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(72) Inventors; and

(71) Applicants : OLSSON, Mark [US/US]; 5897 Soledad Mountain Road, La Jolla, CA 92037 (US). COX, David [US/US]; 3930 Georgia Street, San Diego, CA 92103

(US). BENCH, Stephanie M [US/US]; 1739 Cereus Ct., Carlsbad, CA 92011 (US). SOUKUP, Jan [US/US]; 3541 Burbank, San Diego, CA 92111 (US). TURNER, Timothy M. [US/US]; 389 Shady Lane Unit A, El Cajon, CA 92021 (US). LEVIN, Ryan B. [US/US]; 10737 San Diego Mission Rd #204, San Diego, CA 92108 (US). MEREWETHER, Ray [US/US]; 7714 Ludington Place, La Jolla, CA 92037 (US). MARTIN, Michael J. [US/US]; 4935 Chat-
eau Dr., San Diego, CA 92117 (US).

(74) Agent: TIETSWORTH, Steven; 3527 Talbot St, San Diego, California 92106 (US).

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[Continued on nextpage]

(54) Title: MULTI-FREQUENCY LOCATING SYSTEMS AND METHODS

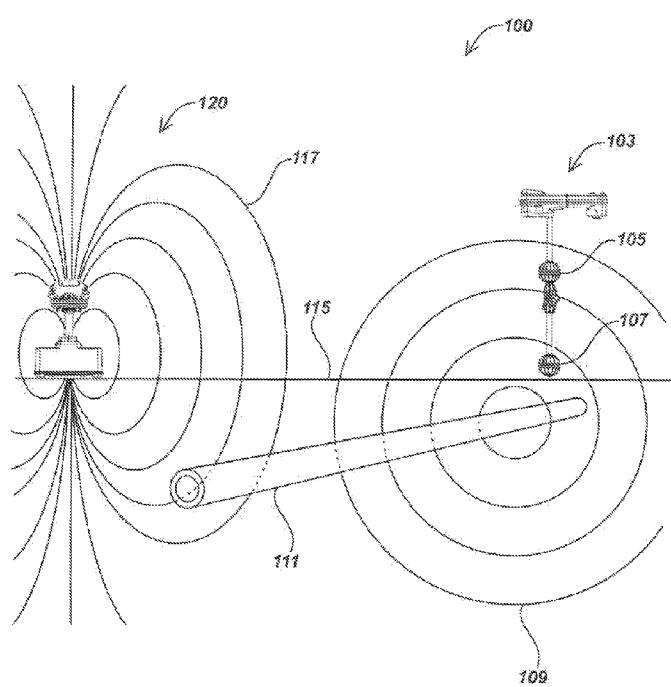


FIG. 1

(57) Abstract: Multi-frequency buried object location system transmitters and locators are disclosed. A transmitter may generate and provide output signals to a buried object at a plurality of frequencies, which may be selected based on a connection type. Corresponding locators may simultaneously receive a plurality of magnetic field signals emitted from the buried object and generate visual and/or audible output information based at least in part on the plurality of received magnetic field signals. The visual and/or audible output may be further based on signals received from a quad-gradient antenna array.

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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INTERNATIONAL SEARCH REPORT

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PCT/US2012/065126

A. CLASSIFICATION OF SUBJECT MATTER
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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 2006/284610 A1 (THOMPSON JEFF [GB] ET AL) 21 December 2006 (2006-12-21) paragraphs [0001], [0015], [0016], [0025], [0041], [0042], [0061]; figure 1 -----	1
Y	US 2008/136631 A1 (FLUCK FREDERICK DEAN [US]) 12 June 2008 (2008-06-12) abstract paragraphs [0002], [0006] - [0010] -----	2-5, 10-15
Y		2-5, 10-15



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 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	Date of mailing of the international search report
16 October 2013	10/01/2014

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

Vollmer, Thorsten

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/065126

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.:

1-5 , 10-15

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: 1-5, 10-15

how to display information

2. claims: 6-9

processing of signals with a unique frequency

3. claims: 16-20

generating simultaneously signals with different frequencies and retrieving magnetic signals

4. claims: 21-35, 100-106

timing of buried transmitters

5. claims: 36-41

processing signals based on timing information

6. claims: 42-46

transmitting of information through the underground

7. claims: 47-51, 76, 77

coupling of output signals to a buried object

8. claims: 52-59

generating of a buried object current

9. claims: 60-65

coupling of a buried object transmitter to the ground

10. claims: 66-75

estimating the depth of a buried object

11. claims: 78-95

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

generating output signals with different frequencies

12. claims: 96-99

retrieving information based on the phases of signals

13. claim: 107

buried object locator system with buried transmitter and a buried receiver

14. claim: 108

buried object locator system with means for generating output signals

15. claims: 109, 111, 112, 115, 116

a buried object transmitter

16. claims: 110, 113, 114, 117, 118

a buried object receiver

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2012/065126

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
us 2006284610	AI 21-12-2006	CA CN EP GB JP US Wo	2613304 AI 101248372 A 1899749 AI 2427474 A 2008544273 A 2006284610 AI 2006136779 AI	28-12-2006 20-08-2008 19-03-2008 27-12-2006 04-12-2008 21-12-2006 28-12-2006
us 2008136631	AI 12-06-2008	US US	2008136631 AI 2008284425 AI	12-06-2008 20-11-2008