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15866 U.S. PTO

PTO/SB/05 (09-04)
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UTILITY PATENT APPLICATION TRANSMITTAL <i>(Only for new nonprovisional applications under 37 CFR 1.53(b))</i>	Attorney Docket No.	14.0123-PCT-US-CONT4
	First Inventor	Oyvind Hillesund
	Title	CONTROL SYSTEM FOR POSTERIZING MARINE SEMIOTIC STRUCTURES
	Express Mail Label No.	EQ547422835US

113260 U.S. PTO
11/455042
061606

APPLICATION ELEMENTS <i>See MPEP chapter 600 concerning utility patent application contents.</i>	ADDRESS TO: Commissioner for Patents P.O. Box 1450 Alexandria VA 22313-1450
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1. **Fee Transmittal Form** (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. **Applicant claims small entity status.**
See 37 CFR 1.27.
3. **Specification** [Total Pages 23]
Both the claims and abstract must start on a new page
(For information on the preferred arrangement, see MPEP 608.01(a))
4. **Drawing(s)** (35 U.S.C. 113) [Total Sheets 3]
5. **Oath or Declaration** [Total Sheets _____]
 - a. Newly executed (original or copy)
 - b. A copy from a prior application (37 CFR 1.63(d))
(for continuation/divisional with Box 18 completed)
 - i. **DELETION OF INVENTOR(S)**
Signed statement attached deleting inventor(s)
name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. **Application Data Sheet.** See 37 CFR 1.76
7. **CD-ROM or CD-R** in duplicate, large table or Computer Program (*Appendix*)
 Landscape Table on CD
8. **Nucleotide and/or Amino Acid Sequence Submission**
(if applicable, items a. - c. are required)
 - a. Computer Readable Form (CRF)
 - b. Specification Sequence Listing on:
 - i. CD-ROM or CD-R (2 copies); or
 - ii. Paper
 - c. Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. **Assignment Papers** (cover sheet & document(s))
Name of Assignee WESTERNECO, L.L.C.
10. **37 CFR 3.73(b) Statement** **Power of Attorney**
(when there is an assignee)
11. **English Translation Document** *(if applicable)*
12. **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
 Copies of citations attached
13. **Preliminary Amendment**
14. **Return Receipt Postcard** (MPEP 503)
(Should be specifically itemized)
15. **Certified Copy of Priority Document(s)**
(if foreign priority is claimed)
16. **Nonpublication Request** under 35 U.S.C. 122(b)(2)(B)(i).
Applicant must attach form PTO/SB/35 or equivalent.
17. **Other:** _____

18. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:

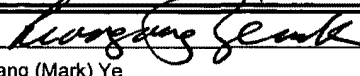
Continuation Divisional Continuation-in-part (CIP) of prior application No.: 09/787,723

Prior application information: Examiner JESUS D. SOTELO Art Unit: 3617

19. CORRESPONDENCE ADDRESS

The address associated with Customer Number: 28116 OR Correspondence address below

Name		Address	
City	State	Zip Code	
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Signature		Date	<u>6/15/2006</u>
Name (Print/Type)	Liangang (Mark) Ye	Registration No. (Attorney/Agent)	48,276

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.
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Effective on 12/08/2004. Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818). FEE TRANSMITTAL For FY 2005		Complete if Known	
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27		Application Number	Filed Concurrently
TOTAL AMOUNT OF PAYMENT (\$) 1700		Filing Date	Filed Concurrently
		First Named Inventor	Oyvind Hillesund
		Examiner Name	Unknown
		Art Unit	Unknown
		Attorney Docket No.	14.0123-PCT-US-CONT4

METHOD OF PAYMENT (check all that apply)

Check
 Credit Card
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 None
 Other (please identify): _____

Deposit Account
 Deposit Account Number: 50-1720
 Deposit Account Name: WesternGeco

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

Application Type	FILING FEES		SEARCH FEES		EXAMINATION FEES		Fees Paid (\$)
	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	
Utility	300	150	500	250	200	100	\$1000
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee (\$)	Small Entity Fee (\$)
	Each claim over 20 or, for Reissues, each claim over 20 and more than in the original patent	50
Each independent claim over 3 or, for Reissues, each independent claim more than in the original patent	200	100
Multiple dependent claims	360	180

Total Claims **Extra Claims** **Fee (\$)** **Fee Paid (\$)** **Multiple Dependent Claims**
 34 - 20 or HP = 14 x \$50 = 700 **Fee (\$)** **Fee Paid (\$)**

HP = highest number of total claims paid for, if greater than 20

Indep. Claims **Extra Claims** **Fee (\$)** **Fee Paid (\$)**
 2 - 3 or HP = 0 x \$200 = 0

