

TERMITE ALERT DEVICE

Field of Invention

The present invention relates generally to a termite alert device for providing an alert when presence of termite is suspected.

Background

Termites are the most important wood-destroying structural pests in the world. They normally live below ground and may move up into a structure where they cause damage. Termites are "social insects" as they live in a nest or colony which is typically found underground, often near a tree, stump, wood pile or other source of 'food' that contain cellulose.

Members of the termite colony forage for food and burrow galleries or passageways in the soil outwardly from the colony or nest, and portions of food located by foraging termites are returned to the nest. Termites can be very destructive because of their voracious appetites, especially for wood and other cellulose materials. The ability of termites to cause considerable damage is in part due to the fact that the termites are typically not seen until termite infestation is at a relatively advanced stage. Termites are difficult to detect and control because they are cryptic creatures that usually cause damage to the interiors of wooden structures, or otherwise in places that are not readily observable. Termites must have moisture and must transport food to the subterranean colonies in order to live. Consequently, they must return to the ground around or beside a building after they have eaten part of the wooden structures.

A typical but effective method to find, and being alerted to the presence of, termites is with a bait station installed in the ground. The bait stations are baited with blocks of wood (the bait or bait structure) which are consumable by termites. Bait stations are commonly spread around the foundation of structures, then monitored by bending over to open a cap and remove blocks of wood.

The baits may be provided in the form of bait cartridges containing compressed cellulose materials that act as monitors to detect termite activity before the "Toxin" is inserted. These

toxins (non-repellent insecticides) used in the baiting station are usually slow acting so that the toxin can be spread by the foraging worker termites to other members of the colony that do not collect their own food. This includes the reproductive 'king' and 'queen' and the soldier termites, as well as those workers that maintain the nest and tend to new offspring.

The typical bait stations require an intense labour involved maintenance program. The pest control technician must first find these devices, then bend over at every unit to open a cap and see if there are any termites present. Once the presence of termites is detected, the pest control technicians are required to introduce toxins into the bait stations or bait cartridges. This is an inefficacious approach as multiple devices may be used for each premise which will put a strain on manpower requirements as well as on the physical well-being of the pest control technicians. Therefore, there is an apparent need for a termite alert device for addressing the foregoing issues.

Summary

In accordance with a first aspect of the invention, there is disclosed a termite alert device comprising a switch having an actuator biased in a first actuator position and displaceable to a second actuator position by a bait structure supported by a bait support, the bait support and the switch being inter-configured and the bait structure being shaped and dimensioned for displacing the actuator to the second actuator position when being supported on the bait support. The termite alert device further comprises sensor telemetry in signal communication with the switch for transmitting an alert signal in response to displacement of the actuator towards the first actuator position being sensed thereby. Wherein at least one of weakening and destruction of the bait structure causes the actuator of the switch to displace towards the first actuator position, the alert signal for being receivable by a data receiver for registering displacement of the actuator of the switch towards the first actuator position.

In accordance with a second aspect of the invention, there is disclosed a termite alert method, comprising operating a termite alert system including a plurality of termite alert devices and a data receiver, each of the plurality of termite alert devices comprising a switch having an actuator biased in a first actuator position and displaceable to a second actuator position by a bait structure supported by a bait support, the bait support and the switch being inter-

configured and the bait structure being shaped and dimensioned for displacing the actuator to the second actuator position when being supported on the bait support, and sensor telemetry in signal communication with the switch for transmitting an alert signal in response to displacement of the actuator towards the first actuator position being sensed thereby. At least one of weakening and destruction of the bait structure causes the actuator of the switch to displace towards the first actuator position, the alert signal for being receivable by a data receiver for registering displacement of the actuator of the switch towards the first actuator position, the alert signal being translatable into alert data at least being indicative of displacement of the actuator being detected. The termite alert method further comprising wirelessly transmitting the alert signal from a first one of the termite alert devices to a second one of the termite alert devices, and wirelessly providing the alert data from the second one of the termite alert devices to the data receiver. The termite alert system is established by placing the first one of the termite alert devices at a first location and providing at the first one of the termite alert devices a first output indicating communication between the first one of the termite alert devices and the data receiver, and positioning the second one of the termite alert devices at a second location and providing at the second one of the termite alert devices a second output indicating direct or indirect communication between the second one of the termite alert devices 20 and the data receiver.

