercera alors plus d'effort vertical vers le bas, tendant à faire descendre l'ensemble.

On disposera avantageusement le long du dispositif de guidage une multitude de déflecteurs 7_1-7_3 , identiques ou non, chacun d'entre eux
5 présentant un angle $\alpha_1 \sim \alpha_3$ se réduisant au fur et à mesure que l'on se rapproche de l'extrémité avant 3_1 , comme illustré sur la figure 11. Lors de la pénétration 24 dans le sol, on obtient alors, dès que l'ensemble des déflecteurs 7_1-7_3 ont atteint une position sensiblement horizontale, la courbure recherchée, comme illustré sur la figure 12.

10 Un procédé de réalisation d'un dispositif de guidage selon ce deuxième mode de réalisation consiste à réaliser une traction T de l'extrémité avant 3_1 de ladite conduite de guidage télescopique rétractée 3 jusqu'à ce que lesdits déflecteurs $7_1, 7_2, 7_3$ se retrouvent enfoncés dans le sol dans une position horizontale pour obtenir une dite courbure
15 recherchée de préférence à un rayon de courbure supérieur à 500 m de préférence encore entre 500 et 1000 m.

Les figures 14 et 15 illustrent une autre version préférée de l'invention dans laquelle lesdits moyens d'enfoncement contrôlé comprennent :

20 - des conduites secondaires 8 de lançage de fluide 18 solidaires de l'élément de conduite télescopique externe de ladite conduite de guidage 3, s'étendant parallèlement à celle-ci et en sous-face de celle-ci, et

- lesdites conduites secondaires 8 présentant un diamètre réduit par
25 rapport à celui desdits éléments de ladite conduite de guidage télescopique 3 et comprenant des perforations 9 en sous-face permettant d'expulser un fluide 18 en direction du fond de la mer lorsque lesdites conduites secondaires 8 sont alimentées par un dit fluide 18 sous pression.

30 De préférence, lesdites conduites secondaires 8 sont reliées par leurs extrémités $8_1, 8_2$ aux extrémités avant et arrière $3_1, 3_3$ dudit élément de conduite externe de ladite conduite de guidage télescopique et communiquent avec lesdites extrémités avant 3_1 et arrière 3_3 de sorte qu'il

est possible de les alimenter par une même conduite d'alimentation 19 depuis ladite extrémité avant 3₁ de ladite conduite de guidage télescopique 3.

Sur la figure 15, on a représenté deux conduites secondaires 8 5 disposées symétriquement par rapport à la conduite de guidage 3.

Sur la figure 14, la conduite secondaire 8 est reliée à leurs deux extrémités, à la conduite de guidage 3 par des clapets anti-retour 8₁, 8₂. Ladite conduite de guidage 3 est elle-même hermétiquement fermée à ses deux extrémités, d'une part par la tête de traction 11 et d'autre part par un bouchon 14. Un orifice est relié par une conduite d'alimentation en eau 10 19, au navire de surface 1 disposant des moyens de pompage nécessaires. Ainsi, lors du remorquage, la conduite de guidage peut être allégée par remplissage de gaz sous pression à travers la conduite, l'excédent de pression s'échappant par les clapets anti-retour 8₁, 8₂, puis 15 par les orifices 9 des conduites secondaires 8. Dès que l'ensemble est déposé sur le fond 4, on injecte, par les mêmes conduites 8, avantageusement de l'eau sous forte pression, ce qui aura pour effet d'alourdir l'ensemble par remplissage de la conduite de guidage 3, puis d'effectuer une dé-cohésion du sol en sous face, ce qui facilite 20 l'enfoncement de la conduite de guidage.

Un procédé de réalisation d'un dispositif de guidage de ce type comprend des étapes dans lesquelles :

- on injecte un gaz sous pression dans lesdites conduites secondaires 8 lorsque l'on veut remorquer la conduite de guidage télescopique rétractée 3 sur le fond de la mer et
- on injecte un liquide sous pression de préférence de l'eau dans lesdites conduites secondaires 8 et de préférence dans ladite conduite de guidage télescopique 3 obturée à ces extrémités 3₁, 3₂ et 25 communicant avec lesdites extrémités 8₁, 8₂ desdites conduites secondaires 8 lorsqu'on veut enfoncer ladite conduite de guidage télescopique rétractée 3.

Dans une autre version préférée de l'invention illustrée sur les figures 16 à 19, on adjoint avantageusement à l'un quelconque des

dispositifs selon les figures 7 à 15, une structure supérieure externe rigide 20, encastrée sur l'avant 3₁ de l'élément de conduite externe télescopique de la conduite de guidage 3, l'ensemble reposant sur le sol par l'intermédiaire de semelles latérales 21, comme illustré sur la figure 19, 5 détaillant la section selon le plan DD.

Plus précisément, le dispositif de guidage comprend :

- 10 - une structure supérieure externe rigide 20 recouvrant et maintenant rectiligne ladite conduite de guidage télescopique rétractée 3 lorsque celle-ci est sensiblement horizontale et repose sur le fond de la mer,
- ladite structure externe 20 présentant une ouverture centrale longitudinale en sous-face permettant à ladite conduite de guidage télescopique rétractée 3 de s'enfoncer dans le sol lorsque celle-ci est tractée T, et
- 15 - au moins un lien 17₁, 17₂, 17₃ reliant au moins la partie arrière 3₃ de l'élément de conduite télescopique externe de ladite conduite de guidage télescopique rétractée à ladite structure externe 20 de manière à empêcher un enfoncement de celle-ci au delà d'une profondeur donnée de manière à limiter la courbure R
- 20 de ladite portion courbe, et
- ladite structure supérieure externe 20 reposant sur le sol au fond de la mer 4 de préférence par l'intermédiaire de semelles latérales 21 situées de part et d'autre de ladite ouverture centrale longitudinale 22, lesdites semelles latérales 21 empêchant
- 25 l'enfoncement de ladite structure externe rigide 20, et
- ladite structure externe 20 étant solidaire de ladite embase 6 dans laquelle ladite portion avant 3₁ de l'élément de conduite télescopique externe de ladite conduite de guidage télescopique rétractée 3 est encastrée.

30 La portion courante de la conduite de guidage est libre de se déplacer verticalement à travers l'ouverture centrale 22 de la structure 20, comme illustré sur la figure 18 détaillant la section selon le plan CC, des éléments de structure 23 limitant les déplacements latéraux.

De préférence, le dispositif de guidage comprend :

- une pluralité de liens souples 17_1 , 17_2 , 17_3 répartis le long de l'élément de conduite télescopique externe de la conduite de guidage télescopique 3 et présentant une longueur croissante au fur et à mesure qu'ils sont plus proches de l'extrémité arrière 3_3 de la conduite de guidage 3 et dont la longueur est telle que ladite conduite de guidage présente une dite portion courbe à la courbure R voulue et une dite portion arrière 3_3 linéaire.

Ces liens souples 17_1 , 17_2 , 17_3 sont par exemple des câbles ou des chaînes reliés d'une part sur la structure externe 20 en 26 et sur la conduite de guidage en 27. Lesdits points d'accrochage 26-27 sont représentés sur la figure 17. Ces liaisons souples 17_1 - 17_3 sont réparties le long de la conduite de guidage, de manière uniforme ou non, et présentent une longueur variable, décroissante lorsque l'on se rapproche de l'avant 3_1 de l'élément de conduite télescopique externe de la conduite de guidage. Leur position et leur longueur sont déterminées, de telle manière qu'en fin de pénétration dans le sol, lorsqu'elles sont toutes en tension, la courbe recherchée est obtenue comme illustré sur la figure 17. Pour éviter l'enfoncement dans le sol de la structure 20, une multitude de semelles latérales 21 est installée en sous-face, de manière à créer une assise suffisante.

Un procédé de réalisation d'un dispositif de guidage de ce type consiste essentiellement à réaliser une traction T de l'extrémité avant 3_1 de l'élément de conduite externe de ladite conduite de guidage télescopique 3 de ladite structure externe rigide 20 solidaire de ladite conduite de guidage jusqu'à ce que le ou lesdits liens 17_1 - 17_3 empêchent un enfoncement supplémentaire d'au moins ladite partie arrière 3_3 de ladite conduite de guidage télescopique rétractée pour obtenir la courbure recherchée R de préférence un rayon de courbure supérieur à 500 m, de préférence encore entre 500 et 1000 m.

Tous ces moyens d'enfoncement contrôlé 5_1 - 5_3 , 7_1 - 7_3 , 13, 20, 17_1 - 17_3 , selon l'invention décrits dans les différents modes de réalisation ci-dessus peuvent être mis en œuvre, soit individuellement, soit en combinaison, la

nature du sol nécessitant dans le cas de fortes cohésion des moyens extrêmement puissants.

La structure externe 20 est de préférence continue le long de la conduite de guidage et représente une masse supplémentaire de 25 à 75 tonnes. Le lançage est effectué avec de l'eau pressurisé depuis la surface à des pressions de 20 à 100 bars dans des conduites secondaires 8.

Dans le cas du dispositif de guidage télescopique, à titre d'illustration, les portions 3a-3b-3c ont un diamètre respectif de 0,55 m (21"), 0,45 m (18") et 0,40 m (16") et une longueur de 100 à 150m chacune.

10 A titre d'exemple, dans le cas du dispositif de guidage pour forage à la verticale tel qu'explicité sur la figure 20, les éléments de conduite télescopique sont au nombre de cinq, de diamètre respectif 30", 24", 21"1/2, 18"3/4 et 16", chacun des éléments de conduite télescopique mesurant environ 200m, ce qui représente une longueur totale déployée de
15 1000m environ. Un ensemble de casings selon l'art antérieur présenterait un même diamètre interne de 16" et les diamètres respectif décroissants seraient alors 36", 30", 24", 20" et 16". L'ensemble mesurerait aussi 1000m environ, mais du fait que chaque élément de casing s'étend vers le bas depuis le niveau du fond de la mer, l'ensemble représente une longueur
20 cumulée d'environ 3000m de conduite, ce qui représente alors un poids d'acier approximativement 2 à 2.5 fois supérieur au poids d'acier requis pour réaliser le casing télescopique selon l'invention.

REVENDICATIONS

1. Dispositif de guidage (3) d'une installation de forage en mer comprenant au moins un riser de forage (2) s'étendant depuis un support flottant (1) jusqu'au dit dispositif de guidage (3) au fond de la mer (4), ledit
5 forage pouvant être réalisé depuis ledit support flottant, à l'aide d'un train de tige de forage (38) équipé à son extrémité d'outils de forage (36) passant à travers ledit riser de forage (2) et ledit dispositif de guidage (3), ledit dispositif de guidage (3) étant caractérisé en ce qu'il comprend une conduite de guidage télescopique (3) comprenant des éléments de conduite
10 télescopiques (3a, 3b, 3c) coaxiaux (XX') et de diamètres décroissants, préassemblés les uns aux autres de manière à ce que lesdits éléments de conduite télescopiques soient aptes à coulisser dans la direction axiale (XX') les uns dans les autres, l'élément de conduite télescopique interne (3c) de plus petit diamètre étant équipé à son extrémité d'un moyen de
15 décohesion (35) du sol apte à créer un enfoncement progressif dans le sol de ladite conduite de guidage télescopique (3) par coulisement vers l'extérieur desdits éléments de conduite télescopiques (3a, 3b, 3c) pour permettre ainsi de guider plus profondément dans le sol un outil de forage (36) à l'extrémité dudit train de tige (38).

