Title: SYSTEMS AND APPARATUS FOR SECURING A CONTAINER

Abstract: An electronic system for securing a shipping container includes the hasp of the shipping container, a bolt seal, and an electronic locking device. The electronic locking device includes a housing, two arms, a sensing circuit, and electronics. The housing encloses a support carriage, an electronics compartment, and a barrier between the two. The pair of arms extend from the support carriage and couple to the hasp. The arms pivot between locked and unlocked configurations relative to the hasp. The bolt seal locks the arms. The sensing circuit, which includes two sensing contacts, is in a “closed” or “open” state depending on whether the arms are pivoted into the locked or unlocked configuration. The electronics recognize whether the sensing circuit is in the “closed” state or the “open” state and output the state of the sensing circuit, thereby indicating whether the arms are locked or unlocked.
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SYSTEMS AND APPARATUS FOR SECURING A CONTAINER

CROSS-REFERENCE TO RELATED APPLICATION

[001] The present application is a nonprovisional of, and claims priority under 35 U.S.C. § 119(e) to, each of: U.S. provisional patent application 61/053,665, filed May 16, 2008; U.S. provisional patent application 61/109,494, filed October 29, 2008; and U.S. provisional patent application 61/151,168, filed February 9, 2009. The present application further is a nonprovisional application of, and claims priority under §119(e) to, each of U.S. provisional patent application nos. 61/140,882; 61/140,887; 61/140,888; 61/141,021; 61/147,917; 61/147,839; and 61/150,298. Each of these provisional applications from which priority is claimed, and the disclosures thereof, are incorporated herein by reference.


[003] Each of these foregoing patent properties is hereby incorporated herein by reference for purposes of disclosure of common designation ("CD") technology (such as, e.g., class-based network ("CBN") technology); wake-up ("WU") technology; and networks and systems that utilize such technologies, such as those of TeraHop Networks ("THN"), Inc. of Alpharetta, Georgia. It is intended that the CD/CBN and WU technologies—and related features, improvements, and enhancements—as disclosed in these incorporated patent references may be utilized in combination with various embodiments and implementations of the present invention.

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BACKGROUND OF THE INVENTION

[005] The present invention generally relates to shipping containers.

[006] Shipping containers today have their doors "locked" by using an ISO standard mechanical bolt seal. In this arrangement, a bolt with a unique (to the manufacturer) serial numbered bolt is inserted into the right hand container door lock hasp and is secured in-lace with a bolt housing containing the same serial number. The bolt needs to be cut with bolt cutters to be removed. Although there is an ISO standard for these bolts, they are not necessarily identical from one manufacturer to another. Variations include the length and diameter of the bolt and the mechanical locking mechanism that secures the bolt to its mated housing.
The abovementioned products and concepts have been universally accepted by industry. Although far from fool proof, the technique does provide a simple method of keeping the doors on shipping containers closed unless deliberate action is taken to cut the bolt. It is quite common for bolts to be cut and containers opened and then re-leased as they traverse through the supply chain. Unfortunately, there is no method of determining when or where the bolts were cut and replaced. Without this knowledge, an end shipper has no recourse to determine when a container bolt has been removed and replaced. Theft or loss assignment, therefore, cannot be made.

A need exists for improvement in securing, monitoring, and tracking shipping containers. This, and other needs, are addressed by one or more aspects of the present invention.

SUMMARY OF THE INVENTION

The invention generally relates to networks, apparatus, methods and systems for securing, monitoring and tracking shipping containers.

The present invention includes many aspects and features. Moreover, while many aspects and features relate to, and are described in, the context of networks, apparatus, methods and systems for securing, monitoring and tracking shipping containers, the present invention is not limited to use only in networks, apparatus, methods and systems for securing, monitoring and tracking shipping containers, as will become apparent from the following summaries and detailed descriptions of aspects, features, and one or more embodiments of the present invention.

