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Patent Summary

(12) Patent Application:	(11) **CA 2700469**
(54) English Title:	CAPACITIVE PROBES AND SENSORS, AND APPLICATIONS THEREFOR, AND MULTIMODE WIRELESS DEVICES
(54) French Title:	SONDES ET CAPTEURS CAPACITIFS, LEURS APPLICATIONS ET DISPOSITIFS SANS FIL MULTIMODAUX

Representative Drawing

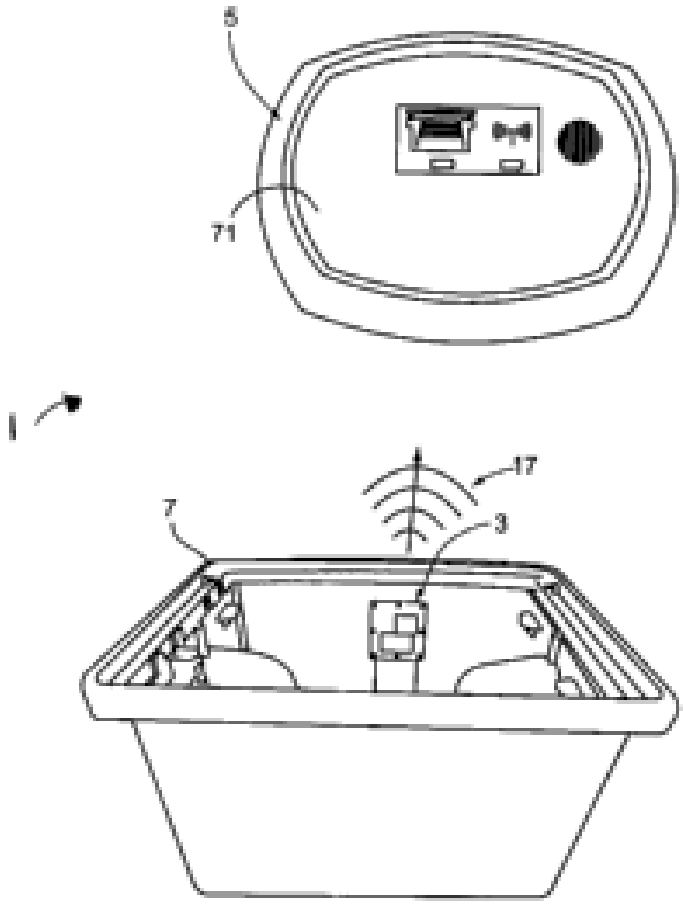

FIG. 1

Abstracts

Third-party disclaimer

English Abstract

Sensor includes electrodes on internal layer of multilayer printed circuit board, and sensing circuitry drives electrodes and reads signal having characteristic based upon capacitance between electrodes. Board may have first layer second layer, with electrodes between layers. One layer may be thicker than other layer such that capacitance external to board is primarily contributed from adjacent other layer. Electrodes may be on internal surface and sensing circuitry may be on opposing external surface. Components for sensing circuitry may be assembled to board such that board and components are multilayer printed circuit board assembly. Circuitry having wireless transmitter and wireless

receiver, wherein circuitry has operating mode to transmit signals remotely through transmitter and ship mode wherein transmitter is silenced, and in operating mode circuitry listens for signals indicating transmitted signal has been received, and if receiver has not received acknowledgement one signal then circuitry enters ship mode.

French Abstract

Selon l'invention, un capteur comprend des électrodes sur une couche interne de carte de circuit imprimé multicouche, et des éléments de circuit de détection qui commandent les électrodes et lisent un signal ayant une caractéristique sur la base d'une capacité entre les électrodes. La carte peut avoir une première couche, une seconde couche, des électrodes étant disposées entre les couches. Une couche peut être plus épaisse que l'autre couche de telle sorte que la capacité externe à la carte provient principalement de l'autre couche adjacente. Des électrodes peuvent être sur une surface interne et des éléments de circuit de détection peuvent être sur une surface externe opposée. Des composants pour des éléments de circuit de détection peuvent être assemblés sur la carte de telle sorte que la carte et les composants forment un ensemble de carte de circuit imprimé multicouche. Les éléments de circuit ont un émetteur sans fil et un récepteur sans fil, les éléments de circuit ayant un mode fonctionnel pour transmettre des signaux à distance par l'émetteur et un mode de transport dans lequel l'émetteur est rendu silencieux et, dans le mode fonctionnel, les éléments de circuit écoutent des signaux indiquant qu'un signal transmis à été reçu et, si le récepteur n'a pas reçu l'acquittement d'un signal, alors les éléments de circuit passent en mode de transport.

Patent Details

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View Patent Image	Download Patent Image in PDF Format	Size of Image (KB)	Number of Pages
Cover Page	Cover Page	51	2
Abstract	Abstract	77	2
Claims	Claims	188	5
Description	Description	1,634	36
Drawings	Drawings	514	28
Representative Drawing	Representative Drawing	6	1

PDF Readers.