20 2. Dispositif de guidage selon la revendication 1 caractérisé en ce que ledit élément de conduite interne (3c) de plus petit diamètre présente un diamètre sensiblement identique à celui dudit riser de forage (2).

3. Dispositif de guidage selon la revendication 1 ou 2 caractérisé
25 en ce que lesdits moyens de décohesion du sol (35) sont constitués par un opercule multi-perforé permettant de le lançage d'eau ou de boue par injection sous très forte pression.

4. Dispositif de guidage selon l'une des revendications 1 à 3 caractérisé en ce qu'il comprend au moins 3 éléments de conduite
30 télescopique coaxiaux (3a, 3b, 3c).

5. Dispositif selon l'un des revendication 1 à 4 caractérisé en ce que chacun desdits éléments de conduite coaxiaux-télescopiques (3a, 3b, 3c) présentent une longueur de 50 à 300 mètres, de préférence 100 à 200 mètres et ladite conduite de guidage déployée présente une longueur de 150
5 à 600 mètres de préférence 200 à 300 mètres.

6. Dispositif de guidage (3) selon l'une des revendications 1 à 5 caractérisé en ce qu'il comprend une dite conduite de guidage télescopique (3) utile dans une installation de forage en mer dans laquelle au moins un riser de forage (2) s'étend depuis un support flottant (1) jusqu'audit
10 dispositif de guidage (3) au fond de la mer (4), ledit riser de forage (2) déviant progressivement depuis une position sensiblement verticale (2a) au niveau dudit support flottant (1) jusqu'à une position sensiblement horizontale ou tangentielle à l'horizontale (2b) au fond de la mer (4), ledit forage pouvant être réalisé depuis ledit support flottant à travers ledit riser
15 de forage (2) et ledit dispositif de guidage (3) de manière à ce que le puit de forage dans le fond de la mer soit amorcé selon une inclinaison donnée (α) par rapport à l'horizontale de préférence de 5 à 60°, de préférence encore de 25 à 45°, ledit dispositif de guidage (3) étant caractérisé en ce qu'il comprend une dite conduite de guidage télescopique (3) dans une
20 position enfoncée (A2) dans laquelle ladite conduite de guidage télescopique en position rétractée (3) ou l'élément de conduite télescopique externe (3a) lorsque ladite conduite télescopique (3) est déployée, comprennent successivement :

- 25 . une extrémité avant (3₁) reposant sensiblement horizontalement sur le fond de la mer,
- . une portion intermédiaire courbe (3₂) enfoncée dans le sous-sol du fond de la mer selon un grand rayon de courbure (R), de préférence un rayon de courbure supérieur à 500 m et,
- . une portion arrière (3₃), sensiblement linéaire, enfoncée dans le
30 sous-sol du fond de la mer selon une dite inclinaison donnée (α), ladite conduite de guidage (3) télescopique ou ledit élément télescopique externe (3a) coopérant avec des moyens d'enfoncement contrôlé (3₄, 5₁-5₃, 7₁-7₃, 8-9, 13) permettant l'enfoncement de ladite conduite de guidage

182

5 la mer dans une position sensiblement horizontale, jusqu'à une dite position enfoncée (A2) dans le sous-sol du fond de la mer.

7. Dispositif de guidage selon la revendication 6, caractérisé en ce que ladite conduite de guidage télescopique rétractée (3) présente une longueur de 100 à 600 m, de préférence 250 à 450 m avec dite inclinaison
10 donnée (α) de la conduite de guidage d'environ 10 à 60°, de préférence 25 à 45°.

8. Dispositif de guidage selon la revendication 6 ou 7, caractérisé en ce que ladite extrémité avant (3₁) est encastrée dans une embase (6) comprenant une charge reposant sur une semelle avant (5₁) de sorte que
15 ladite embase (6) maintient ladite extrémité avant (3₁) sensiblement horizontalement sur le fond de la mer lorsque celle-ci est tractée (T).

9. Dispositif de guidage selon l'une des revendications 6 à 8, caractérisé en ce que lesdits moyens d'enfoncement contrôlé comprennent :

- 20 - une semelle avant (5₁) posée sur le fond de la mer et supportant ladite extrémité avant (3₁) et solidaire de celle-ci,
- au moins une semelle intermédiaire (5₂, 5₃) supportant ladite portion intermédiaire courbe (3₂) et/ou de la portion arrière (3₃) et solidaire de celle-ci, dont la surface est plus petite que celle de ladite semelle avant (5₁), de préférence plusieurs dites semelles
25 intermédiaires (5₂, 5₃) réparties le long desdites portion intermédiaire (3₂) et portion arrière (3₃) dont la surface est de plus en plus petite par rapport à ladite semelle avant au fur et à mesure qu'elles sont plus proches de ladite extrémité arrière (3₃),
et
- 30 - une ancre (13) reliée (12) à ladite portion arrière (3₃) et apte à s'enfoncer dans le sol sous l'effet de ladite traction de ladite extrémité avant (3₁).

182

10. Dispositif de guidage suivant l'une des revendications 6 à 9, caractérisé en ce que lesdits moyens d'enfoncement contrôlé comprennent au moins un déflecteur ($7_1, 7_2, 7_3$) solidaire dudit élément de conduite télescopique externe (3a) de ladite conduite de guidage télescopique (3) dans ladite portion intermédiaire (3_2) ou ladite portion arrière (3_3) de la conduite de guidage télescopique rétractée, comprenant des surfaces planes de préférence symétriques par rapport au plan axial vertical (XX' , YY') de ladite conduite de guidage dans la direction longitudinale lorsque celle-ci est en position horizontale rectiligne, et lesdites surfaces planes des déflecteurs étant inclinées par rapport à un plan axial horizontale (XX' , ZZ') de ladite conduite de guidage lorsque celle-ci est en position horizontale sur le fond de la mer, ledit déflecteur ($7_1, 7_2, 7_3$) étant incliné d'un angle ($\alpha_1, \alpha_2, \alpha_3$) de manière à créer un enfoncement de ladite conduite de guidage télescopique rétractée (3) lorsque celle-ci est tractée depuis ladite position initiale (A1) sensiblement horizontale jusqu'à une dite position enfoncée (A2) dans le fond de la mer.

11. Dispositif de guidage selon la revendication 10, caractérisé en ce qu'il comprend une pluralité de déflecteurs ($7_1, 7_2, 7_3$) répartis le long de l'élément de conduite télescopique externe (3a) de ladite conduite de guidage télescopique, lesdits déflecteurs étant inclinés selon des angles ($\alpha_1, \alpha_2, \alpha_3$) se réduisant au fur et à mesure que ledit déflecteur ($7_1, 7_2, 7_3$) est plus proche de ladite extrémité avant (3_1).

12. Dispositif de guidage selon l'une des revendications 1 à 11, caractérisé en ce que lesdits moyens d'enfoncement contrôlé comprennent :

- des conduites secondaires (8) de lançage de fluide (18) solidaires de ladite conduite de guidage télescopique (3), s'étendant parallèlement à celle-ci et en sous-face de celle-ci, et
- lesdites conduites secondaires (8) présentant un diamètre réduit par rapport à celui de la conduite de guidage télescopique (3) et comprenant des perforations (9) en sous-face permettant d'expulser un fluide (18) en direction du fond de la mer lorsque

(83)

lesdites conduites secondaires (8) sont alimentées par un dit fluide (18) sous pression.

13. Dispositif de guidage selon la revendication 12, caractérisé en ce que lesdites conduites secondaires (8) sont reliées par leurs extrémités (8₁, 8₂) aux extrémités avant et arrière (3₁, 3₃) de ladite conduite de guidage 5 télescopique rétractée (3) et communiquent avec lesdites extrémités avant (3₁) et arrière (3₃) de sorte qu'il est possible de les alimenter par une même conduite d'alimentation (19) depuis ladite extrémité avant (3₁) de ladite conduite de guidage (3).

10 14. Dispositif selon l'une des revendications 1 à 13, caractérisé en ce que le dispositif de guidage comprend :

- 15 - une structure supérieure externe rigide (20) recouvrant et maintenant rectiligne ladite conduite de guidage télescopique rétractée (3) lorsque celle-ci est sensiblement horizontale et repose sur le fond de la mer,
- ladite structure externe (20) présentant une ouverture centrale longitudinale en sous-face permettant à ladite conduite de guidage télescopique rétractée (3) de s'enfoncer dans le sol lorsque celle-ci est tractée (T), et
- 20 - au moins un lien (17₁, 17₂, 17₃) reliant au moins la partie arrière (3₃) de l'élément de conduite télescopique externe (3a) de la conduite de guidage télescopique (3) à ladite structure externe (20) de manière à empêcher un enfoncement de celle-ci au delà d'une profondeur donnée de manière à limiter la courbure (R) de
- 25 ladite portion courbe, et
- ladite structure supérieure externe (20) reposant sur le sol au fond de la mer (4) de préférence par l'intermédiaire de semelles latérales (21) situées de part et d'autre de ladite ouverture centrale longitudinale (22), lesdites semelles latérales (21)
- 30 empêchant l'enfoncement de ladite structure externe rigide (20), et

- ladite structure externe (20) étant solidaire de ladite embase (6) dans laquelle ladite portion avant (3₁) de la conduite de guidage (3) est encastrée.

15 15. Dispositif de guidage selon la revendication 14, caractérisé en ce qu'il comprend une pluralité de liens souples (17₁, 17₂, 17₃) répartis le long de l'élément de conduite télescopique externe (3a) de ladite conduite de guidage télescopique (3) et présentant une longueur croissante au fur et à mesure qu'ils sont plus proches de l'extrémité arrière (3₃) de la conduite de guidage (3) et dont la longueur est telle que ladite conduite de guidage
10 présente une dite portion courbe à la courbure (R) voulue et une dite portion arrière (3₃) linéaire.

16. Procédé de réalisation d'un dispositif de guidage selon les revendication 6 à 15, caractérisé en ce qu'on réalise des étapes dans lesquelles :

15 - on met en place une dite conduite de guidage télescopique en position rétractée (3) dans une dite position initiale (A1) reposant sensiblement horizontalement et de façon rectiligne sur le fond de la mer, ladite conduite de guidage télescopique (3) coopérant avec desdits moyens d'enfoncement contrôlé (3₄, 5₁-5₃,
20 7₁-7₃, 8-9, 13), et
- on réalise une traction (T) au fond de la mer de ladite extrémité avant (3₁) de ladite conduite de guidage télescopique en position rétractée (3), de préférence dans la direction longitudinale axiale XX' de ladite conduite de guidage, depuis ladite position initiale
25 (A1) jusqu'à une dite position enfoncée (A2).

17. Procédé de réalisation d'un dispositif de guidage selon la revendication 16, caractérisé en ce qu'on utilise des dispositifs de guidage selon la revendication 8 ou 9 et on réalise une traction (T) de l'extrémité avant (3₁) de ladite conduite de guidage télescopique rétractée (3) jusqu'à
30 ce que lesdites semelles intermédiaires (5₂, 5₃) se retrouvent enfoncées dans le sol de plus en plus profond au fur et à mesure qu'elles sont plus proches de l'extrémité arrière (3₃) de conduite de guidage pour obtenir la courbure

recherchée (R), de préférence un rayon de courbure supérieur à 500 m de préférence encore entre 500 et 1000 m.