Accordingly, one aspect of the present invention relates to An electronic locking device for securing a shipping container. An exemplary such electronic locking device includes a housing enclosing a support carriage, an electronics compartment, and a barrier to prevent access to the electronics enclosure from the support carriage; a pair of arms, extending from the support carriage and adapted to couple to a hasp on a shipping container, wherein at least one of the arms is capable of pivoting, relative to the other of the arms, between a locked configuration and an unlocked configuration, relative to the hasp, and wherein the arms are adapted to receive a bolt seal only when placed in the locked configuration; a sensing circuit, including two sensing contacts, that is placed in a "closed" state when the at least one arm is pivoted into the locked configuration and is placed in an "open" state when the at least one arm is pivoted into the unlocked configuration; and electronics, housed in the electronics compartment and coupled to the sensing circuit, that
recognize, when active, whether the sensing circuit is in the “closed” state or the “open” state and generate an output indicating the state of the sensing circuit. Furthermore, in this aspect of the invention, the output of the electronics represents an indication as to whether the arms are in the locked configuration or the unlocked configuration.

[012] In a variation of this aspect, the electronics compartment and the support carriage are contained within a rugged mechanical housing.

[013] In a feature of this aspect of the invention, a pin extends from a first arm, of the pair of arms, and is adapted to extend through the hasp. In further features of this aspect of the invention, in the locked configuration, the presence of the pin, extending through the hasp, prevents the hasp from being opened; the pin has a distal end that is disposed adjacent a second arm, of the pair of arms, when the device is in the locked configuration, thereby preventing the hasp from being opened; and the second arm includes a pin receptacle adapted to receive and secure the distal end of the pin and wherein, in the locked configuration, the distal end of the pin is disposed within the pin receptacle.

[014] In another feature of this aspect of the invention, in the unlocked configuration, the pin is withdrawn from the hasp, thereby permitting the hasp to be opened.

[015] In another feature of this aspect of the invention, the pin is a bolt.

[016] In another feature of this aspect of the invention, the arms are adapted to be maintained in the locked configuration by the bolt seal. In a further feature, the arms are prevented from pivoting, relative to each other, by the bolt seal, thereby maintaining the arms in the locked configuration.

[017] In another feature of this aspect of the invention, each sensing contact is disposed in or on a respective arm of the pair of arms. In a further feature, the sensing contact on the at least one pivoting arm is moved toward the sensing contact on the other of the arms when the at least one pivoting arm is pivoted toward the other arm.

[018] In another feature of this aspect of the invention, one arm pivots around a point within the support carriage; the other arm is fixed in place; the sensing contacts extend from portions of the arms interior the support carriage; the pin is located exterior the support carriage; the second arm includes a pin receptacle adapted to receive and secure the distal end of the pin, and the pin receptacle is located exterior the support carriage; and each of the arms has a hole adapted to receive a bolt seal.

[019] In another feature of this aspect of the invention, the arms pivot around respective points within the support carriage; the sensing contacts extend from portions of the arms interior the support carriage; the pin is located exterior the pivot arm support carriage; the
second arm includes a pin receptacle adapted to receive and secure the distal end of the pin, and the pin receptacle is located exterior the pivot arm support carriage; and each of the arms has a hole adapted to receive the bolt seal. In further features, the bolt seal holes are further from the support carriage than are the pin and pin receptacle; or alternatively, the pin and pin receptacle are further from the support carriage than are the bolt seal holes.

[020] In another feature of this aspect of the invention, both arms have a pivot point within the support carriage and wherein the pivot points are located between the sensing contacts and the pin and pin receptacle.

[021] In another variation of this aspect, the arms are carried by a pivot arm assembly that is removable from the support carriage. In features of this aspect of the invention, pivoting the at least one arm into the locked configuration while the removable pivot arm assembly is within the support carriage mechanically secures the removable pivot arm assembly; and further, securing the removable pivot arm assembly by pivoting the arms into the locked configuration places the sensing circuit in the "closed" state.

