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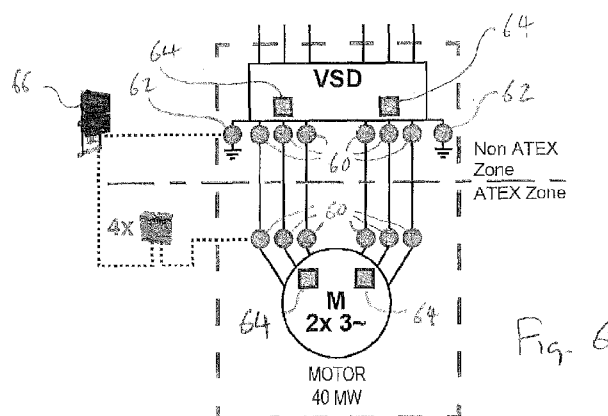
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(88) Date of publication of the international search report:

10 November 2016

(54) Title: CONDITION MONITORING METHOD AND APPARATUS FOR HIGH-VOLTAGE AC ELECTRICAL SYSTEMS



(57) Abstract: Monitoring apparatus for monitoring partial discharge activity in an AC electrical system comprises: a pair (60) of high- and low-frequency sensors; a timing module arranged to receive a cyclic signal from the low-frequency sensor and to provide a timing signal derived from the timing of successive cycles of the cyclic signal; and a monitoring unit (66) arranged to digitise a signal from the high-frequency sensor, to capture the digitised signal as consecutive data blocks of varying duration, and to trigger the capture of each data block in response to the timing signal. A condition monitored electrical system comprises a variable-speed drive (VSD) and a motor (M) operated by the drive, wherein the pair (60) of sensors is arranged at an end of a cable supplying power from the drive to a winding of the motor. A sensor unit (60) for condition monitoring of a high-voltage electrical system comprises a split-core current transformer with a low-frequency winding, arranged for sensing a high-voltage AC waveform in a cable about which the transformer is positionable, and a high-frequency winding arranged for sensing pulses in the cable that originate from partial discharge activity.

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2016/050942

A. CLASSIFICATION OF SUBJECT MATTER

INV. G01R31/34 G01R15/18 G01R31/06 G01R31/12 G01R31/42
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)

G01R H01H

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 2013/191049 A1 (SALES CASALS LLUIS-RAMON [IT] ET AL) 25 July 2013 (2013-07-25) figures 1-6 paragraph [0031] - paragraph [0035] paragraph [0073] - paragraph [0085] paragraphs [0096], [0156], [0163] paragraph [0156] - paragraph [0164] -----	1-8, 11-24, 26-37
A	US 2011/006755 A1 (YOUNSI KARIM [US] ET AL) 13 January 2011 (2011-01-13) paragraphs [0053], [0046], [0041], [0039]; figures 4,6 -----	27-37
A	US 2002/097065 A1 (KRAHN JOHN RAYMOND [US] ET AL) 25 July 2002 (2002-07-25) paragraph [0019] - paragraph [0024] figure 2 ----- -/-	27-37



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

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"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

9 September 2016

Date of mailing of the international search report

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Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2016/050942

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2014/320139 A1 (RENFORTH LEE [GB] ET AL) 30 October 2014 (2014-10-30) paragraph [0045] - paragraph [0052] paragraph [0059] - paragraph [0065] -----	1-8, 11-24, 26-37

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2016/050942

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.:

1-8, 11-24, 26-37
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.:

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, 11-24, 26

Monitoring partial discharge.

2. claims: 27-37

Condition monitored electrical system with a variable-speed drive operating a motor.

3. claims: 9, 10, 25, 38-47

Sensor unit with split-core current transformer.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2016/050942

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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