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[Continued on next page]

(54) **Title:** DECLINATION COMPENSATION FOR SEISMIC SURVEYS

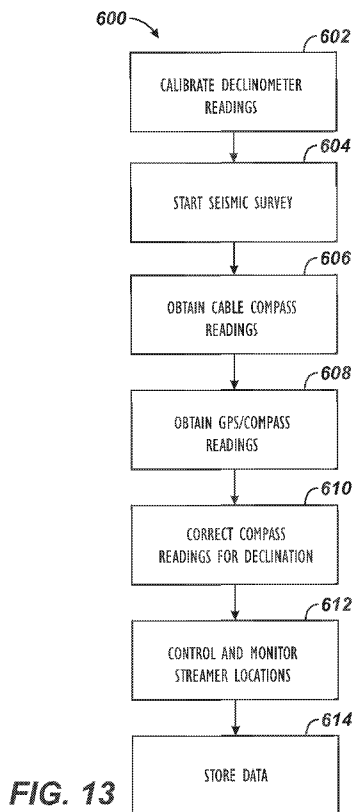
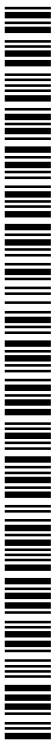


FIG. 13

(57) **Abstract:** In seismic survey for icy waters, streamers are towed behind a vessel under the water's surface to avoid ice. GPS readings may not be consistently obtained because the ice prevents a tail buoy with a GPS receiver from trailing from streamer at the surface. Instead, a device tows on the streamer under the water's surface. The streamer's absolute position is tracked by intermittently bringing the towed device toward the surface so GPS readings can be obtained. The streamer's absolute position can then be used in conjunction with compass readings and can correlate various seismic sensor signals obtained along the streamer during the survey. The compass readings can be corrected for declination using declinometer readings, which can be compensated for iron effects from the vessel or other device carrying the declinometer.



MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(88) Date of publication of the international search report:

3 October 2013

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/036739

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01V11/00 G01V1/00 G01V1/38
ADD.

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)
G01V

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/226204 A1 (GAGLIARDI JOSEPH R [US] ET AL) 9 September 2010 (2010-09-09)	1,2,5-8, 14-20
Y	paragraph [0010] paragraph [0056] paragraph [0119] - paragraph [0148] paragraph [0206] - paragraph [0213] paragraph [0219]	3,4
Y	US 6 021 577 A (SHIELLS GORDON MALCOLM [US] ET AL) 8 February 2000 (2000-02-08) column 2, line 14 - line 26	3,4
A	US 2010/312519 A1 (HUANG RONALD KERYUAN [US] ET AL) 9 December 2010 (2010-12-09) paragraph [0024] - paragraph [0027]	1,18
A	US 2008/163504 A1 (SMITH JOHN E [US] ET AL) 10 July 2008 (2008-07-10) paragraph [0102]	3,4

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	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"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
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 24 April 2013	Date of mailing of the international search report 22/07/2013
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Breccia, Luca
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/036739

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 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 No. III Observations where unity of invention is lacking (Continuation of item 3 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 fees, this Authority did not invite payment of additional fees.
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.:
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.:

1-8, 14-20

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- 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: 1-8, 14-20

Seismic survey method and apparatus including correction of declination based on interpolation of geomagnetic field measurements from more base locations.

2. claims: 9-13, 21

Method and apparatus for calibration of a seismic survey system.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/036739

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