[022] In another variation of this aspect, the electronic locking device further includes a spring situated between the arms, wherein the spring biases the arms away from one another and a force must be applied to hold the arms in proximity to one another. In a feature of this aspect of the invention, a pin extends from a first arm, of the pair of arms, and is adapted to extend through the hasp; in the locked configuration, the presence of the pin, extending through the hasp, prevents the hasp from being opened; the second arm includes a pin receptacle adapted to receive and retain the distal end of the pin; and the securement of the pin within the pin receptacle provides the force to hold the arms in proximity to one another.

[023] Another aspect of the invention relates to an electronic system for securing a shipping container. An exemplary such electronic system includes a hasp adapted for use in securing a shipping container; a bolt seal; and an electronic locking device. The electronic locking device includes a housing enclosing a support carriage, an electronics compartment, and a barrier to prevent access to the electronics enclosure from the support carriage; a pair of arms, extending from the support carriage and adapted to couple to the shipping container hasp, wherein at least one of the arms is capable of pivoting, relative to the other of the arms, between a locked configuration and an unlocked configuration, relative to the hasp, and wherein the arms are adapted to receive the bolt seal only when placed in the locked configuration; a sensing circuit, including two sensing contacts, that is placed in a "closed" state when the at least one arm is pivoted into the locked configuration and is placed in an "open" state when the at least one arm is pivoted into the unlocked configuration; and
electronics, housed in the electronics compartment and coupled to the sensing circuit, that recognize, when active, whether the sensing circuit is in the "closed" state or the "open" state and generate an output indicating the state of the sensing circuit. Furthermore, in this aspect of the invention, the output of the electronics represents an indication as to whether the arms are in the locked configuration or the unlocked configuration.

[024] In a variation of this aspect, the electronics compartment and the support carriage are contained within a rugged mechanical housing.

[025] In a feature of this aspect of the invention, a pin extends from a first arm, of the pair of arms, and is adapted to extend through the hasp. In further features, in the locked configuration, the presence of the pin, extending through the hasp, prevents the hasp from being opened; the pin has a distal end that is disposed adjacent a second arm, of the pair of arms, when the device is in the locked configuration, thereby preventing the hasp from being opened; and the second arm includes a pin receptacle adapted to receive and secure the distal end of the pin and wherein, in the locked configuration, the distal end of the pin is disposed within the pin receptacle.

[026] In another feature of this aspect of the invention, in the unlocked configuration, the pin is withdrawn from the hasp, thereby permitting the hasp to be opened.

[027] In another feature of this aspect of the invention, the pin is a bolt.

[028] In another feature of this aspect of the invention, the arms are adapted to be maintained in the locked configuration by the bolt seal. In a further feature, the arms are prevented from pivoting, relative to each other, by the bolt seal, thereby maintaining the arms in the locked configuration.

[029] In another feature of this aspect of the invention, each sensing contact is disposed in or on a respective arm of the pair of arms. In a further feature, the sensing contact on the at least one pivoting arm is moved toward the sensing contact on the other of the arms when the at least one pivoting arm is pivoted toward the other arm.

[030] In another feature of this aspect of the invention, one arm pivots around a point within the support carriage; the other arm is fixed in place; the sensing contacts extend from portions of the arms interior the support carriage; the pin is located exterior the support carriage; the second arm includes a pin receptacle adapted to receive and secure the distal end of the pin, and the pin receptacle is located exterior the support carriage; and each of the arms has a hole adapted to receive the bolt seal.

[031] In another feature of this aspect of the invention, the arms pivot around respective points within the support carriage; the sensing contacts extend from portions of the arms
interior the support carriage; the pin is located exterior the pivot arm support carriage; the second arm includes a pin receptacle adapted to receive and secure the distal end of the pin, and the pin receptacle is located exterior the pivot arm support carriage; and each of the arms has a hole adapted to receive the bolt seal. In further features, the bolt seal holes are further from the support carriage than are the pin and pin receptacle; or alternatively, the pin and pin receptacle are further from the support carriage than are the bolt seal holes.

[032] In another feature of this aspect of the invention, both arms have a pivot point within the support carriage and wherein the pivot points are located between the sensing contacts and the pin and pin receptacle.

[033] In another variation of this aspect, the arms are carried by a pivot arm assembly that is removable from the support carriage.