18. Procédé de réalisation d'un dispositif de guidage selon la revendication 16 ou 17, caractérisé en ce qu'on utilise un dispositif de guidage selon la revendication 10 ou 11 et on réalise une traction (T) de l'extrémité avant (3₁) de ladite conduite de guidage télescopique rétractée (3) jusqu'à ce que lesdits déflecteurs (7₁, 7₂, 7₃) se retrouvent enfoncés dans le sol dans une position horizontale pour obtenir une dite courbure recherchée de préférence à un rayon de courbure supérieur à 500 m de préférence encore entre 500 et 1000 m.

19. Procédé de réalisation d'un dispositif de guidage selon l'une des revendications 16 à 18, caractérisé en ce qu'on utilise un dispositif de guidage selon l'une des revendications 12 ou 13 et

- on injecte un gaz sous pression dans lesdites conduites secondaires (8) lorsque l'on veut remorquer la conduite de guidage (3) sur le fond de la mer et
- on injecte un liquide sous pression de préférence de l'eau dans lesdites conduites secondaires (8) et de préférence dans ladite conduite de guidage télescopique (3) obturée à ces extrémités (3₁, 3₂) et communicant avec lesdites extrémités (8₁, 8₂) desdites conduites secondaires (8) lorsqu'on veut enfoncer ladite conduite de guidage (3).

20. Procédé de réalisation d'un dispositif de guidage selon l'une des revendications 16 à 19, caractérisé en ce qu'on utilise un dispositif de guidage selon l'une des revendications 14 ou 15 et on réalise une traction (T) de l'extrémité avant (3₁) de ladite conduite de guidage télescopique rétractée (3) de ladite structure externe rigide (20) solidaire de ladite conduite de guidage jusqu'à ce que le ou lesdits liens (17₁-17₃) empêchent un enfoncement supplémentaire d'au moins ladite partie arrière (3₃) de ladite conduite de guidage télescopique rétractée (3) pour obtenir la courbure recherchée (R) de préférence un rayon de courbure supérieur à 500 m, de préférence encore entre 500 et 1000 m.

21. Installation de forage en mer comprenant un riser de forage (2) s'étendant depuis un support flottant jusqu'à un dit dispositif de guidage (3) selon l'une des revendications 1 à 15 auquel ledit riser de forage (2) est connecté.

5 22. Installation de forage en mer selon la revendication 21, comprenant un riser de forage (2) s'étendant depuis un support flottant (1) jusqu'à un dispositif de guidage (3) selon l'une des revendications 6 à 15, auquel ledit riser de forage est connecté, ledit riser de forage (2) déviant progressivement depuis une position sensiblement verticale (2a) au niveau
10 dudit support flottant (1) jusqu'à une position sensiblement horizontale ou tangentielle à l'horizontale (2b) au fond de la mer, le forage pouvant être réalisé depuis ledit support flottant (1) à travers ledit riser de forage (2) et ledit dispositif de guidage (3) de manière à ce que le puit de forage s'amorce dans le fond de la mer selon une inclinaison donnée (α) par
15 rapport à l'horizontale, de préférence de 10 à 80°.

23. Procédé de réalisation d'une installation de forage selon la revendication 21 ou 22 caractérisé en ce que on réalise des étapes dans lesquelles:

- 20 - on réalise un dispositif de guidage selon un procédé selon l'une des revendications 16 à 20, et
- on réalise la connexion d'au moins dudit riser de forage (2) à ladite extrémité avant (3₁) de la conduite de guidage reposant sur le fond de la mer (4).

24. Procédé de forage à l'aide d'une installation de forage selon la
25 revendication 21 ou 22, caractérisé en ce qu'on réalise des opérations de forage et on construit un puits de forage en déployant des trains de tiges coopérant avec des outils de forage et des colonnes de tubes ou de cuvelages, à travers un dit riser de forage (2) et un dit dispositif de guidage (3) enfoncé dans le fond de la mer (4).

