


PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
 Stylesheet Version v1.2

EPAS ID: PAT3612129

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT
CONVEYING PARTY DATA	
Name	Execution Date
ZHIMIN TAN	10/25/2007
MIKE POWELL	10/25/2007
YANQIU ZHANG	10/25/2007
THOMAS KOLANSKI	10/25/2007
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Property Type	Number
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SIGNATURE:	/Jeffrey B. Haendler/
DATE SIGNED:	11/11/2015
Total Attachments: 5	

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Supersession:		Procedure Type	ORIGINATOR	P. Williams	
		CERTIFICATE OF INVENTION	Revision No.	1	
Revisions are in <i>italics and lined</i>		Procedure No.	Date of issue		

Patent Department Date Stamp	Docket N ^o (To be filled in only by Patent Department)
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WELLSTREAM INTERNATIONAL LIMITED
CERTIFICATE OF INVENTION

Please fill in all blanks using ink or typewriting
Use "not applicable" or "none" where appropriate


TITLE OF INVENTION: Weight Added Wave Configuration of Flexible Riser

A The Inventor(s)									
1.	<table border="1"> <tr> <td>Surname <i>Tan</i></td> <td>Forename(s) <i>Zhimin</i></td> </tr> <tr> <td>Citizenship <i>United States of America</i></td> <td>Social Security No.</td> </tr> <tr> <td colspan="2">Residence <i>23807 Allingham Ln, Kary, TX</i></td> </tr> <tr> <td colspan="2">Post / Zip Code: <i>77494</i></td> </tr> </table>	Surname <i>Tan</i>	Forename(s) <i>Zhimin</i>	Citizenship <i>United States of America</i>	Social Security No.	Residence <i>23807 Allingham Ln, Kary, TX</i>		Post / Zip Code: <i>77494</i>	
Surname <i>Tan</i>	Forename(s) <i>Zhimin</i>								
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Post / Zip Code: <i>77494</i>									
2.	<table border="1"> <tr> <td>Surname <i>Powell</i></td> <td>Forename(s) <i>Mike</i></td> </tr> <tr> <td>Citizenship <i>United Kingdom</i></td> <td>Social Security No.</td> </tr> <tr> <td colspan="2">Residence</td> </tr> <tr> <td colspan="2">Post / Zip Code</td> </tr> </table>	Surname <i>Powell</i>	Forename(s) <i>Mike</i>	Citizenship <i>United Kingdom</i>	Social Security No.	Residence		Post / Zip Code	
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Citizenship <i>United Kingdom</i>	Social Security No.								
Residence									
Post / Zip Code									
3.	<table border="1"> <tr> <td>Surname <i>Zhang</i></td> <td>Forename(s) <i>Yanqiu</i></td> </tr> <tr> <td>Citizenship <i>United States of America</i></td> <td>Social Security No.</td> </tr> <tr> <td colspan="2">Residence <i>7923 Barnes Ridge, HOUSTON, TX 77072</i></td> </tr> <tr> <td colspan="2">Post / Zip Code <i>77072</i></td> </tr> </table>	Surname <i>Zhang</i>	Forename(s) <i>Yanqiu</i>	Citizenship <i>United States of America</i>	Social Security No.	Residence <i>7923 Barnes Ridge, HOUSTON, TX 77072</i>		Post / Zip Code <i>77072</i>	
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4.	<table border="1"> <tr> <td>Surname <i>Kolanski</i></td> <td>Forename(s) <i>Thomas</i></td> </tr> <tr> <td>Citizenship <i>United States of America</i></td> <td>Social Security No.</td> </tr> <tr> <td colspan="2">Residence <i>5423 Kansas St. Houston, TX</i></td> </tr> <tr> <td colspan="2">Post / Zip Code <i>77007</i></td> </tr> </table>	Surname <i>Kolanski</i>	Forename(s) <i>Thomas</i>	Citizenship <i>United States of America</i>	Social Security No.	Residence <i>5423 Kansas St. Houston, TX</i>		Post / Zip Code <i>77007</i>	
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Citizenship <i>United States of America</i>	Social Security No.								
Residence <i>5423 Kansas St. Houston, TX</i>									
Post / Zip Code <i>77007</i>									

If there are more than two joint inventors, please attach an additional sheet giving the above information.