[034] In a feature of this aspect of the invention, pivoting the at least one arm into the locked configuration while the removable pivot arm assembly is within the support carriage mechanically secures the removable pivot arm assembly. In a further feature, securing the removable pivot arm assembly by pivoting the arms into the locked configuration places the sensing circuit in the "closed" state.

[035] In another variation of this aspect, the electronic system further includes a spring situated between the arms, wherein the spring biases the arms away from one another and a force must be applied to hold the arms in proximity to one another. In a further feature, a pin extends from a first arm, of the pair of arms, and is adapted to extend through the hasp; in the locked configuration, the presence of the pin, extending through the hasp, prevents the hasp from being opened; the second arm includes a pin receptacle adapted to receive and retain the distal end of the pin; and the securement of the pin within the pin receptacle provides the force to hold the arms in proximity to one another.

[036] Another aspect of the invention relates to a method for securing a shipping container. An exemplary such method includes: providing an electronic locking device; configuring the electronic locking device from a locked configuration to an unlocked configuration by pivoting at least one of the arms away from the other arm; as a function of the at least one arm being pivoted away from the other arm, placing the sensing circuit in an "open" state; recognizing, by the electronics, the "open" state of the sensing circuit; generating, by the electronics, an output indicating the "open" state of the sensing circuit; positioning the electronic locking device in proximity to a hasp on a shipping container; coupling the arms to the hasp on the shipping container by pivoting at least one of the arms towards the other arm from the unlocked configuration into the locked configuration; as a function of the at least
one arm being pivoted toward the other arm, placing the sensing circuit in a "closed" state; recognizing, by the electronics, the "closed" state of the sensing circuit; and generating, by the electronics, an output indicating the "closed" state of the sensing circuit. The electronic locking device includes: a housing enclosing a support carriage, an electronics compartment, and a barrier to prevent access to the electronics enclosure from the support carriage; a pair of arms, extending from the support carriage; a sensing circuit; and electronics, housed in the electronics compartment and coupled to the sensing circuit.

[037] In a variation of this aspect, the method further includes a step of locking the electronic locking device in the locked configuration with a standard bolt seal.

[038] In a feature of this aspect of the invention, the method further includes a step of translating the output to indicate whether the arms were in the locked configuration or the unlocked configuration.

[039] In another feature of this aspect of the invention, the step of placing the sensing circuit in an "open" state is effectuated by separating a sensing contact on one arm from the sensing contact on the other arm.

[040] In another feature of this aspect of the invention, the step of locking the electronic locking device in the locked configuration with a standard bolt seal includes inserting a bolt of the standard bolt seal through respective openings on the arms.

[041] In addition to the aforementioned aspects and features of the present invention, it should be noted that the present invention further encompasses the various possible combinations and subcombinations of such aspects and features.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[042] One or more preferred embodiments of the present invention now will be described in detail with reference to the accompanying drawings, wherein the same elements are referred to with the same reference numerals, and wherein,

[043] FIG. 1 is an illustration of a conventional shipping container having an electronic locking system installed thereon, for securing the container, in accordance with one or more aspects of the present invention;

[044] FIG. 2 is a schematic perspective illustration of a first variation of the electronic locking system of FIG. 1;

[045] FIG. 3 is a more detailed schematic illustration of the electronic locking system of FIG. 1;
FIG. 4 is another schematic illustration of the electronic locking system of FIG. 3, shown in an unlocked configuration;

FIG. 5 is a schematic illustration of a second variation of an electronic locking system for securing a shipping container in a locked configuration, including a bolt located between the hasp and the seal housing, in accordance with or more aspects of the present invention;

FIG. 6 is a schematic illustration of a third variation of an electronic locking system for securing a shipping container in a locked configuration, including sensor contacts on the reverse side of the arm pivot points, in accordance with or more aspects of the present invention;

FIG. 7 is a schematic illustration of a fourth variation of an electronic locking system for securing a shipping container in a locked configuration, including an arrangement in which the lower arm is fixed with only the upper arm able to pivot, in accordance with or more aspects of the present invention;