85

1/10

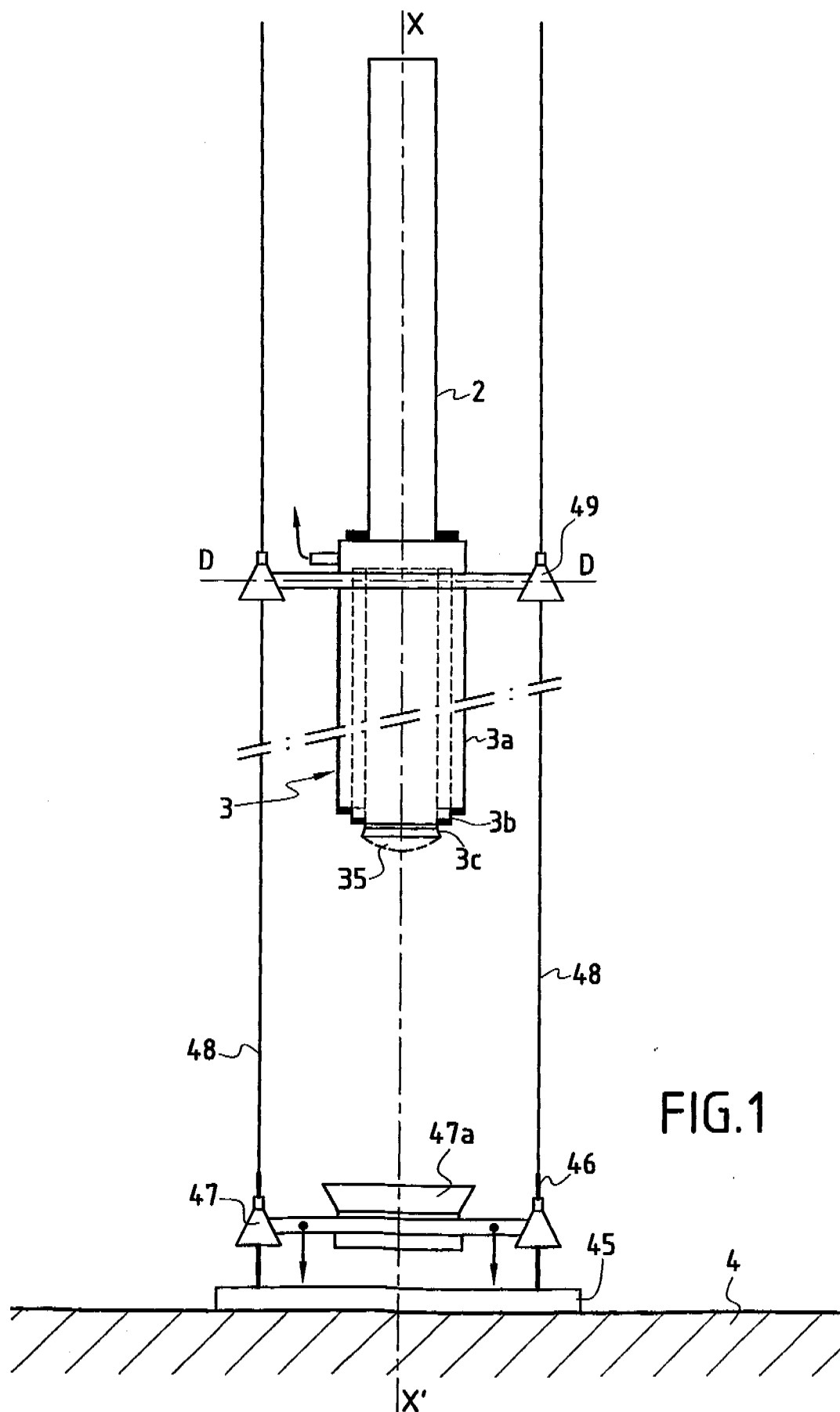


FIG.1

185

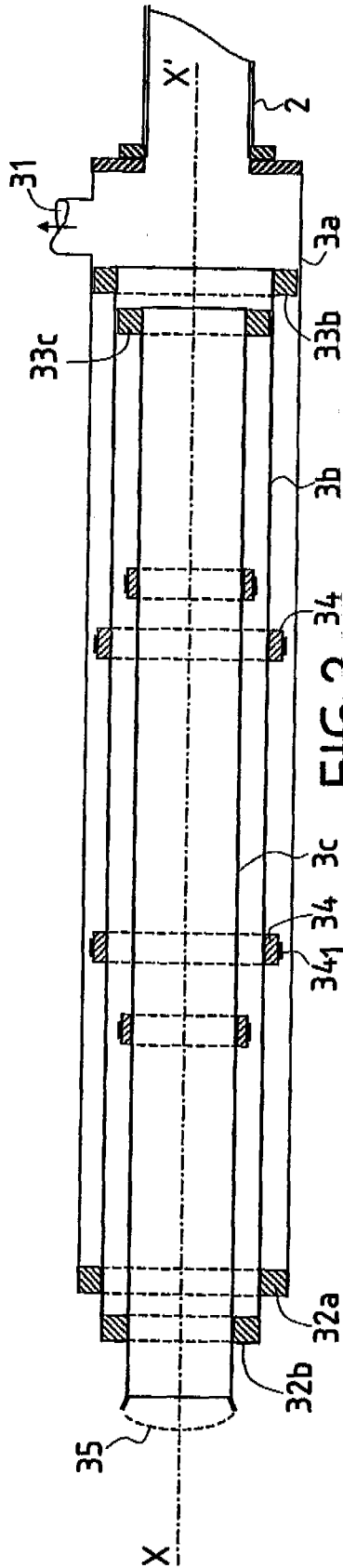


FIG. 2

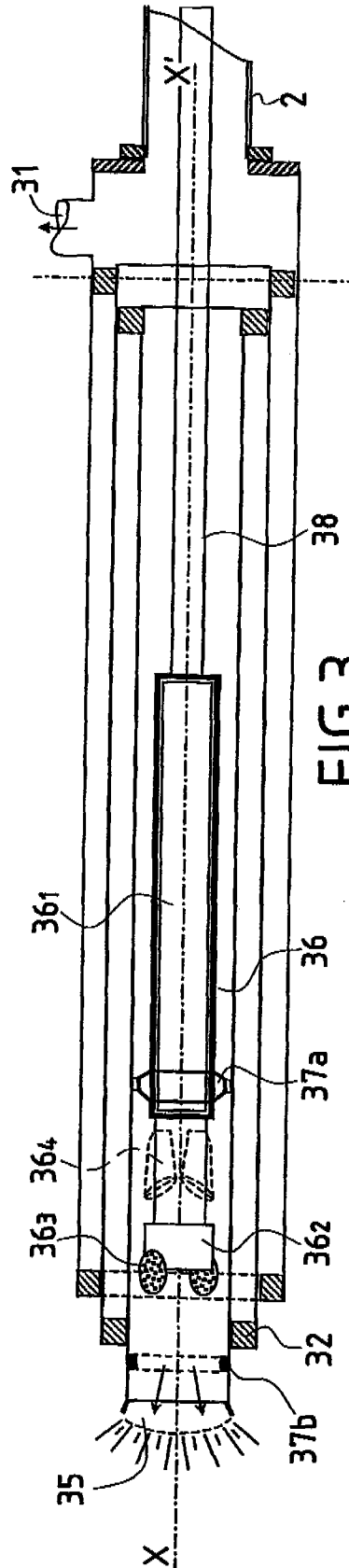


FIG. 3

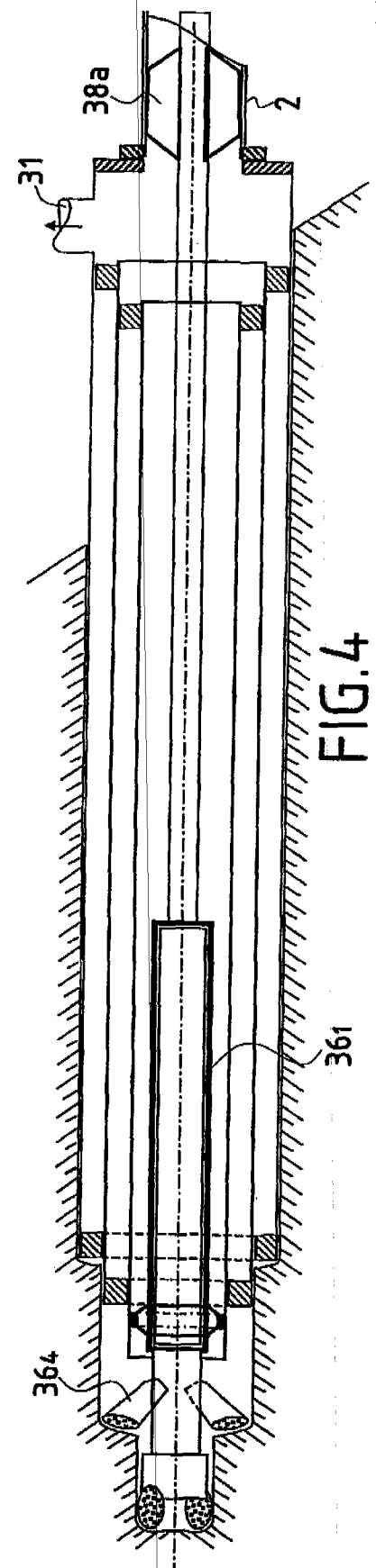


FIG. 4

186

3/10

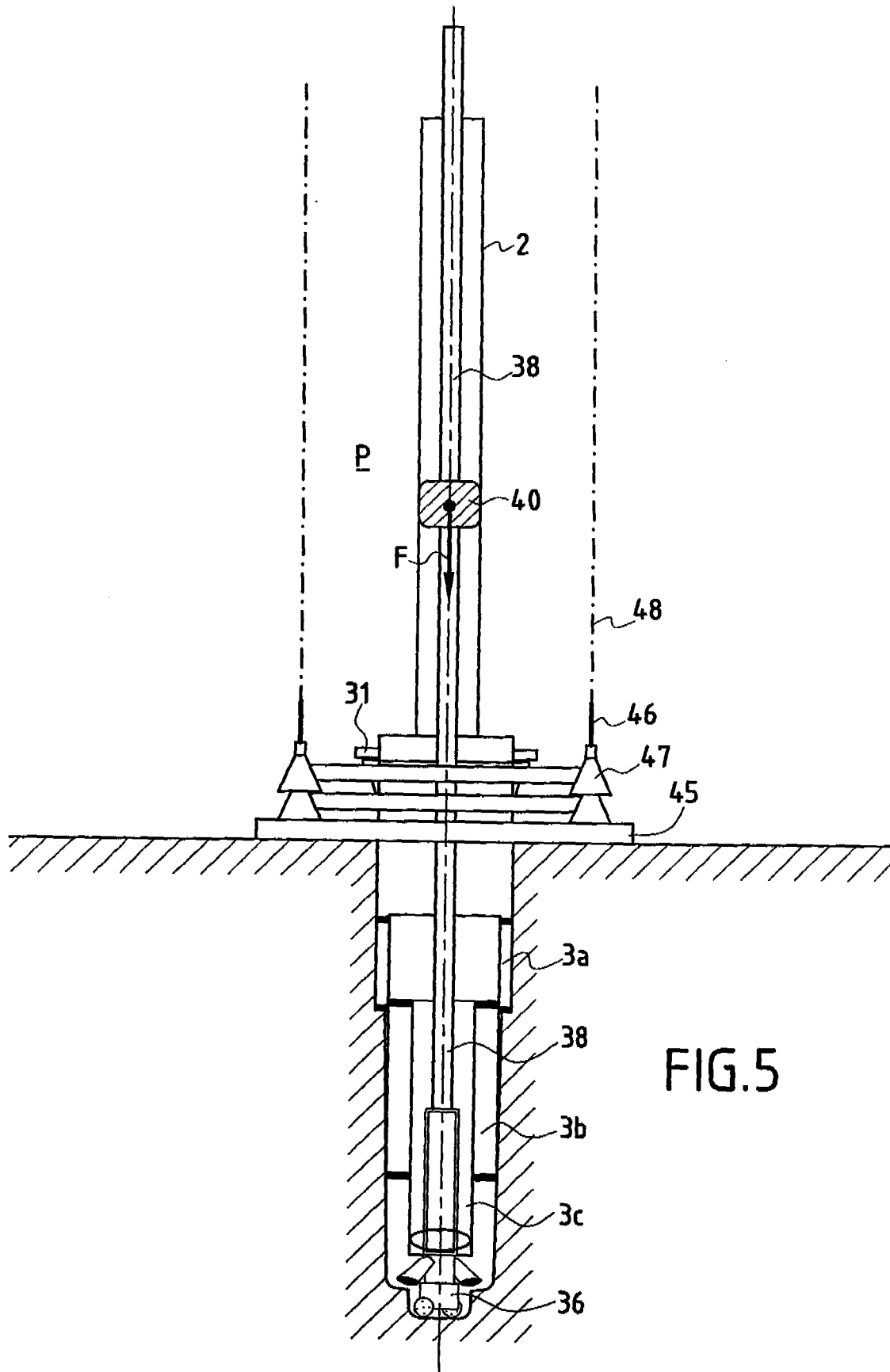
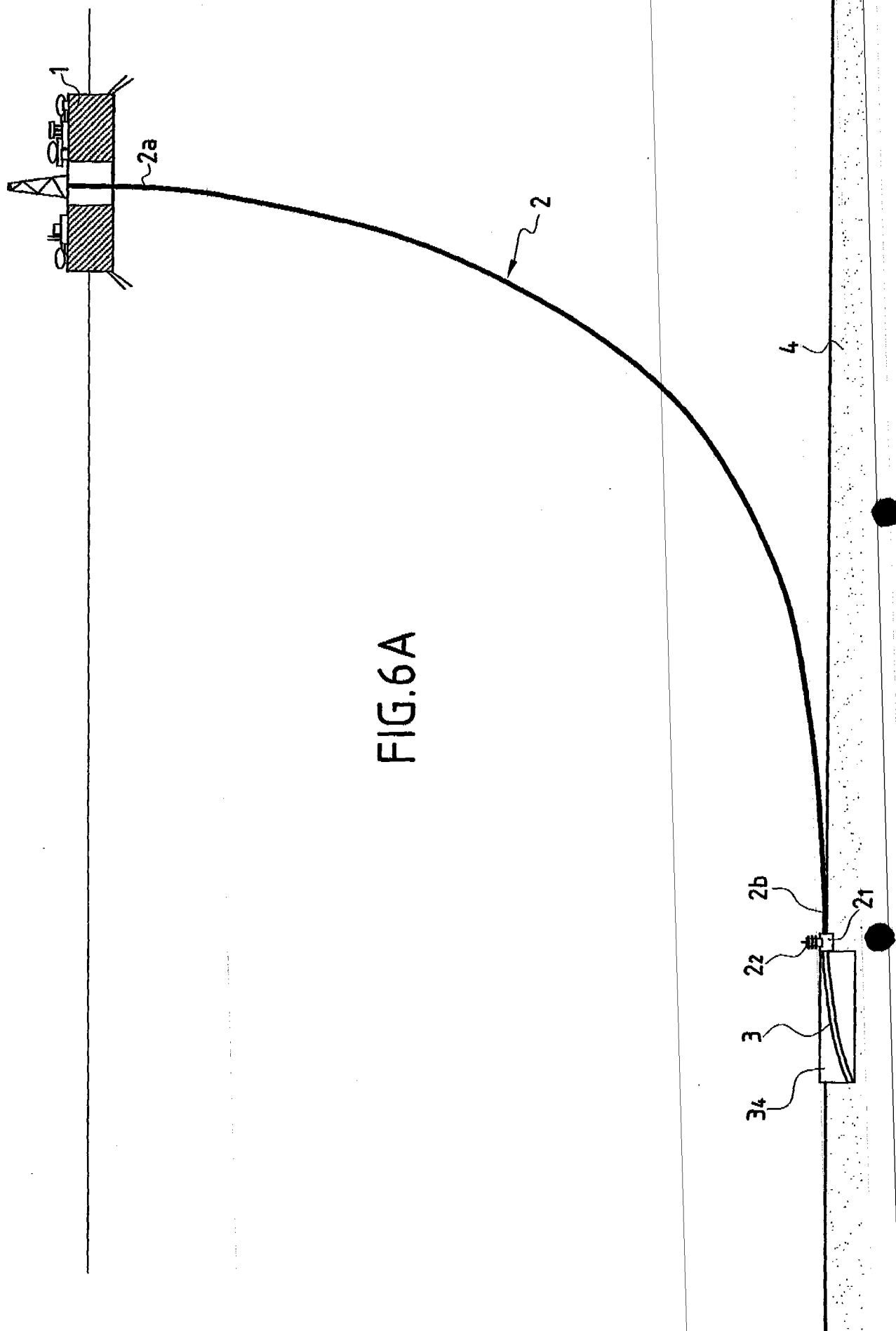