Brief Description of the Drawings

FIG. 1 shows a partial front elevation a termite alert device in accordance with an aspect of the invention with a first housing coupled to a second housing;

FIG. 2 shows a partial front sectional view of the termite alert device of FIG. 1 with a battery module, a sensor telemetry, a switch and a plunger arranged with a bait structure;

FIG. 3 shows a partial front elevation of the termite alert device of FIG. 1 without the first housing and the second housing;

FIG. 4 shows a partial front elevation of the termite alert device of FIG. 1 without the first housing and the second housing and in the absence of the battery module of FIG. 2;

FIG. 5 shows a partial system diagram of the termite alert device of FIG. 1;

FIG. 6 shows a partial system diagram of a plurality of the termite alert device of FIG. 1 being used in a termite alert system; and

FIG. 7 shows a partial process flow diagram of a termite alert method for use with the termite alert device of FIG. 1.

Detailed Description

Reference will now be made in detail to an exemplary embodiment of the present invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the embodiment, it will be understood that they are not intended to limit the invention to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of embodiments of the present invention, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be recognized by one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, components, and circuits have not been described in detail as not to unnecessarily obscure aspects of the embodiments of the present invention

An exemplary embodiment of the invention, a termite alert device 20, is described with reference to FIGS 1 to 7. The termite alert device 20 comprises a switch 22 having an actuator 24 biased in a first actuator position and displaceable to a second actuator position by a bait structure 26 supported by a bait support 28. The bait support 28 and the switch 22 are inter-configured and the bait structure 26 is shaped and dimensioned for displacing the actuator 24 to the second actuator position when being supported on the bait support 28. The termite alert device 20 further comprises sensor telemetry 30 in signal communication with the switch 22 for transmitting an alert signal in response to displacement of the actuator 24 towards the first actuator position being sensed thereby. At least one of weakening and destruction of the bait structure 26 causes the actuator 24 of the switch 22 to displace towards the first actuator position. The alert signal is receivable by a data receiver 32 for registering displacement of the actuator 24 of the switch 22 towards the first actuator position and the alert signal is translatable into alert data at least being indicative of displacement of the actuator 24 being detected. Displacement of the actuator 24 is indicative of weakening or destruction of the bait structure 26 which in turn can mean or infer the presence of termites.

The termite alert device 20 further comprises the bait support 28 adapted for at least one of abutting, supporting, holding and substantially isolating movement of the bait structure 26 prior to being weakened. The bait structure 26 is elongated along a first axis 34 with the first axis 34 coinciding the bait support 28 and the actuator 24 when positioned therebetween to displace the actuator 24 towards the second actuator position. Besides being elongated, the bait structure 26 may take on other shapes such as planar and other rectilinear shapes that is able to be positioned for abutting the actuator, directly or indirectly, to displace the actuator 24 towards the second actuator position and where weakening or destruction of the bait structure 26 will release the actuator 24 from the second actuator position which in turn will allow the actuator 24 to displace towards the first actuator position wheretowards it is resiliently biased.

Preferably, the sensor telemetry 30 comprises a transducer circuit 36 for transducing displacement of the actuator 24 of the switch 22 into the alert data, and a communication module 38 for transmitting the alert signal from the transducer circuit 36. The switch 22 may be calibrated and the transducer circuit 36 may be adapted to generate the alert signals when any displacement of the actuator 24 is detected, when the actuator 24 displaces from the second actuator position or when the actuator 24 reaches the first actuator position.

Preferably, the termite alert device 20 further comprises a battery module 40 for storing energy and for discharging the electrical energy to power the sensor telemetry 30. The termite alert device 20 may further comprise a photovoltaic device for generating electrical energy in the presence of light for charging the battery module 40. Additional or alternative to the photovoltaic module, the termite alert device 20 can further comprise an inductive charging device to enable the battery module 40 to be inductively charged, or a connector, for example a USB adaptor or connector to enable direct charging of the battery module 40 via an external power source.