HP = highest number of independent claims paid for, if greater than 3

3. APPLICATION SIZE FEE

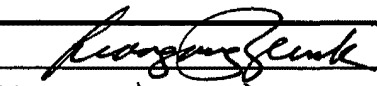
If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets **Extra Sheets** **Number of each additional 50 or fraction thereof** **Fee (\$)** **Fee Paid (\$)**
 26 - 100 = 0 / 50 = 0 (round up to a whole number) x \$250 = 0

4. OTHER FEE(S) **Fees Paid (\$)**

Non-English Specification, \$130 fee (no small entity discount)

Other: _____

SUBMITTED BY			
Signature		Registration No. (Attorney/Agent)	Telephone
Name (Print/Type)	LEONARD L. MANN	48,276	713-689-5799
			Date
			06/10/2006

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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IN THE UNITED STATES PATENT & TRADEMARK OFFICE

United States Patent Application

For

CONTROL SYSTEM FOR POSITIONING OF MARINE SEISMIC STREAMERS

By: Oyvind Hillesund and Simon Hastings Bittleston

CONTROL SYSTEM FOR POSITIONING OF MARINE SEISMIC STREAMERS

Cross-reference to Related Applications

[0001] Applicant claims priority under 35 U.S.C. § 120 from co-pending serial number 11/070,614, filed March 2, 2005, which was a continuation of parent application
5 serial no. 09/787,723, filed July 2, 2001, now Patent No. 6,932,017, which was a 35 U.S.C. § 371 national stage filing from Patent Cooperation Treaty application number PCT/IB99/01590, filed September 28, 1999, which in turn claimed priority from Great Britain patent application number 9821277.3, filed October 1, 1998, from which Applicant claims foreign priority under 35 U.S.C. § 119, all of which are incorporated herein by
10 reference. This application is also related to co-pending application serial numbers 11/____
_____ and 11/_____, filed simultaneously herewith, which also are both incorporated herein by reference.

Background of the Invention

[0002] This invention relates generally to systems for controlling seismic data
15 acquisition equipment and particularly to a system for controlling a marine seismic streamer positioning device.

[0003] A marine seismic streamer is an elongate cable-like structure, typically up to several thousand meters long, which contains arrays of seismic sensors, known as hydrophones, and associated electronic equipment along its length, and which is used in
20 marine seismic surveying. In order to perform a 3D marine seismic survey, a plurality of such streamers are towed at about 5 knots behind a seismic survey vessel, which also tows one or more seismic sources, typically air guns. Acoustic signals produced by the seismic sources are directed down through the water into the earth beneath, where they are reflected from the various strata. The reflected signals are received by the hydrophones, and then
25 digitized and processed to build up a representation of the subsurface geology.

[0004] The horizontal positions of the streamers are typically controlled by a deflector, located at the front end or "head" of the streamer, and a tail buoy, located at the back end or "tail" of the streamer. These devices create tension forces on the streamer which

constrain the movement of the streamer and cause it to assume a roughly linear shape. Cross currents and transient forces cause the streamer to bow and undulate, thereby introducing deviations into this desired linear shape.

5 [0005] The streamers are typically towed at a constant depth of approximately ten meters, in order to facilitate the removal of undesired "ghost" reflections from the surface of the water. To keep the streamers at this constant depth, control devices known as "birds", are typically attached at various points along each streamer between the deflector and the tail buoy, with the spacing between the birds generally varying between 200 and 400 meters. The birds have hydrodynamic deflecting surfaces, referred to as wings, that allow
10 the position of the streamer to be controlled as it is towed through the water. When a bird is used for depth control purposes only, it is possible for the bird to regularly sense its depth using an integrated pressure sensor and for a local controller within the bird to adjust the wing angles to maintain the streamer near the desired depth using only a desired depth value received from a central control system.

15 [0006] While the majority of birds used thus far have only controlled the depth of the streamers, additional benefits can be obtained by using properly controlled horizontally steerable birds, particularly by using the types of horizontally and vertically steerable birds disclosed in our published PCT International Application No. WO 98/28636. The benefits that can be obtained by using properly controlled horizontally steerable birds
20 can include reducing horizontal out-of-position conditions that necessitate reacquiring seismic data in a particular area (i.e. in-fill shooting), reducing the chance of tangling adjacent streamers, and reducing the time required to turn the seismic acquisition vessel when ending one pass and beginning another pass during a 3D seismic survey.

[0007] It is estimated that horizontal out-of-position conditions reduce the
25 efficiency of current 3D seismic survey operations by between 5 and 10%, depending on weather and current conditions. While incidents of tangling adjacent streamers are relatively rare, when they do occur they invariably result in prolonged vessel downtime. The loss of efficiency associated with turning the seismic survey vessel will depend in large part on the seismic survey layout, but typical estimates range from 5 to 10%. Simulations have

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