FIG.5

186

4/10



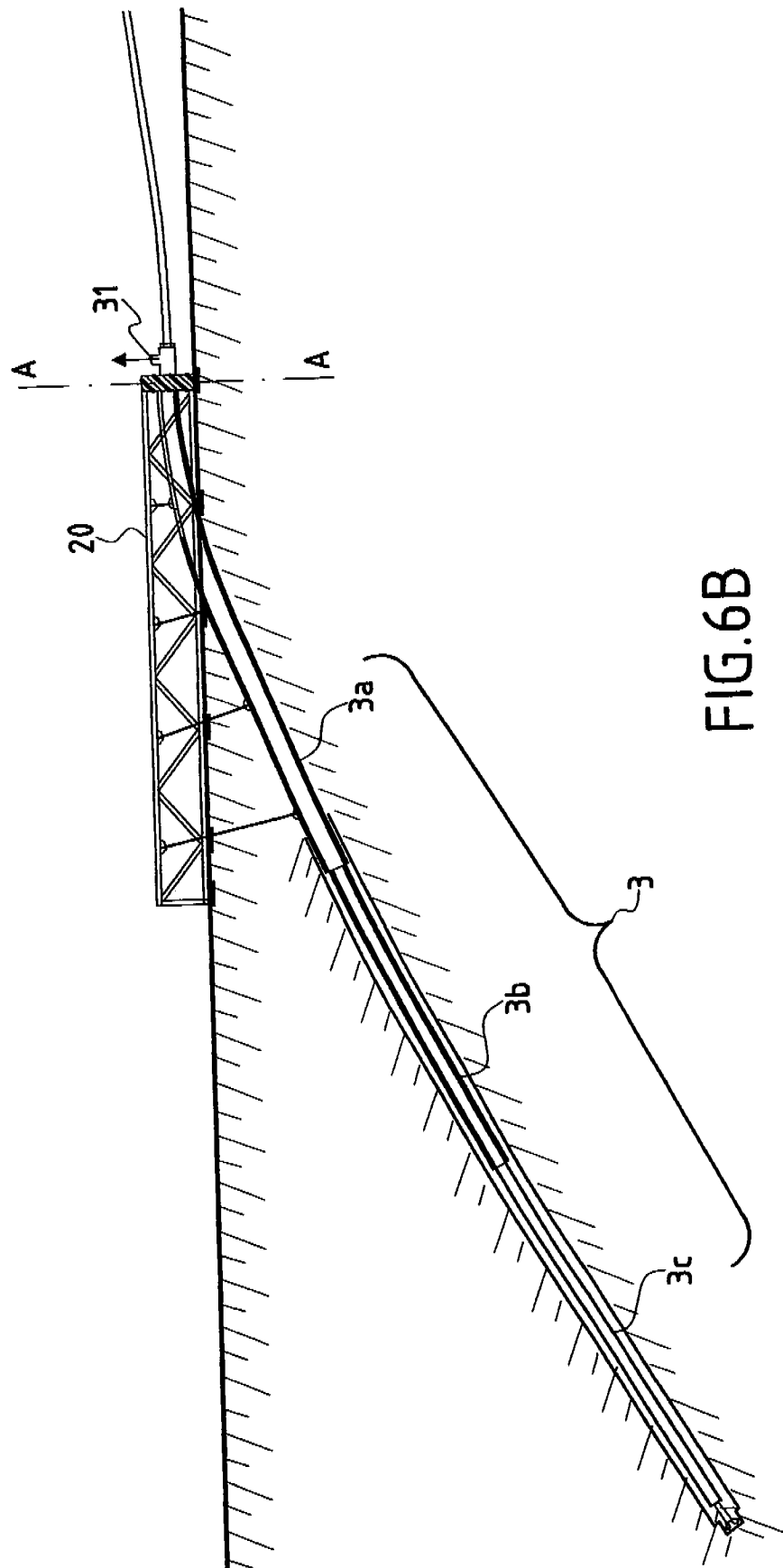


FIG. 6B

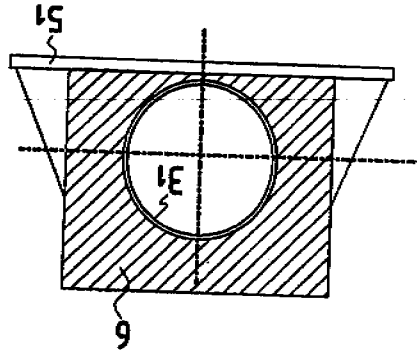


FIG. 10

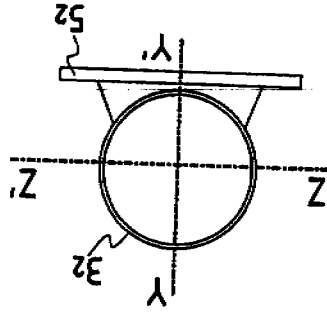


FIG. 9

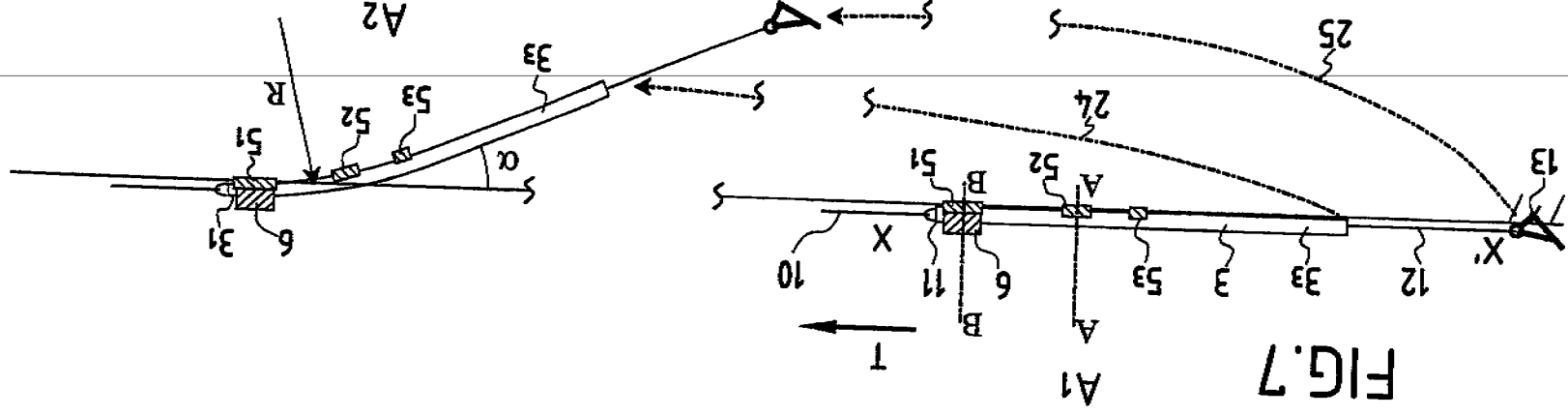


FIG. 7

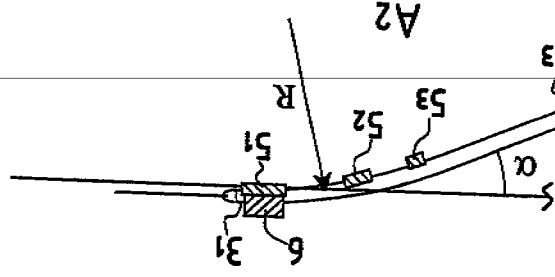


FIG. 8

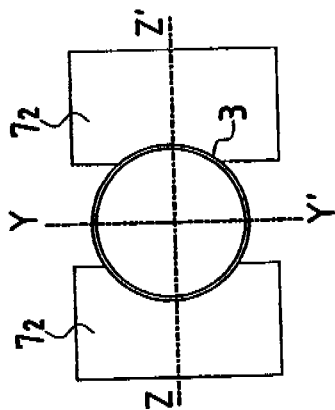


FIG. 13

FIG. 11

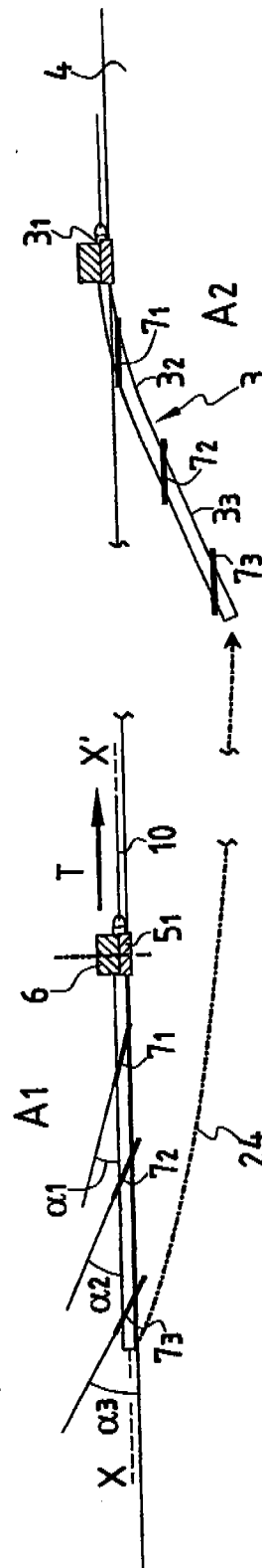


FIG. 12

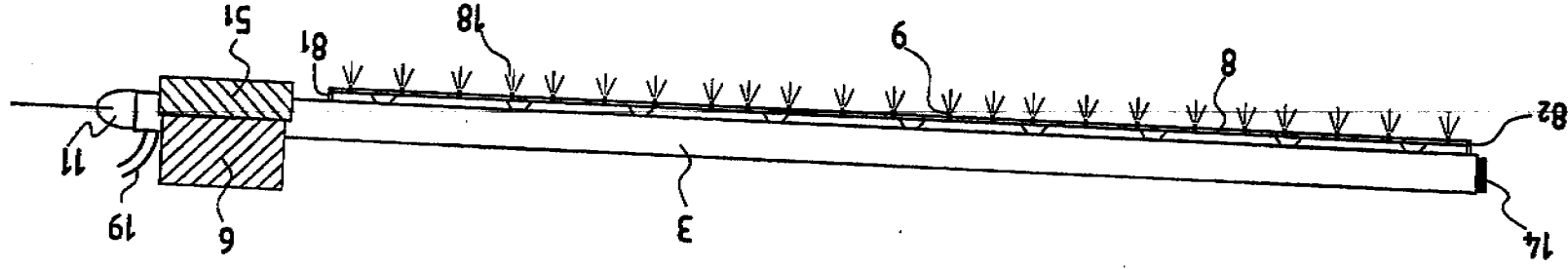


FIG. 14

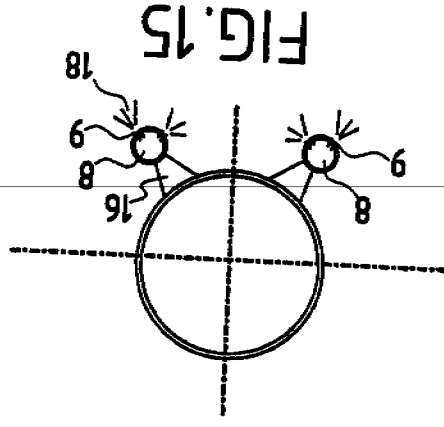


FIG. 15

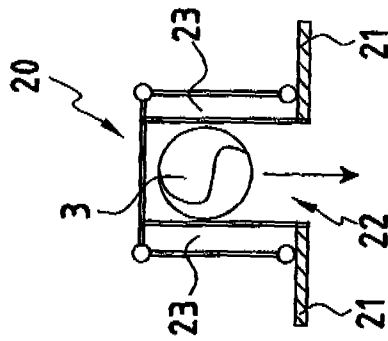


FIG. 18

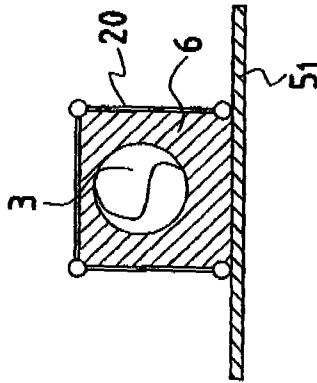


FIG. 19

FIG. 6

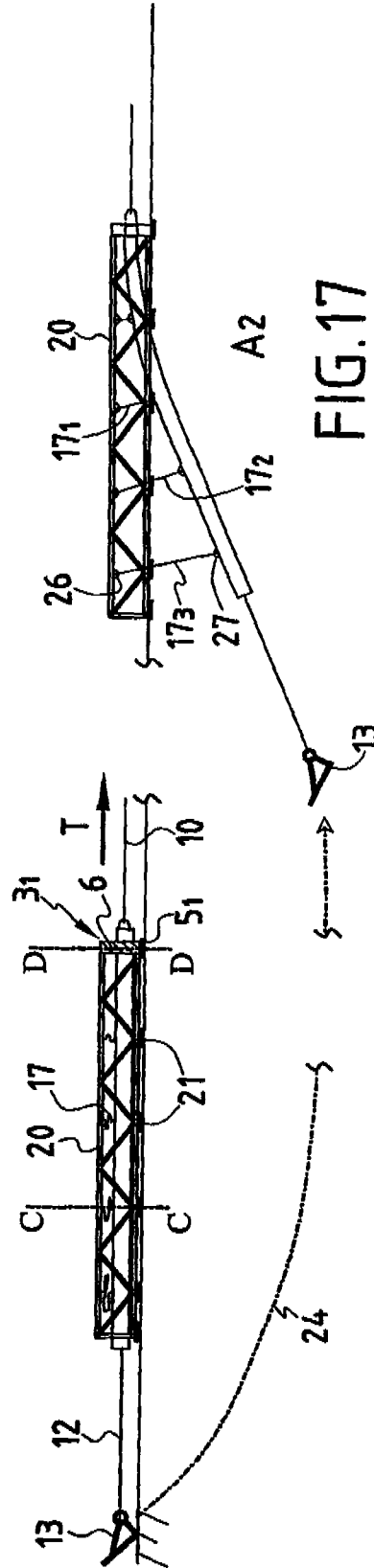
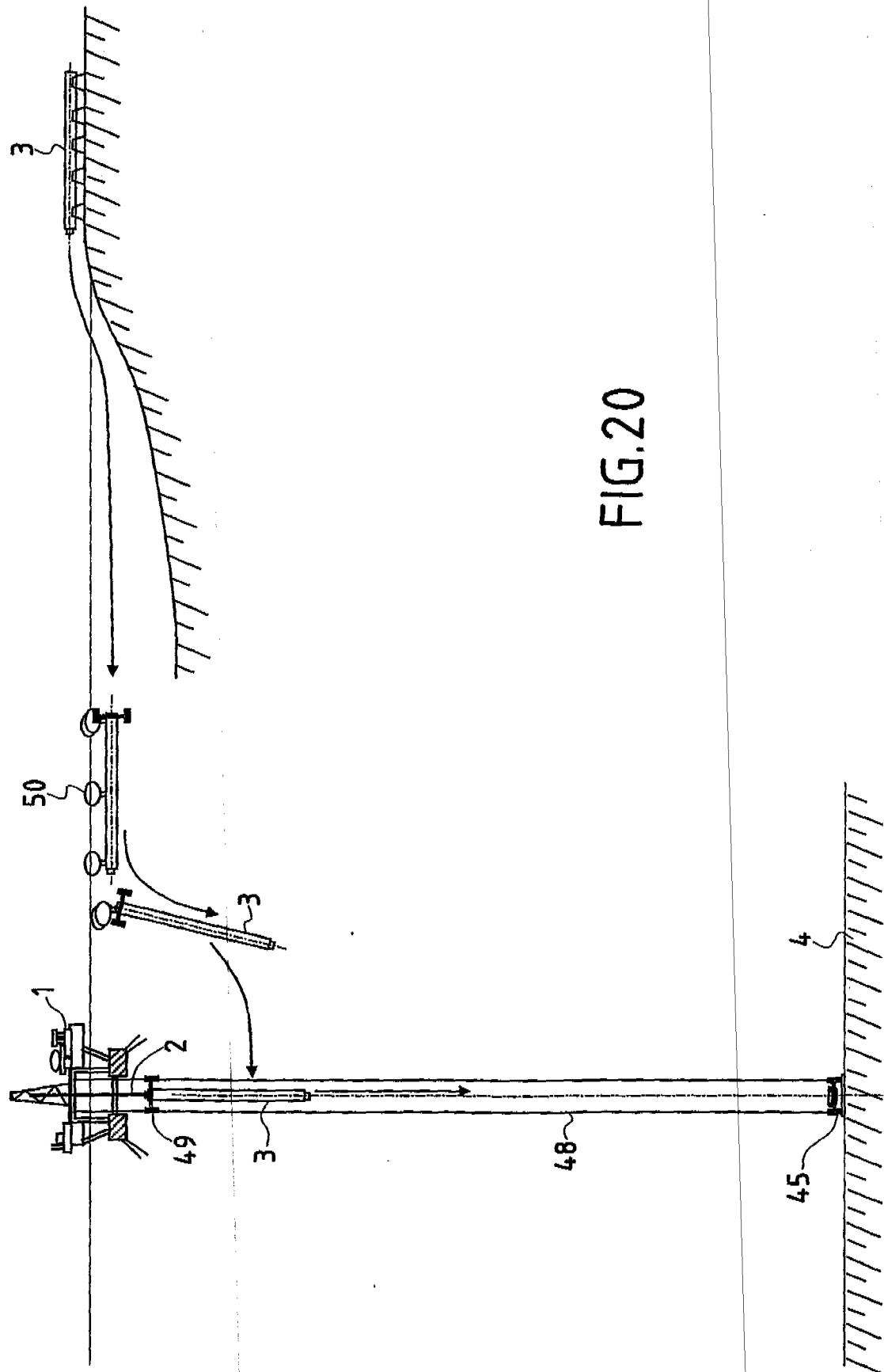


FIG. 17



INTERNATIONAL SEARCH REPORT

International Application No
PCT/FR 03/01867

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E21B7/20 E21B43/10 E21B7/04 E21B7/128

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 338 009 A (HEAD PHILIP) 8 December 1999 (1999-12-08) cited in the application page 12, line 7 - line 28; figures 19-21	1
A	FR 2 122 709 A (MINET ALBERT) 1 September 1972 (1972-09-01) page 1, line 28 -page 2, line 16; figure 2	1
A	EP 0 952 301 A (COOPER CAMERON CORP) 27 October 1999 (1999-10-27) cited in the application See abstract figures 1,3	1
A	US 4 223 737 A (O'REILLY DALE) 23 September 1980 (1980-09-23) figures 2,4	1



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *G* document member of the same patent family

Date of the actual completion of the international search

24 October 2003

Date of mailing of the international search report

04/11/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Dantinne, P

INTERNATIONAL SEARCH REPORT

International Application No

PCT/FR 03/01867

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 216 835 A (NELSON NORMAN A) 12 August 1980 (1980-08-12) See abstract figure 3	1
A	FR 2 027 067 A (BALT CORP) 25 September 1970 (1970-09-25) figure 9	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/FR 03/01867

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
GB 2338009	A	08-12-1999	NO	992652 A	05-12-1999
			US	6223823 B1	01-05-2001
FR 2122709	A	01-09-1972	FR	2122709 A5	01-09-1972
EP 0952301	A	27-10-1999	EP	0952301 A1	27-10-1999
			AU	2140599 A	07-10-1999
			BR	9901204 A	28-03-2000
			NO	991478 A	28-09-1999
			SG	77669 A1	16-01-2001
			US	2002157866 A1	31-10-2002
			US	2001047869 A1	06-12-2001
US 4223737	A	23-09-1980	NONE		
US 4216835	A	12-08-1980	GB	2010360 A , B	27-06-1979
FR 2027067	A	25-09-1970	CA	923379 A1	27-03-1973
			ES	374918 A1	16-05-1972
			FR	2027067 A5	25-09-1970
			HK	49376 A	06-08-1976
			JP	49025713 B	02-07-1974
			NL	6919447 A , B,	26-06-1970
			NO	129894 B	10-06-1974
			US	3685479 A	22-08-1972
			GB	1294303 A	25-10-1972

RAPPORT DE RECHERCHE INTERNATIONALE

Demande internationale No

PCT/FR 03/01867

A. CLASSEMENT DE L'OBJET DE LA DEMANDE

CIB 7 E21B7/20 E21B43/10 E21B7/04 E21B7/128

Selon la classification internationale des brevets (CIB) ou à la fois selon la classification nationale et la CIB