The termite alert device 20 as in claim 1, further comprising a controller module 44 further for sensing energy level of the battery module 40 and for generating and transmitting a maintenance signal, translatable into maintenance data being indicative of at least one of a request for maintenance, maintenance type and maintenance requirements, for receipt by the

data receiver 32 in response to the energy level of the battery module 40 being below a pre-determined level. The controller circuit 44 can comprise the sensor telemetry 30. Alternatively, the controller circuit 44 is independent from but in signal communication with the sensor telemetry 30.

To enable the source of the alert signal to be identifiable, the alert data, and consequently the alert signal, preferably comprises at least one of an identifier for uniquely identifying the sensor telemetry 30, a date stamp and a time stamp. The alert signal preferably contains alert data indicating at least one of the activation, or deactivation, of the switch 22 and status of the termite alert device 22. The alert data can further comprise the identifier. Preferably, the bait structure 26 containing at least cellulosic material.

The termite alert device 20 further comprises a first housing 46 wherein the sensor telemetry 30 and the switch 22 are contained, and a plunger 48 movably coupled to the first housing 46 and configured to displace along a plunger axis 50 defined by the first housing 46 and to abut the actuator 24 for following displacement thereof between the first actuator position and the second actuator position. The plunger 48 interposes the actuator 24 and the bait structure 26 when the bait structure 26 is positioned for support by the bait support 28. The first housing 46 can comprise a guide structure 51a in the form of rails, slots, notches or the like to guide movement of the plunger 48 along the plunger axis 50. Although not necessary but preferred in our current embodiment of the invention, the plunger axis 50 is substantially parallel the first axis 34. The first housing 46 can further comprise a plunger biasing assembly 51b, for example through the use of one or more coil springs, for resiliently biasing the plunger 48 away from the switch 22. The plunger biasing assembly 51b assist in the displacement of the plunger 48 along the plunger axis 50 and away from the switch 22 to allow the actuator 24 to better displace towards its first actuator position when the bait structure 26 has been weakened or destroyed. This allows the force applied on the bait structure 26 to be increased beyond what the resilience biasness, or force, that can be applied by the actuator 24. Further, the actuating force or sensitivity of to the structural integrity of the bait structure 26 can be calibrated or varied by selecting the right spring stiffness of springs used in the plunger biasing assembly 51b.

The termite alert device 20 further comprises a user-interface (UI) module 52 being operable for providing at least one of an audible indicator and a visual indicator when the energy level of the battery module 40 is at least one of above and below a pre-determined level. Preferably, the first housing 46 is substantially weather-sealed. The UI module 52 can comprise a display, for example an LCD screen or LED arrays, for displaying or visually indicating, for example connectivity status to the data receiver 32, energy level of the battery module 40 or the like indicator of the status of the termite alert device 22 and constituents of the alert data.

The termite alert device 20 further comprises a second housing 54 defining a concavity 56 and an opening 58 to the concavity 56. The bait support 28 is defined within the concavity 56 of the second housing 54 with the second housing 54 being shaped and dimensioned for receiving the bait structure 26 when the opening 58 of the second housing 54 couples with the first housing 46 for disposing the bait structure 26 between the plunger 48 and the bait support 28 to thereby displace the actuator 24 to the second actuator position.

The second housing 54 defines a plurality of apertures 60 for enabling termite access to the bait structure 26. Preferably, each of the first housing 46 and the second housing 54 being substantially cylindrically-shaped to enable removable nesting of the first housing 46 with the second housing 54 at the opening 58 of the second housing 54.

The termite alert device 20 further comprises a lock mechanism 62 for locking and impeding separation of the first housing 46 to the second housing 54 when inter-nested. Further, the lock mechanism may be un-locked via a physical key or a magnet to enable decoupling of the second housing 54 from the first housing 46.

Preferably, the termite alert device 20 further comprises an adaptor structure (not shown) for inter-coupling the first housing 46 and the second housing 54. The adaptor structure may come in varying sizes and preferably has an annular-like shape. This will enable the same first housing 46 to be used with various differently-shaped and/or sized second housings 54.