B Information about making the invention:	
(1)	The invention was first thought of on or about _____
(2)	The invention was first explained to (Name of Person or Persons) _____ On or about _____
(3)	The first drawing of the invention was made on or about _____
(4)	The first written description of the invention was made on or about _____
(5)	The invention is disclosed or described in Engineering Notebook(s) _____, Pages _____
(6)	Describe the contribution of each inventor to the invention
1	Inventor: <i>Zhimin Tan</i> Contribution: _____


Supersession:		Procedure Type	ORIGINATOR	P. Williams
		CERTIFICATE OF INVENTION	Revision No.	1
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	<i>contents density change and to maintain a working configuration.</i>
2	Inventor: <i>Mike Powell</i> Contribution:
3	Inventor: <i>Yanaiu Zhang</i> Contribution:
4	Inventor: <i>Thomas Kolanski</i> Contribution:

C Information about use of the Invention	
(1)	A device, product or process embodying or using the invention has been made or used and tested?
(2)	Product or process embodying or using the invention has been sold, used in making a product or performing a service that has been sold or information concerning the same has been communicated to a customer or potential customer?
(3)	Specific plans for the use, sale, offer for sale or testing of the invention or the preparation of any technical paper, article, advertisement, or other printed document or verbal communication describing the invention, in the near future?
If the answer to any of these questions in this paragraph C is "yes", give applicable dates. In case of Sales or communications to a customer or potential customer, give the name of the customer. In cases of documents, etc., attach a copy if possible.	

D Prior Art: (If possible and as appropriate, furnish copies and point out relevant portions)	
(1)	Identify the most closely related device, product or process existing before the invention:
(2)	<p>Brief description of the Invention: (Describe the machine, circuit, method, product or composition of matter that is the subject of this certificate. Attach sketches or diagrams as necessary. Be sure to describe the preferred form of the invention but identify alternate forms where appropriate.)</p> <p><i>A weight chain is designated to be attached to the buoyancy modulus (moduli) of a flexible riser wave configuration with part of the chain sitting on the sea bed. The weight chain acts as a self adjusting device by increasing/decreasing the suspended weight as it is lifted from/laid on the sea bed during the changes in density of the riser contents to automatically maintain the riser within a desirable working configuration.</i></p> <p><i>A weight chain can also be attached directly to the riser section of a flexible riser wave configuration for the same self adjusting purpose.</i></p> <p><i>The member which adds weight and compliance does not necessarily have to be gravity based weighted chain. It can be any means by which to vary the downward force applied to the riser. This may entail a spring, elastic, or any similar means.</i></p>

Supersession:		Procedure Type	ORIGINATOR	P. Williams	 Wellstream
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- (3) Identify any persons apt to be involved with the patent application having knowledge of additional information relevant to any of the above answers:
None known

E Invention Disclosure: (include a complete written disclosure of your invention including any sketches, diagrams, drawings, prints etc., which will aid in the understanding of this invention.)

- (1) Purpose of Invention: (Explain the results sought to be accomplished, difficulties to be overcome or eliminate and advantages to be gained by invention)

The invention is to provide a practical solution for shallow water application of a flexible riser wave configuration, where the riser configuration could either float at the water surface or sink to sea bed due to its sensitivity to the content density change.

The invention inherits the advantage of low installation cost and short installation time of a Wave configuration, and yet the performance advantage enjoyed by S wave configuration, for example, it is less dependent up on the riser weight change

This system will be suitable where the depth of the riser system may vary due to internal fluid density changes, and external environmental changes rather than being limited to shallow water only. Such a compliant system will be beneficial in any range of water depths. The purpose of the invention is a means by which to manipulate and control the desired depth and configuration of the riser system

- (2) Brief description of the Invention: (Describe the machine, circuit, method, product or composition of matter that is the subject of this Certificate. Attach sketches or diagrams as necessary. Be sure to describe the preferred from the invention but identify alternate forms where appropriate)

The new invented riser configuration is referred to as Weight Added Wave (WAW) configuration for distinction. The Figure below illustrates schematically a potential WAW configuration which could be either a Steep or Lazy WAW configuration according to the riser arrangement at the sea bed touch down area.

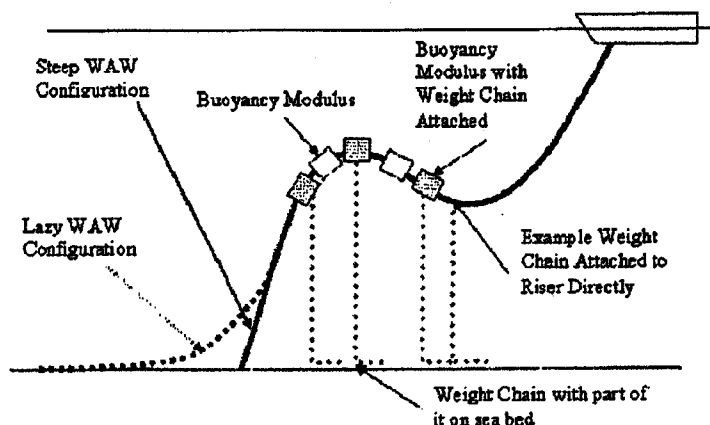


Figure - Weight Added Wave Configuration

The WAW configuration has the following characteristics.