B. DOMAINES SUR LESQUELS LA RECHERCHE A PORTE

Documentation minimale consultée (système de classification suivi des symboles de classement)

CIB 7 E21B

Documentation consultée autre que la documentation minimale dans la mesure où ces documents relèvent des domaines sur lesquels a porté la recherche

Base de données électronique consultée au cours de la recherche internationale (nom de la base de données, et si réalisable, termes de recherche utilisés)

EP0-Internal

C. DOCUMENTS CONSIDERES COMME PERTINENTS

Catégorie * Identification des documents cités, avec, le cas échéant, l'indication des passages pertinents no. des revendications visées

A GB 2 338 009 A (HEAD PHILIP)
8 décembre 1999 (1999-12-08)
cité dans la demande
page 12, ligne 7 - ligne 28; figures 19-21

1

A FR 2 122 709 A (MINET ALBERT)
1 septembre 1972 (1972-09-01)
page 1, ligne 28 -page 2, ligne 16; figure
2

1

A EP 0 952 301 A (COOPER CAMERON CORP)
27 octobre 1999 (1999-10-27)
cité dans la demande
See abstract
figures 1,3

1

-/-

☒ Voir la suite du cadre C pour la fin de la liste des documents☒ Les documents de familles de brevets sont indiqués en annexe

* Catégories spéciales de documents cités:

- "A" document définissant l'état général de la technique, non considéré comme particulièrement pertinent
 "E" document antérieur, mais publié à la date de dépôt international ou après cette date
 "L" document pouvant jeter un doute sur une revendication de priorité ou cité pour déterminer la date de publication d'une autre citation ou pour une raison spéciale (telle qu'indiquée)
 "O" document se référant à une divulgation orale; à un usage, à une exposition ou tous autres moyens
 "P" document publié avant la date de dépôt international, mais postérieurement à la date de priorité revendiquée

"T" document ultérieur publié après la date de dépôt international ou la date de priorité et n'appartenant pas à l'état de la technique pertinent, mais cité pour comprendre le principe ou la théorie constituant la base de l'invention

"X" document particulièrement pertinent; l'invention revendiquée ne peut être considérée comme nouvelle ou comme impliquant une activité inventive par rapport au document considéré isolément

"Y" document particulièrement pertinent; l'invention revendiquée ne peut être considérée comme impliquant une activité inventive lorsque le document est associé à un ou plusieurs autres documents de même nature, cette combinaison étant évidente pour une personne du métier

"&" document qui fait partie de la même famille de brevets

Date à laquelle la recherche internationale a été effectivement achevée

24 octobre 2003

Date d'expédition du présent rapport de recherche internationale

04/11/2003

Nom et adresse postale de l'administration chargée de la recherche internationale

Office Européen des Brevets, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tél. (+31-70) 340-2040, Tx. 31 651 epo nl,
 Fax: (+31-70) 340-3016