The first housing 46 comprises a battery holder 66 defined in the first housing 46 and a removal hatch 68 to enable placement, retention and removal of batteries, for example the battery module 40, into the battery holder 66. The batteries are for powering the sensor telemetry 30.

Preferably, the data receiver 32 is for rebroadcasting the alert signal, and consequently for rebroadcasting the alert data, being received thereby. The data receiver 32 may function only to rebroadcast the alert signal or is another termite alert device capable of transmitting its own alert signal as well as to rebroadcast alert signals received thereby. Additionally or alternatively, the data receiver 32 is further for collating for generating actionable data from or a data ensemble from the collated alerted signals. As such, the sensor telemetry 30, or the controller module 44, can further function to rebroadcast alert signals received from other termite alert device. In one implementation, the data receiver 32 may be a back-end server for receiving the alert data from the termite alert device 20 via a telecommunication network, for example a mobile network, or via the Internet.

The controller module 44 can be operated, via UI module 52, to signal pair with the data receiver 32. Pairing and signal communication, including data exchange, can occur via low-power WAN, WiFi, Bluetooth, cellular network, HF signalling or the like communication means, platform and protocols. The controller module 44 may also communicate with handheld smart devices, for example by Bluetooth, to initiate and configure pairing or to check on the health and status of the termite alert device 20.

One embodiment of the present application is a termite alert system 80 that includes the data receiver and a plurality of the termite alert devices 20 being spaced apart within and/or around a premise being monitored for the presence of termites and preferably the general location of the termite colonies. The termite alert devices 20 each include a sensor and wireless communication circuitry. At least some of the termite alert devices 20 are structured to relay information, transmitted and received in the form of the alert signals, received from one or more other of the termite alert devices 20 to the data receiver. In one form, the data receiver is in communication with a remotely located data management server via a computer

network. Alternatively or additionally, the data receiver can be a form of gateway structured to collect information from each control device and communicate it to a remote destination.

The termite alert system 80 includes a termite monitoring arrangement 82 that communicates with a central data management server 84 by a communication network 86. The communication network 86 is more specifically depicted in three nonlimiting forms as a wireless Wide Area Network (WAN), a cellular network and the Internet. A number of clients 122 of central data management server 84 are also employable that can selectively access central data management server 84 through Internet. The client includes browser subsystem, spreadsheet interface, email interface, Short Message Service (SMS) interface, and other interface subsystems. It should be appreciated that while wireless WAN and Internet are specifically depicted, other types of data communication networks can be utilized additionally or alternatively.

The termite monitoring arrangement 82 includes a number of device groups 88 where each may be installed at a different location/premise to monitor termite infestation. Each device group 88 includes the data receiver 32 in a communication gateway, and several of the termite alert devices 20. The communication gateway interfaces with central data management server 84 via computer network 86 and interfaces with termite alert devices 20 via, for example, wireless Local Area Network (LAN). Alternatively, each device group 88 can contain one or more of the termite alert devices 20 that is able to communicate directly with the central data management server 84 through the internet, for example via a gateway, or via a cellular network, with the central data management server 84 functioning as the data receiver 32.

For a given device group 88, the termite alert devices 20 may be arranged to monitor/protect a designated building, room, storage area, or region from termites.

The communication module 38 includes wireless communication circuitry that defines wireless communication node. Specifically, the wireless communication circuitry includes RF transceiver 52 that in turn includes transmitter (TXR) 54 and receiver (RXR) 56. The wireless communication circuitry further includes communication antenna. It should be

appreciated that at least a portion of transmitter and receiver can be provided in the same integral unit. For example, commonly shared aspects would include antenna and/or RF front-end circuitry. However, in other arrangements transceiver is defined by independent transmitter and receiver units that collectively provide both transmission and reception functionality.