- Based on the normal wave configuration with discrete buoyancy modulus*
- A number of, or all buoyancy modulus may be attached to the weight chain*
- A part of the weight chain should be laid on the sea bed at the nominal configuration. When the riser content density reduces, the buoyancy will be balanced by the additional chain weight as it is lifted from the sea bed. When the riser content density increases, the buoyancy will be balanced by reduced chain weight as the additional chain is laid on the sea bed*
- The number of the buoyancy modulus selected for weight chain attachment will be analyzed for optimal*

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riser configuration performance

The WAW configuration requires larger buoyancy modules than a typical Wave configuration. The applied buoyancy modules ensure that: 1) the configuration always remains in a floating state even when the pipe weight reaches the heaviest state in combination with any marine growth, buoyancy loss, and content density change, and the weight of the suspended chains, and 2) the weight chains have to be trimmed at the sea bed to ensure that a section of the chains remains on sea bed at the lightest riser configuration. The length of the chain on seabed will be determined for the largest potential change, for example, in the riser contents.

A High level installation process is indicated below:

- *A length of chain would be attached to each or selected buoyancy module as it leaves the installation deck of the installation vessel, and before it reaches the surface water.*
- *The rest of the chain could be lowered into water after it is attached to the buoyancy module*
- *The riser could be paid out continually until the next buoyancy module reaches the installation deck for the weight chain attachment*

Modifications.

- 1 The System relies on progressively mobilizing additional weight as the chain is lifted off seabed by the reducing weight of the pipe contents. The amount of buoyancy added to compensate for the weight of the chain may be reduced by replacing the upper, (non active) length of chain with wire or synthetic rope.*
- 2. During installation, the chain and rope assembly may be tied back to the buoyancy module and then released underwater, after installation.*
- 3. Where the pipe itself has sufficient residual buoyancy, the system can be used without the addition of buoyancy modules. In this case the weight chain will be attached directly to the flexible riser through a clamping device for example*
- 4 This system may be used for any circumstance where a pipe is required to remain at a controlled height above the seabed, such as bridging unstable, aggressive, environmentally sensitive, or active seabed conditions, and may include the use of additional tethers to control lateral position*


(3) Distinctive Features: (How does the disclosed invention differ from earlier attempts to solve the same problem?)

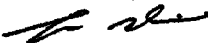

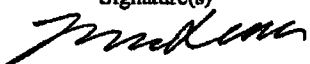
The system of the weight chain and the buoyancy modulus is characterised in terms of its acting as a self buoyancy/weight adjusting device for automatically maintaining a working flexible riser wave configuration. The invention is featured by a part of the weight chain sitting on the sea bed

(4) Examples of Commercial Use:

For use in flexible riser wave configuration.

For controlling the height above the seabed of a pipe spanning unfavourable or environmentally sensitive seabed conditions in both shallow and deep water applications.

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F Assignment:			
<p>In accordance with the provisions of my (our) Employee Invention and Assignment Agreement, I (we) hereby assign the entire right, title and interest in and to the herein described inventions, discoveries and conceptions to Wellstream International Limited (hereinafter "the company")</p> <p>In addition to my (our) Employee Invention and Assignment Agreement, or in the absence thereof, by signing below I (we) hereby assign, to the Company, all of my (our) entire right, title and interest in and to the herein described inventions and in and to all patent applications and patents which may be granted therefore and all divisions, reissues, continuations and continuations in part, continued prosecution applications and extensions thereof, for and in consideration of one dollar (\$1.00) and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged.</p> <p>I (we) also agree to assist the Company at any time during or after my (our) employment is terminated, at the Company's expense, in the preparation, execution and delivery of any disclosures, patent applications or papers within the scope and intent of the herein described invention, required to obtain patents in this or in other countries and in connection with such other proceedings as may be necessary to enforce the Company's rights in such inventions against others or to vest title hereto in the Company, its assigns, successors, or legal representatives</p> <p>Furthermore, I (we) hereby appoint Wellstream's appointed representative with full power of substitution and revocation, to prepare, file and prosecute a patent application, and to transact all business in the United Kingdom United States or other national Patent and Trademark Office connected therewith, and to file and prosecute any international patent applications filed thereon, before any international authorities under the Patent Co operation Treaty.</p>			
Signature(s)	Of	Inventor(s)	Date Signed
		Zhimin Tan	Oct. 25, 2007
		Mike Powell	Oct. 25, 2007
		Yanqiu Zhang	Oct. 25, 2007
		Thomas Kolanski	Oct. 25, 2007
<p>Witnesses: each of the undersigned witnesses declares that he has read, understood and signed this Certificate of Invention, including attachments thereto, on the date following his signature</p>			
	Signature(s)	Name(s)	Date Signed
1.		Frank Ma	Oct 25, 2007
2.			