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CLAIMS

1. A sensor comprising: electrodes on an internal surface between first and second printed circuit board substrate layers of a multilayer printed circuit board, and sensing circuitry to drive the electrodes and to read a signal having a characteristic based upon the capacitance between the electrodes including capacitance external to the multilayer printed circuit board, wherein the first printed circuit board substrate layer of the multilayer printed circuit board is thicker than the second printed circuit board substrate layer such that capacitance external to the multilayer printed circuit board is primarily contributed from adjacent the second printed circuit board substrate layer.

2. The sensor of claim 1 wherein the electrodes are on an internal surface of the second printed circuit board substrate layer and the sensing circuitry is on an opposing external surface of the second printed circuit board substrate layer.

3. The sensor of claim 2 wherein components for the sensing circuitry are assembled to the multilayer printed circuit board such that the board and components are a multilayer printed circuit board assembly.

4. A sensor comprising: A multilayer printed circuit board including a probe having two electrodes side by side on a buried first surface between first and second printed circuit board substrate layers of the multilayer printed circuit board, and sensing circuitry on an outer second surface of the multilayer printed circuit board to drive the electrodes and sense a signal having a characteristic dependent on the capacitance between the electrodes, and a cover about the sensing circuitry in sealed connection with the printed circuit board outer second surface.

5. The sensor of claim 4 wherein the first surface and the second surface are opposing surfaces of the first printed circuit board substrate layer of the multilayer printed circuit board.

6. The sensor of claim 5 wherein the second printed circuit board substrate layer is sealed to the first surface of the first printed circuit board substrate layer about the two electrodes.

7. The sensor of claim 5 wherein the wherein the capacitance between the electrodes is provided through the first printed circuit board substrate layer of the multilayer printed circuit board and the first printed circuit board substrate layer is sufficiently thin such that the probe has a sufficient range of capacitance for sensing when the first printed circuit board substrate layer is adjacent air and when the probe is adjacent water.

8. The sensor of claim 5 wherein the electrodes are separated by a narrow uniform gap such that the probe has a sufficient range of capacitance for sensing when the probe is adjacent air and when the probe is adjacent water.

9. The sensor of claim 5 wherein the capacitance between the electrodes is the capacitance between the electrodes through the first printed circuit board substrate layer of the multilayer printed circuit board and the first printed circuit board substrate layer is sufficiently thin and the electrodes are separated by a narrow uniform gap such that the probe has a sufficient range of capacitance for sensing when the probe is adjacent air and when the probe is adjacent water.

10. The sensor of claim 9 wherein the sensing circuitry drives the electrodes to charge the capacitance between the electrodes and senses a charging time constant of the signal.

11. The sensor of claim 10 wherein the sensing circuitry drives the electrodes to charge the capacitor and senses a frequency of the signal.

12. The sensor of claim 11 wherein the sensor is configured to sleep for an extended time between successive cycles of driving the electrode and sensing the

signal.

13. The sensor of claim 12 wherein the sensor further comprises a wireless radio frequency transmitter to transmit a signal remote from the sensor containing information based on the sensed capacitance.

14. A sensing system comprising: the sensor of claim 13, and a remote unit to receive the signal and determine a level of grease on the probe.

15. The system of claim 14, wherein the remote unit further has a display to display information about a level of grease where the sensor is installed.

16. A grease interceptor comprising: a tank to intercept grease, and the sensing system of claim 14, wherein the sensor is installed in the tank and senses capacitance of contents within the tank and the remote unit displays a level of grease within the tank.

17. A sensor comprising: a printed circuit board substrate having opposing first and second surfaces including a probe having two electrodes side by side on a first surface of the printed circuit board, and sensing circuitry on a surface of the printed circuit board substrate to drive the electrodes and sense a signal having a characteristic dependent on the capacitance between the electrodes through the first and second surfaces of the printed circuit board substrate.

18. A method of sensing grease within a grease interceptor tank comprising: driving with a pulse a sensor comprising electrodes on an internal surface between first and second printed circuit board substrate layers of a multilayer printed circuit board, and sensing circuitry to drive the electrodes and to read a signal having a characteristic based upon the capacitance between the electrodes including capacitance external to the multilayer printed circuit board, wherein the first printed circuit board substrate layer of the multilayer printed circuit board is thicker than

the second printed circuit board substrate layer such that capacitance external to the multilayer printed circuit board is primarily contributed from adjacent the second printed circuit board substrate layer, sensing the time constant of a resistor-capacitor (RC) circuit provided by the sensor through the probe to determine a measure of capacitance for the probe when in contact with grease, water or a combination thereof.

19. The method of claim 18 further comprising wirelessly transmitting a signal remote from the sensor containing information based on the sensed capacitance.

20. The method of claim 19 further comprising remotely receiving the signal, and determining a level of grease on the probe.

21. The method of claim 19 wherein the sensor is installed in a grease interceptor tank, and the method further comprises remotely receiving the sensor signal, and determining and displaying to a user a level of grease in the tank based on the received signal.