The wireless communication node further includes power management circuitry 60 and operated by the controller module 44. The controller module 44 can include include memory and can comprise one or more components, including digital circuitry, analog circuitry, or both. The controller module 44 may be a software and/or firmware programmable type; a hardwired, dedicated state machine; or a combination of these. In one embodiment, controller module 44 is a programmable microcontroller solid-state integrated circuit that integrally includes a processing unit and memory. The controller module 44 functions in accordance with operating logic defined by software and/or firmware programming, hardware, or a combination of these. At least one of the controller module 44 and the communication module 38 can include signal conditioners, signal format converters (such as analog-to-digital and digital-to-analog converters), limiters, clamps, filters, dedicated timers, and the like as needed to perform various operations described in the present application. In one form, the controller module 44, wireless communication circuitry and power management circuitries are at least partially defined by the same integrated circuit device.

The switch 22 is electrically coupled to the transducer module 26 to provide a corresponding signal indicative of termite presence and/or activity brought about by displacement of the actuator 24 due to the destruction or weakening of the bait structure 26. In one form, the switch 22 provides an electrical input to the transducer module 36 which functions as an analog-to-digital converter (ADC).

In one implementation, termite alert devices 20 are configured to operate with a standard battery power source, for example the battery module 40, for from a few months to a few years, communicating only a relatively small amount of data routinely in the form of the alert signal. Nonetheless, in other arrangements any or all of these aspects could vary. In typical termite applications, the termite alert device 20 takes the form of an in-ground station with

the position of the actuator 24 being altered by termite consumption of the bait structure 26 to trigger an alert/detection. With this arrangement, pesticide may not be delivered until termite presence is verified, although immediate pesticide application and/or above-ground monitoring may be utilized additionally or alternatively.

The sensor telemetry 30 may further comprise temperature sensor which, without limitation could be a thermistor, a thermocouple, or the like that provides an analog input to an ADC unit within controller module 44. In other embodiments, the sensor telemetry 30 can further comprise a moisture sensor in addition to or in lieu of the temperature sensor.

For clarity, the termite alert system 80, by way of use of a plurality of the termite alert devices 20, may be implemented using a termite alert method 100 comprising operating the termite alert system 80 including a plurality of the termite alert devices 20 and a data receiver in a step 110, wirelessly transmitting the alert signal from a first one of the termite alert devices 20 to a second one of the termite alert devices 20 in a step 112, and wirelessly providing the alert data from the second one of the termite alert devices to the data receiver in a step 114. Wherein in one embodiment, the termite alert system 80 is established by placing the first one of the termite alert devices 20 at a first location and providing at the first one of the termite alert devices a first output indicating communication between the first one of the termite alert devices 20 and the data receiver, also known as pairing or communication pairing, and positioning the second one of the termite alert devices 20 at a second location and providing at the second one of the termite alert devices 20 a second output indicating direct or indirect communication between the second one of the termite alert devices 20 and the data receiver.

In a forgoing manner, a termite alert device is described according to an exemplary embodiment of the invention. Although only one embodiment of the invention is disclosed in this document, it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modifications can be made to the disclosed embodiment without departing from the scope and spirit of the invention.

Claims

1. A termite alert device comprising:

a switch having an actuator biased in a first actuator position and displaceable to a second actuator position by a bait structure supported by a bait support, the bait support and the switch being inter-configured and the bait structure being shaped and dimensioned for displacing the actuator to the second actuator position when being supported on the bait support; and

sensor telemetry in signal communication with the switch for transmitting an alert signal in response to displacement of the actuator towards the first actuator position being sensed thereby,

wherein at least one of weakening and destruction of the bait structure causes the actuator of the switch to displace towards the first actuator position, the alert signal for being receivable by a data receiver for registering displacement of the actuator of the switch towards the first actuator position, the alert signal being translatable into alert data at least being indicative of displacement of the actuator being detected.

2. The termite alert device as in claim 1, further comprising:

the bait support adapted for at least one of abutting, supporting, holding and substantially isolating movement of the bait structure prior to being weakened.

3. The termite alert device as in claim 1, the bait structure being elongated along a first axis with the first axis coinciding the bait support and the actuator when positioned therebetween to displace the actuator towards the second actuator position.