Fonctionnaire autorisé

Dantinne, P

RAPPORT DE RECHERCHE INTERNATIONALE

Demande internationale No

PCT/FR 03/01867

C.(suite) DOCUMENTS CONSIDERES COMME PERTINENTS

Catégorie	Identification des documents cités, avec, le cas échéant, l'indication des passages pertinents	no. des revendications visées
A	US 4 223 737 A (O'REILLY DALE) 23 septembre 1980 (1980-09-23) figures 2,4 -----	1
A	US 4 216 835 A (NELSON NORMAN A) 12 août 1980 (1980-08-12) See abstract figure 3 -----	1
A	FR 2 027 067 A (BALT CORP) 25 septembre 1970 (1970-09-25) figure 9 -----	1

RAPPORT DE RECHERCHE INTERNATIONALE

Renseignements relatifs aux membres de familles de brevets

Demande internationale No

PCT/FR 03/01867

Document brevet cité au rapport de recherche		Date de publication	Membre(s) de la famille de brevet(s)	Date de publication
GB 2338009	A	08-12-1999	NO 992652 A US 6223823 B1	05-12-1999 01-05-2001
FR 2122709	A	01-09-1972	FR 2122709 A5	01-09-1972
EP 0952301	A	27-10-1999	EP 0952301 A1 AU 2140599 A BR 9901204 A NO 991478 A SG 77669 A1 US 2002157866 A1 US 2001047869 A1	27-10-1999 07-10-1999 28-03-2000 28-09-1999 16-01-2001 31-10-2002 06-12-2001
US 4223737	A	23-09-1980	AUCUN	
US 4216835	A	12-08-1980	GB 2010360 A , B	27-06-1979
FR 2027067	A	25-09-1970	CA 923379 A1 ES 374918 A1 FR 2027067 A5 HK 49376 A JP 49025713 B NL 6919447 A , B, NO 129894 B US 3685479 A GB 1294303 A	27-03-1973 16-05-1972 25-09-1970 06-08-1976 02-07-1974 26-06-1970 10-06-1974 22-08-1972 25-10-1972

103

3,376,922

2 Sheets-Sheet 1

Filed June 8, 1966



BY *Alan G. Pearl*

ATTORNEY

193

April 9, 1968

E. LEONHARDT, JR

3,376,922

JET STRING AND WEIGHT CAN ASSEMBLY

Filed June 8, 1966

2 Sheets-Sheet 2

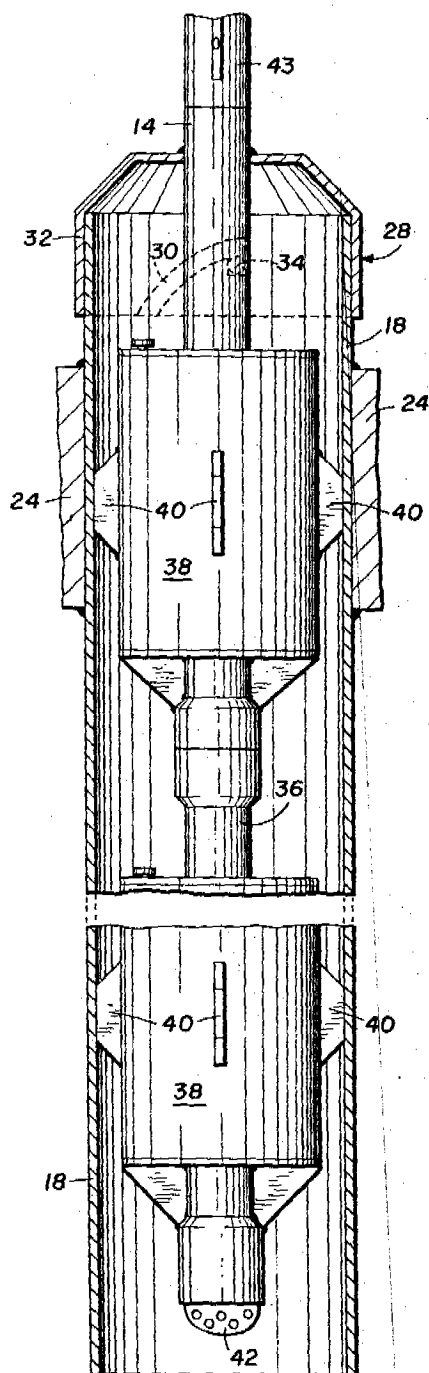


FIG. 2

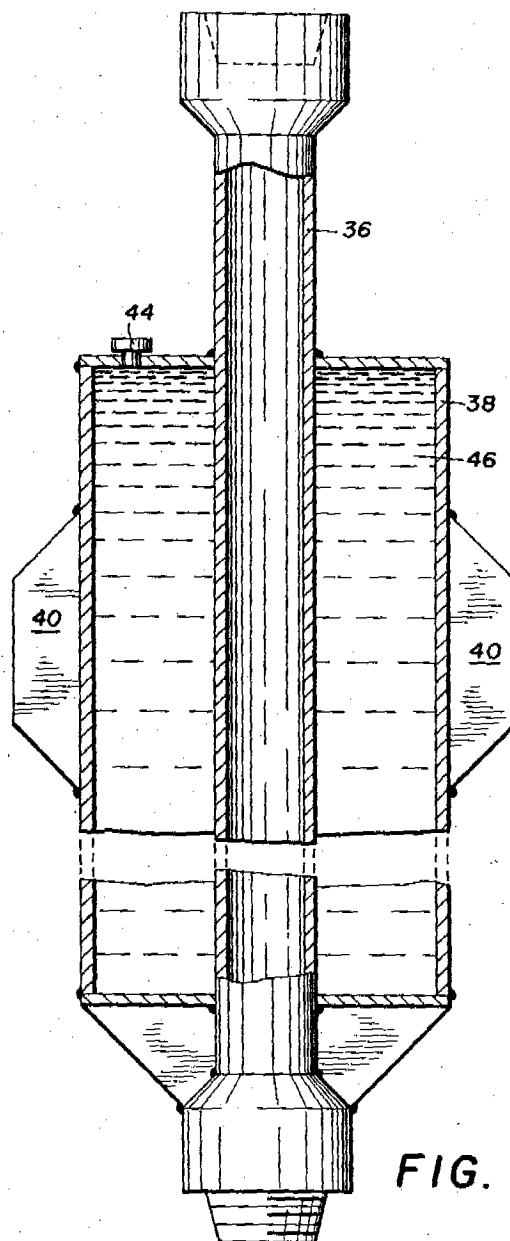


FIG. 3

ERNST LEONHARDT, JR.
INVENTOR

BY *Alan E. Paul*
ATTORNEY

1

3,376,922

JET STRING AND WEIGHT CAN ASSEMBLY
Ernst Leonhardt, Jr., Celle, Germany, assignor to Mobil
Oil Corporation, a corporation of New York
Filed June 8, 1966, Ser. No. 556,220
6 Claims. (Cl. 166—5)

ABSTRACT OF THE DISCLOSURE

This invention relates to the offshore drilling of oil and/or gas wells and more particularly to a method and apparatus for installing a surface well casing or conductor pipe for a subaqueous well.

In drilling an offshore gas and/or oil well from an above-surface platform, particularly from a floating vessel, a connection must be made with the marine bottom and the underlying formations, to provide a base point for guidelines connecting the borehole with the floating vessel, so that the well can be re-entered after the drill string is withdrawn. One common method of initiating a subaqueous well is to position a surface casing or conductor pipe in a preliminary wellbore, extending several hundred feet into the underlying formations. A weighted landing base supporting a guidance and alignment system, including the flexible guidelines, would be attached to the upper end of the surface conductor pipe to help support the conductor pipe during the drilling operation and provide a firm base for hanging the later casings and tubings in the well.

Two common methods of setting the surface casing in a subaqueous wellbore are concerned with first forming a preliminary borehole. In one of these methods, the drill string is lowered from the above-surface station to the ocean floor and a hole is formed in the ocean floor by drilling or jetting. The drill string is removed from the hole and surface casing is then suspended from the drill string and lowered into the borehole where it is set and anchored as by cementing. When drilling in deeper water, the surface casing is first suspended from the vessel beneath the rotary table and the drill string is lowered through the pipe to the ocean floor. After the drilling operation, the surface casing is slipped down over the drill string into the hole where it is cemented along at least a portion of its length. Each of the methods requires that the subaqueous formations underlying the marine bottom be consolidated enough so that a hole may be drilled or jetted therein, without the earth caving in or filling the hole. When using the first method, a diver would be required to relocate the hole subsequent to being drilled and prior to the surface casing being set. The second method would require a collapsible drill bit so that the original hole could be drilled large enough for the surface casing to settle therein while still allowing the drill string to be withdrawn after the casing is stripped down over the drill string into the hole. It has usually been considered more satisfactory to drill the hole than to jet it, due to the more accurate control over the size of the hole under these conditions.

It is desirable to utilize a single-step procedure rather than the two-step procedures noted above. In one such procedure, the surface casing itself is utilized as the lower joints of the drill string and it is fitted with a bit on the lower end thereof for drilling through the underlying formations or a jetting head for jetting into the marine bottom. This approach has proved to be necessary in fact, where the upper formations of the marine bottom are not consolidated enough to be drilled without the earth caving in and filling the hole when a drill string

2

is withdrawn. It is even more desirable to be able to permanently mount the guidance and alignment system, including a landing base, directly on the conductor pipe before it is guided down to the marine bottom. This is not possible if the initial hole is drilled, since the rotation of the entire landing base and guidance system at drilling speeds would be virtually impossible. Therefore, where the underlying formations are soft enough to permit it or make it necessary, the forming of the preliminary borehole by jetting would appear advisable especially if the diameter of the borehole can be sufficiently controlled.

Such a system which has been utilized consist of releasably fixing the lower end of a drill string within the surface casing itself and lowering the unit to the ocean bottom. A jetting head is fixed to the end of the drill string which is displaced slightly up from the lower end of the surface casing. The surface casing is jetted in and the drilling returns are conducted up the annulus between the drill string and the surface casing. In this way the upper end of the hole does not tend to widen by being continually washed away by the drilling returns, as would be the case with an open jet pipe. Mounted above the surface casing or conductor pipe on the drill string are removable weights, being applied to the upper end of the surface casing to assist in driving the casing down into the marine bottom. These weights, above the surface casing, raise the center of gravity of the drilling apparatus, making it difficult to control the drill string from the above-surface platform. The large weights also provide more surface area for the ocean currents increasing the drag imposed on the drill string. Furthermore, the axial length of the weight cans makes the use of this apparatus inconvenient in shallow water where the distance between the marine bottom and the drilling deck is rather restricted.

An object of this invention is to provide a lower center of gravity for the combined drill string and surface casing to control better the string during the jetting-in operation.

Another object of the invention is to provide a more compact arrangement, for jetting in a surface casing, that would be adaptable for use in shallow water.

Other objects and advantages of the present invention will be apparent from the following description taken with reference to the accompanying drawings wherein is shown a preferred embodiment of the invention:

FIGURE 1 is an elevational view of a surface casing, with a landing base attached thereto, of the present invention, being jetted into the marine bottom;

FIGURE 2 is a cross-sectional view of a portion of the apparatus, partially in cross section, illustrating the arrangement of the surface casing and the enclosed weight cans mounted on the drill string; and

FIGURE 3 is a cross-sectional view of one joint of the drill string with a weight can affixed thereto.

