US009411069B1

(12) **United States Patent**
Lamberti et al.

(10) **Patent No.: US 9,411,069 B1**
(45) **Date of Patent: Aug. 9, 2016**

(54) **WIRELESS RADIATION SENSOR**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/842,007**

(22) Filed: **Sep. 1, 2015**

Related U.S. Application Data

(63) Continuation-in-part of application No. 14/493,811, filed on Sep. 23, 2014, which is a continuation-in-part of application No. 13/832,873, filed on Mar. 15, 2013, now Pat. No. 8,871,523.

(51) **Int. Cl.**

G01N 27/72	(2006.01)
G01N 27/74	(2006.01)
G01N 33/00	(2006.01)
G01V 5/00	(2006.01)
G01N 27/80	(2006.01)
G01N 33/20	(2006.01)

(52) **U.S. Cl.**
CPC ***G01V 5/0008*** (2013.01); ***G01N 27/80*** (2013.01); ***G01N 33/203*** (2013.01); *G01N 27/72* (2013.01); *G01N 33/0057* (2013.01); *G01N 2033/0093* (2013.01); *Y10T 436/25875* (2015.01)

(58) **Field of Classification Search**
CPC G01N 33/0004; G01N 33/0057; G01N 33/20; G01N 33/203; G01N 33/22; G01N 33/227; G01N 1/22; G01N 1/2273; G01N 27/72; G01N 27/74; G01N 27/80; G01N 2033/0093; Y10T 436/25875; G01V 5/0008
USPC 436/73, 84, 149, 150, 151, 181; 422/68.1, 69, 83, 88
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,821,129	A	10/1998	Grimes et al.	
6,270,591	B2	8/2001	Chiriac et al.	
6,393,921	B1	5/2002	Grimes et al.	
7,694,346	B2	4/2010	Adams	
7,824,619	B1	11/2010	Aviram	
8,871,523	B1 *	10/2014	Lambert	G01N 33/00057 422/83
2006/0032289	A1	2/2006	Pinnaduwage et al.	
2006/0231420	A1	10/2006	Garzon et al.	

OTHER PUBLICATIONS

Skorvanek et al. Phys. Stat. Sol., vol. 99, 1987, pp. 275-278.*
Ong et al. Journal of IEEE Sensors, vol. 6, No. 3, Jun. 2006, pp. 514-523.*

(Continued)

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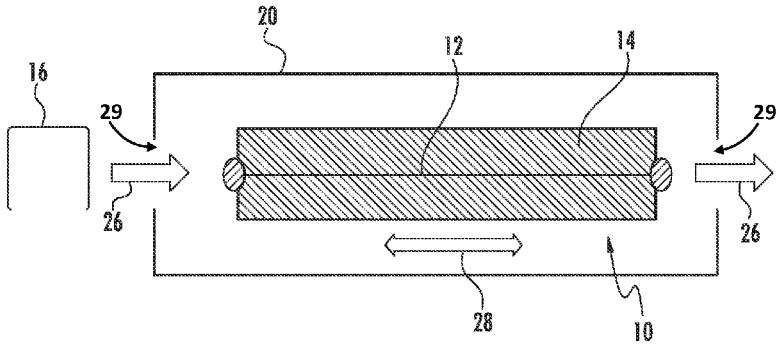
(57) **ABSTRACT**

Disclosed is a sensor for detecting radiation. The sensor includes a ferromagnetic metal and a radiation sensitive material coupled to the ferromagnetic metal. The radiation sensitive material is operable to change a tensile stress of the ferromagnetic metal upon exposure to radiation. The radiation is detected based on changes in the magnetic switching characteristics of the ferromagnetic metal caused by the changes in the tensile stress.

18 Claims, 5 Drawing Sheets