4. The termite alert device as in claim 1, the sensor telemetry comprising:

a transducer circuit for transducing displacement of the actuator of the switch into the alert data; and

a communication module for transmitting the alert signal from the transducer circuit.

5. The termite alert device as in claim 1, further comprising:
 - a battery module for storing electrical energy and for discharging the electrical energy to power the sensor telemetry.
6. The termite alert device as in claim 5, further comprising:
 - a photovoltaic device for generating electrical energy in the presence of light for charging the battery module.
7. The termite alert device as in claim 1, further comprising:
 - a controller module for sensing energy level of the battery module and for generating and transmitting a maintenance signal for receipt by the data receiver in response to the energy level of the battery module being below a pre-determined level.
8. The termite alert device as in claim 1, the alert data comprising at least one of an identifier for uniquely identifying the sensor telemetry, a date stamp and a time stamp.
9. The termite alert device as in claim 1, the bait structure containing at least cellulosic material.
10. The termite alert device as in claim 1, further comprising:
 - a first housing wherein the sensor telemetry and the switch are contained; and
 - a plunger coupled to the first housing and configured to displace along a plunger axis defined by the first housing and to abut the actuator for following displacement thereof between the first actuator position and the second actuator position, the plunger interposing the actuator and the bait structure when the bait structure is positioned for support by the bait support.
11. The termite alert device as in claim 10, further comprising:
 - a user-interface (UI) module being operable for providing at least one of an audible and a visual indicator when the energy level of the battery module is at least one of above and below a pre-determined level.

12. The termite alert device as in claim 10, the first housing being substantially weather-sealed.
13. The termite alert device as in claim 10, further comprising:
 - a second housing defining a concavity and an opening to the concavity, the bait support being defined within the concavity of the second housing with the second housing being shaped and dimensioned for receiving the bait structure when the opening of the second housing couples with the first housing for disposing the bait structure between the plunger and the bait support to thereby displace the actuator to the second actuator position.
14. The termite alert device as in claim 13, further comprising:
 - an adaptor structure for inter-coupling the first housing and the second housing.
15. The termite alert device as in claim 11, the second housing defining a plurality of apertures for enabling termite access to the bait structure.
16. The termite alert device as in claim 13, each of the first housing and the second housing being substantially cylindrically-shaped to enable removable nesting of the first housing with the second housing at the opening of the second housing.
17. The termite alert device as in claim 16, further comprising:
 - a lock mechanism for locking and impeding separation of the first housing to the second housing when inter-nested.
18. The termite alert device as in claim 13, the first housing comprising a battery holder defined in the first housing and a removal hatch to enable placement, retention and removal of batteries into the battery holder, the batteries for powering the sensor telemetry.

19. The termite alert device as in claim 1, the data receiver for rebroadcasting the alert signal being received thereby.
20. A termite alert method, comprising:
 - operating a termite alert system including a plurality of termite alert devices and a data receiver, each of the plurality of termite alert devices comprising:
 - a switch having an actuator biased in a first actuator position and displaceable to a second actuator position by a bait structure supported by a bait support, the bait support and the switch being inter-configured and the bait structure being shaped and dimensioned for displacing the actuator to the second actuator position when being supported on the bait support; and
 - sensor telemetry in signal communication with the switch for transmitting an alert signal in response to displacement of the actuator towards the first actuator position being sensed thereby,
 - wherein at least one of weakening and destruction of the bait structure causes the actuator of the switch to displace towards the first actuator position, the alert signal for being receivable by a data receiver for registering displacement of the actuator of the switch towards the first actuator position, the alert signal being translatable into alert data at least being indicative of displacement of the actuator being detected;
 - wirelessly transmitting the alert signal from a first one of the termite alert devices to a second one of the termite alert devices; and
 - wirelessly providing the alert data from the second one of the termite alert devices to the data receiver,
 - wherein the termite alert system is established by placing the first one of the termite alert devices at a first location and providing at the first one of the termite alert devices a first output indicating communication between the first one of the termite alert devices and the data receiver, and positioning the second one of the termite alert devices at a second location and providing at the second one of the termite alert devices a second output indicating direct or indirect communication between the second one of the termite alert devices and the data receiver.