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Ban et al.

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(54) **REFLECTIVE SENSOR FOR DETECTION OF MATERIAL DEGRADATION**

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(58) **Field of Classification Search**

None
See application file for complete search history.

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(56) **References Cited**

U.S. PATENT DOCUMENTS

5,367,583 A 11/1994 Sirkis
2006/0077379 A1 4/2006 Frot et al.

(Continued)

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OTHER PUBLICATIONS

Wan, Kai Tai, et al., "Durability Tests of a Fiber Optic Corrosion Sensor," Mar. 16, 2012, *Sensors* 2012, 12, pp. 3656-3668.*

(Continued)

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(57) **ABSTRACT**

A sensor for detecting material degradation may include an optical fiber and a housing through which the optical fiber extends. An end cap may be affixed to an end of the housing. Light provided through the optical fiber may be reflected off of the end cap back through the optical fiber. The end cap may be made of a material of interest, and may be situated in an environment wherein the material of interest is present. A light source may provide input light through the optical fiber. A portion of the input light may be reflected off of the end cap. A light receptor may receive the reflected light via the optical fiber. A processing unit may be adapted to compare a measured intensity of the reflected light to a threshold, and to initiate an alarm condition if the measured intensity is below the threshold.

18 Claims, 5 Drawing Sheets

