



(43) International Publication Date
18 September 2014 (18.09.2014)

(51) International Patent Classification:
G01S 15/89 (2006.01)

(21) International Application Number:
PCT/US2014/029597

(22) International Filing Date:
14 March 2014 (14.03.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/786,521 15 March 2013 (15.03.2013) US

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(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,

KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, 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.

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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:
11 December 2014

(54) Title: SYSTEM AND METHOD FOR CALIBRATION OF ECHO SOUNDING SYSTEMS AND IMPROVED SEAFLOOR IMAGING USING SUCH SYSTEMS

2200 meter Calibration Site - June 2012

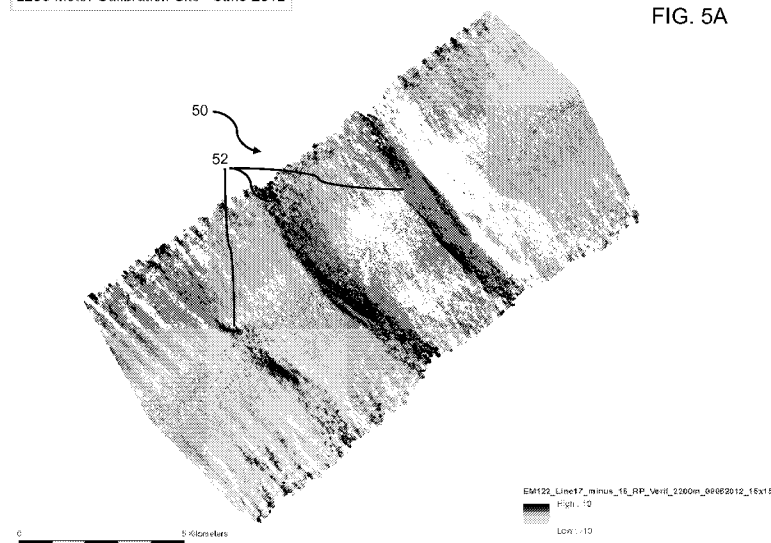


FIG. 5A

(57) Abstract: A system and method are provided for visualizing an offset in static parameters in an echo sounding system by generating a difference grid by subtracting a first survey line from a second survey line to determine difference values at each point in the grid; and displaying the difference grid on a display device, where the difference values are represented on a visual scale. The difference values may be used to calibrate the echo sounding system or check the quality of the calibration of an echo sounding system or evaluate transducer performance. Improved resolvability of echo sounding data is provided by acquiring multiple overlapping survey lines.

INTERNATIONAL SEARCH REPORT

PCT/US2014/029597 17-10-2014

International application No.

PCT/US2014/029597

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G01S 15/89 (2014.01)

USPC - 367/100

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(8) - G01S 15/02, 04, 08, 89; G01V 1/28, 30, 34, 36 (2014.01)

USPC - 367/87, 88, 99, 100; 702/2, 5, 167

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

CPC - G01S 15/02, 04, 08, 89; G01V 1/28, 30, 34, 36 (2014.02)

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

PatBase, Google Patents, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/0197773 A1 (BREWSTER et al) 08 September 2005 (08.09.2005) entire document	1-4, 7-10, 15-18, 21, 22
Y		5, 6, 11-14, 19, 20, 23, 24
Y	US 6,317,384 B1 (LUO et al) 13 November 2001 (13.11.2001) entire document	5, 6, 11-14, 19, 20
Y	US 6,055,482 A (SUDHAKAR et al) 25 April 2000 (25.04.2000) entire document	13, 14, 23, 24
A	US 5,124,952 A (KNIZE et al) 23 June 1992 (23.06.1992) entire document	1-24
A	US 4,661,935 A (SHOCK et al) 28 April 1987 (28.04.1987) entire document	1-24
A	US 2006/0004519 A1 (HUMPHREY et al) 05 January 2006 (05.01.2006)	1-24

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

* 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 application or patent 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

23 September 2014

Date of mailing of the international search report

17 OCT 2014

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

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PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

014/029597 17.10.2014
International application No.

PCT/US2014/029597

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 Extra 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 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.:
1-24

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.

Continuation of Box No. III:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-24, drawn to method for visualizing an offset in static parameters.

Group II, claims 25-36, drawn to a method for increasing the resolvability of an echo sounding system.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: generating a difference grid by subtracting a first survey line from a second survey line to determine difference values at each point in the grid; and displaying the difference grid on a display device as claimed therein is not present in the invention of Group II. The special technical feature of the Group II invention: a method for increasing the resolvability of an echo sounding system comprising producing overlapping swaths of seafloor data as claimed therein is not present in the invention of Group I.

Groups I and II lack unity of invention because even though the inventions of these groups require the technical feature of an echo sounding system comprising multiple survey lines, this technical feature is not a special technical feature as it does not make a contribution over the prior art. Specifically, US 2006/0004519 A1 (HUMPHREY et al) 05 January 2006 (05.01.2006) teaches an echo sounding system comprising multiple survey lines (a multi-beam echo sounder system for use in geophysical survey comprising multiple survey lines, Paras. 42 and 44).

Since none of the special technical features of the Group I or II inventions are found in more than one of the inventions, unity of invention is lacking.