Now referring to FIGURE 1, a floating vessel 10, having a drilling rig 12 mounted thereon, is positioned above a drilling site. A drill string 14 is suspended by a swivel 16 of the drilling rig 12 and is connected below to a surface casing or conductor pipe 18 being jetted into the marine bottom 20 to form a preliminary borehole 22 and position the surface casing 18 therein. A landing base 24, fixed on the upper end of the surface casing 18, has flexible guide cables 26 extending back to the drilling vessel 10 to conduct equipment down to the borehole 22 after the jetting-in operation has been completed and the drill string 14 has been removed.

Now looking at FIGURE 2, the surface casing 18 is shown as connected to the drill string 14 by a J slot connector 28, the J slot connector consisting in part of a plurality of shaped slots 30 in an enlarged cap 32 fixed

194

to the drill string 14. The slots 30 in the cap 32 coact with radially extending pins 34 projecting from the outer surface of the casing 18. Each of the drill pipe joints 36 of the drill string 14, within the surface casing 18, has a cylindrical weight can 38 coaxially mounted thereon. Radial fins 40, spaced around each of the weight cans, act to center the drill string 14 within the casing 18. A jetting head or nozzle 42 is connected to the lower end of the drill string, within the surface casing 18, and is spaced upwardly from the lower end of the casing. A bumper sub 43 is inserted above the J connector 28 in the drill string 14 and can be actuated as a hammer, as well as taking up any vertical movement of the surface vessel 10.

As shown in FIGURE 3, the cylindrical weight can 38 is hollow and has a capped valve 44 in the upper end thereof for adding sufficient weighting material 46. The weighting material can be barite, galena, or other material commonly used for controlling mud weight.

To jet in the surface casing 18, the casing is connected by the J connector 28 to the lower end of the drill string 14 and lowered until the casing 18 rests on the marine bottom 20. The drill string 14 serves as a wash pipe through which water is then jetted into the interior of the surface casing to flush out the unconsolidated material. The jet head 42 is spaced a distance above the lower end of the surface casing which is driven continuously into the underlying formations by the weighted drill string 14, so that no water escapes up the outside of the surface casing to overenlarge the hole and impair the necessary frictional contact between the casing and the sides of the borehole. This frictional contact permits the surface casing to support the weight of the tubing later hung therein. The jetting returns are conducted out of the borehole 22 through the annular space between the weight cans 38 and the casing 18, exiting through the J connector cam slots 30. When the surface casing 18 has been jetted in until the landing base 24 rests on the marine bottom 20, the drill string 14 is rotated to release it from the surface casing 18. The drill string 14 is then raised up out of the borehole 22 leaving the casing 18 in place. The flexible guidelines 26 connected to the landing base 24 are then used to mount, on the upper end of the casing 18, a blowout preventer (not shown) and either a surface riser pipe or a receiver assembly with a flexible drilling mud return line (also not shown), depending whether the drilling is to be done with an enclosed or an open pipe, respectively. The subaqueous well can then be drilled in a convention operation to the total depth.

Although the present invention has been described in connection with details of the specific embodiment thereof, it is to be understood that such details are not intended to limit the scope of the invention. Terms and expressions employed are used in a descriptive and not a limiting sense and there is no intention of excluding such equivalents in the invention described, as fall within the scope of the claims. Now having described the apparatus and method of the invention, reference should be had to the claims which follow.

What is claimed is:

1. Apparatus for jetting a surface well casing into a marine bottom at an offshore site comprising: a surface

casing; a drill string made up of a plurality of drill string joints, said drill string having a jetting head on a first end thereof; means for releasably suspending said casing over said first end of said drill string; at least one cylindrical weight can having a diameter substantially less than the internal diameter of said surface casing, said weight can being mounted on one of said joints of said drill string within said surface casing; and spaced radial guide means on said weight can for centrally locating said drill pipe within said surface casing to form an annulus for the jetting returns whereby the jetting apparatus is compact and center of gravity is lowered to increase the controllability of said drill string during the jetting operation.

2. The apparatus for jetting a surface well casing into a marine bottom at an offshore site as recited in claim 1 wherein said jetting head on said first end of said drill string is within said surface casing, spaced a distance from the end thereof whereby the sides of the borehole being jetted are not washed out and the size of the borehole can be controlled.

3. The apparatus for jetting a surface well casing into a marine bottom at an offshore site as recited in claim 1 wherein said weight can is hollow and wherein the weighting material used to adjust the weight of said weight can is the same material used to weight drilling mud.

4. The apparatus for jetting a surface well casing into a marine bottom at an offshore site as recited in claim 1 wherein said joints of said drill string within said surface casing each has one of said weight cans affixed thereto.

5. The apparatus for jetting a surface well casing into a marine bottom at an offshore site as recited in claim 1 wherein said means for suspending said surface casing from said drill string comprises: a cap portion fixed to said drill string and adapted to fit over an end of said surface casing; a plurality of cam slots in the surface of said cap; and radial pins on said end of surface casing to coact with said slots whereby the surface casing is releasably suspended from said drill string during jetting.

6. Apparatus for jetting a surface well casing into a marine bottom at an offshore site as recited in claim 1 wherein said apparatus includes an above-surface platform; means on said above-surface platform for supporting said drill string and lowering said drill string into said marine bottom; and a landing base mounted on the upper end of said surface casing and flexible guidelines attached to said landing base and extending to said above-surface platform.

References Cited

UNITED STATES PATENTS

1,517,556	12/1924	Grant	175-10
2,891,770	6/1959	Bauer et al.	175-7
3,073,393	1/1963	Smith	166-242
3,104,719	9/1963	Fite	166-2
3,215,201	11/1965	Lacy et al.	175-67 X

CHARLES E. O'CONNELL, *Primary Examiner.*

RICHARD E. FAVREAU, *Assistant Examiner.*

95
SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 900176089-2

CERTIFICACION DE EXCEDENTE : 07 - 98,593
: DICIEMBRE 3 DE 2007

**** CONSIGNACION ****

DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	Nº. PAGO	FECHA PGO	Vr. PAGO
CLARKE MOREY Y CO. COLOMB	CONSIGNACION	BANCO POPULAR	050-00110-6	64177535	03/12/2007	22,650,000.00

**** CONCEPTO ****

Nº.	CONCEPTO	TOTAL CONCEPTO
1 50005-01-09 OTROS SERVICIOS DE PROPIEDAD I	99 OTROS SERVICIOS ADMINISTRATIVOS	5,000.00
TOTAL :		\$ 5,000.00

SON: CINCO MIL PESOS

RESPONSABLE : _____

RECIBO DE CAJA APLICADO AL EXPEDIENTE Nº. _____

196

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

NIT : 800178089-2

RECIBO OFICIAL DE CAJA : 07 - 98,460
: DICIEMBRE 3 DE 2007
CHA

***** CONSIGNACION *****

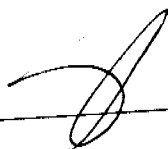
DEPOSITANTE	TIPO PAGO	BANCO	CUENTA	Nº. PAGO	FECHA PGO	VAL. PAGO
CLARKE MODEST Y CO. COLOMBIA	CONSIGNACION	BANCO POPULAR	050-00110-6	84177535	03/12/2007	22,500,000.00

***** CONCEPTO *****

CONCEPTO	TOTAL CONCEPTO
INT. SENTISTICO	
1 50005-01-08 PRORROGA DE TERMINOS	72,000.00
31 PRORROGA DE TERMINOS	72,000.00
TOTAL :	72,000.00

SON: SETENTA Y DOS MIL PESOS

RESPONSABLE :



RECIBO DE CAJA APLICADO AL EXPEDIENTE Nº. _____



20000-0000

REQUISITOS MINIMOS PARA ADMISION A TRAMITE PCT

PATENTE DE INVENCION

☒

MODELO DE UTILIDAD ☐

- ◆ Indicación de que se solicita la concesión de una patente ☒
- ◆ Datos de identificación del solicitante o de la persona que presenta la solicitud ☒
- ◆ Descripción de la invención ☒
- ◆ Dibujos de ser estos pertinentes ☒
- ◆ Comprobante de pago de las tasas establecidas ☒

COMPLETA ☐

INCOMPLETA ☐

DISEÑO INDUSTRIAL ☐

- ◆ Indicación de que se solicita el registro de Diseño Industrial ☐
- ◆ Datos de identificación del solicitante o de la persona que presenta la solicitud ☐
- ◆ Representación gráfica y fotográfica del Diseño Industrial o muestra del material que incorpora el diseño ☐
- ◆ Comprobante de pago de las tasas establecidas ☐

COMPLETA ☐

INCOMPLETA ☐

ESQUEMA DE TRAZADO ☐

- ◆ Indicación de que se solicita el registro de un Esquema de Trazado ☐
- ◆ Datos de identificación del solicitante o de la persona que presenta la solicitud ☐
- ◆ Representación gráfica del esquema trazado ☐
- ◆ Comprobante de pago de las tasas establecidas ☐

COMPLETA ☐

INCOMPLETA ☐

Edgar Naranjo

Firma Responsable

Fecha 03-12-07.

Carrera 13 No. 27-00 Piso 5, 7 y 10
Conmutador: 3 82 08 40
Fax: 350 52 20
E-mail: info@sic.gov.co
www.sic.gov.co
Bogotá, D.C., Colombia

108

108

REPUBLICA DE COLOMBIA
SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO

Bogotá,
2020

Doctor(a)
RODRIGUEZ D ALEMAN DILIA MARIA
Apoderado(a) y/o Representante de
BP EXPLORATION OPERATING COMPANY LIMITED

REFERENCIA	Radicación No.	7 127749
	Solicitud internacional	PCT/GB2006/001692
	Fecha inicio fase nacional	25/12/2007
	Trámite	11
	Evento	379
	Actuación	430
	Oficio No.	2303

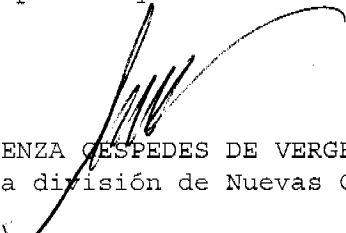
Como resultado del examen de forma, realizado con fundamento en el artículo 38 de la Decisión 486 de la Comisión de la Comunidad Andina, artículo 27 del Tratado de Cooperación en Materia de Patentes (PCT), regla 51 bis del Reglamento y Circular Única de la Superintendencia de Industria y Comercio, se le comunica que:

1. La traducción de los capítulos descriptivo y reivindicatorio debe estar acompañada de los respectivos dibujos.

2. La solicitud no contiene la copia del documento en que consta la cesión del derecho a la patente del inventor al solicitante o a su causante. (Art. 26-k) Decisión 486.

En cumplimiento de lo dispuesto por el artículo 39 de la Decisión 486, se le requiere para que dentro del término de dos meses siguientes a la fecha de notificación del presente oficio, complete los requisitos anteriormente enunciados. En caso de no dar cumplimiento al presente requerimiento, la solicitud se considerará abandonada y perderá su prelación.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única No.10 de 2001.


ALIX CARMENZA GÁSPEDES DE VERGEL
Jefe de la división de Nuevas Creaciones

El anterior requerimiento fue notificado por fijación en lista de fecha 15 FEB 2008
jfernand