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- (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, ML, MR, NE, SN, TD, TG).

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))

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- with international search report (Art. 21(3))

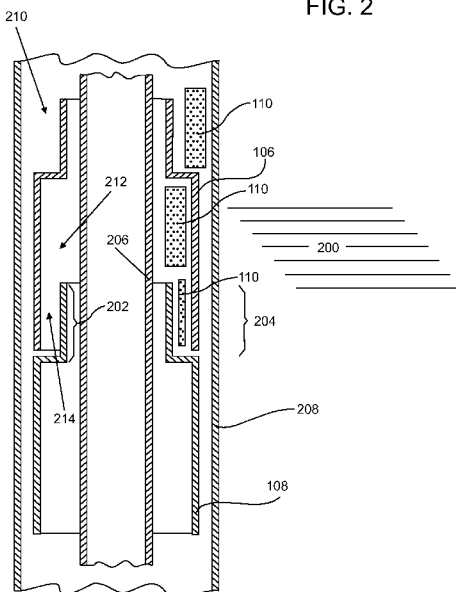
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[Continued on next page]

(54) **Title:** DISTRIBUTED SENSORS TO MEASURE CEMENT STATE

(57) **Abstract:** A system for determining a curing state for cement disposed in a borehole penetrating the earth that includes a transceiver that includes a transmitting coil and that is configured to provide an input signal to the coil that sweeps through a frequency range and to measure the magnitude of the voltage across the coil. The system also includes a plurality of sensor nodes disposed in the concrete. The sensor nodes include a receiving coil and a capacitor coupled to the receiving coil to form a receiving circuit and that has a capacitance that changes as one of pressure or strain in the cement changes.

FIG. 2



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— *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))*

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A. CLASSIFICATION OF SUBJECT MATTER*E21B 47/09(2006.01)i, E21B 47/13(2012.01)i*

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)

E21B 47/09; E21B 47/00; G06F 17/00; E21B 33/13; G08B 23/00

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: curing, cement, transceiver, sensor, coil, capacitor

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 7712527 B2 (RODDY, CRAIG W.) 11 May 2010 See column 3, line 64 - column 5, line 17, and column 10, line 30 - column 11, line 20.	1-8
Y	US 7478108 B2 (TOWNSEND, CHRISTOPHER P. et al.) 13 January 2009 See column 8, lines 8 - 21, column 10, lines 37 - 48 and figure 3.	1-8
A	US 2010-0051275 A1 (LEWIS, SAM et al.) 04 March 2010 See the whole document.	1-8
A	US 2010-0051266 A1 (RODDY, CRAIG W. et al.) 04 March 2010 See the whole document.	1-8

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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Information on patent family members

International application No.

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