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(54) Title: SENSING SYSTEM FOR DETECTING MACHINE FLUID DEGRADATION

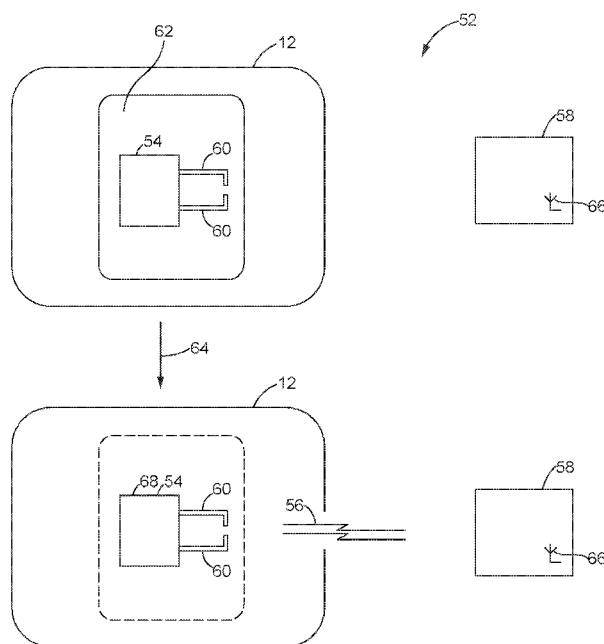


FIG. 3

(57) Abstract: A sensing system (52) for detecting degradation of a machine fluid (12) is disclosed. The sensing system (52) may comprise a tag (54) having electrical contacts (60). The tag (54) may be configured to transmit a wireless signal (56) when the electrical contacts (60) are in electrical communication. The sensing system (52) may further comprise a dissolvable element (62) separating the electrical contacts (60) and obstructing electrical communication between the electrical contacts (60). The dissolvable element (62) may be configured to dissolve and allow electrical communication between the electrical contacts (60) when an acid content of the machine fluid (12) reaches a level indicative of the degradation of the machine fluid (12).



MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,  
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A. CLASSIFICATION OF SUBJECT MATTER  
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ADD.  
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B. FIELDS SEARCHED  
Minimum documentation searched (classification system followed by classification symbols)  
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 675 662 A (KONDO KENJI [JP] ET AL) 23 June 1987 (1987-06-23) abstract; figures 1,3 -----	1-11
A	WO 2007/051216 A2 (AC2T RES GMBH [AT]; AGOSTON ATTILA [AT]; JAKOBY BERNHARD [AT]) 10 May 2007 (2007-05-10) abstract; figure 8 -----	1-11
A	WO 00/45145 A2 (WENMAN RICHARD A [US]) 3 August 2000 (2000-08-03) page 9, line 19 - page 10, line 33 -----	1-11
A	US 2003/046985 A1 (SCHOESS JEFFREY N [US]) 13 March 2003 (2003-03-13) abstract; figure 1 -----	1-10
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See patent family annex.

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Date of the actual completion of the international search  20 July 2018	Date of mailing of the international search report  02/08/2018
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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  Gilow, Christoph
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International application No  
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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 2006/230833 A1 (LIU JAMES Z [US] ET AL) 19 October 2006 (2006-10-19) abstract; figure 9 -----	1-10

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2017/059905
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4675662	A	23-06-1987	NONE
-----			
WO 2007051216	A2	10-05-2007	AT 502876 A1 15-06-2007
			EP 1943496 A2 16-07-2008
			WO 2007051216 A2 10-05-2007
-----			
WO 0045145	A2	03-08-2000	CA 2359230 A1 03-08-2000
			EP 1379886 A2 14-01-2004
			US 6577140 B1 10-06-2003
			WO 0045145 A2 03-08-2000
-----			
US 2003046985	A1	13-03-2003	NONE
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US 2006230833	A1	19-10-2006	CN 101198865 A 11-06-2008
			EP 1869447 A1 26-12-2007
			KR 20070120602 A 24-12-2007
			US 2006230833 A1 19-10-2006
			WO 2006112915 A1 26-10-2006
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