FIG. 8 is a schematic illustration of a fifth variation of an electronic locking system for securing a shipping container in a locked configuration, including an arrangement in which the pivot arm or arms could be removed from the seal housing entirely, in accordance with or more aspects of the present invention;

FIG. 9 is a schematic illustration of a sixth variation of an electronic locking system for securing a shipping container in a locked configuration, including a spring assembly added to the housing, in accordance with or more aspects of the present invention;

FIG. 10 is a schematic illustration of the electronic locking system of FIG. 9, shown in an unlocked position; and

FIG. 11 is a schematic illustration of a particular implementation of the electronic locking system of FIG. 9, including a bolt for holding the two pivot arms together.

DETAILED DESCRIPTION

As a preliminary matter, it will readily be understood by one having ordinary skill in the relevant art ("Ordinary Artisan") that the present invention has broad utility and application. Furthermore, any embodiment discussed and identified as being "preferred" is considered to be part of a best mode contemplated for carrying out the present invention. Other embodiments also may be discussed for additional illustrative purposes in providing a full and enabling disclosure of the present invention. Moreover, many embodiments, such as adaptations, variations, modifications, and equivalent arrangements, will be implicitly
disclosed by the embodiments described herein and fall within the scope of the present invention.

[055] Accordingly, while the present invention is described herein in detail in relation to one or more embodiments, it is to be understood that this disclosure is illustrative and exemplary of the present invention, and is made merely for the purposes of providing a full and enabling disclosure of the present invention. The detailed disclosure herein of one or more embodiments is not intended, nor is to be construed, to limit the scope of patent protection afforded the present invention, which scope is to be defined by the claims and the equivalents thereof. It is not intended that the scope of patent protection afforded the present invention be defined by reading into any claim a limitation found herein that does not explicitly appear in the claim itself.

[056] Thus, for example, any sequence(s) and/or temporal order of steps of various processes or methods that are described herein are illustrative and not restrictive. Accordingly, it should be understood that, although steps of various processes or methods may be shown and described as being in a sequence or temporal order, the steps of any such processes or methods are not limited to being carried out in any particular sequence or order, absent an indication otherwise. Indeed, the steps in such processes or methods generally may be carried out in various different sequences and orders while still falling within the scope of the present invention. Accordingly, it is intended that the scope of patent protection afforded the present invention is to be defined by the appended claims rather than the description set forth herein.

[057] Additionally, it is important to note that each term used herein refers to that which the Ordinary Artisan would understand such term to mean based on the contextual use of such term herein. To the extent that the meaning of a term used herein—as understood by the Ordinary Artisan based on the contextual use of such term—differs in any way from any particular dictionary definition of such term, it is intended that the meaning of the term as understood by the Ordinary Artisan should prevail.

[058] Furthermore, it is important to note that, as used herein, "a" and "an" each generally denotes "at least one," but does not exclude a plurality unless the contextual use dictates otherwise. Thus, reference to "a picnic basket having an apple" describes "a picnic basket having at least one apple" as well as "a picnic basket having apples." In contrast, reference to "a picnic basket having a single apple" describes "a picnic basket having only one apple."

[059] When used herein to join a list of items, "or" denotes "at least one of the items," but does not exclude a plurality of items of the list. Thus, reference to "a picnic basket having
cheese or crackers" describes "a picnic basket having cheese without crackers", "a picnic basket having crackers without cheese", and "a picnic basket having both cheese and crackers." Finally, when used herein to join a list of items, "and" denotes "all of the items of the list." Thus, reference to "a picnic basket having cheese and crackers" describes "a picnic basket having cheese, wherein the picnic basket further has crackers," as well as describes "a picnic basket having crackers, wherein the picnic basket further has cheese."

[060] Referring now to the drawings, one or more preferred embodiments of the present invention are next described. The following description of one or more preferred embodiments is merely exemplary in nature and is in no way intended to limit the invention, its implementations, or uses.

[061] FIG. 1 is an illustration of a conventional shipping container 6 having an electronic locking system 10 installed thereon, for securing the container 6, in accordance with one or more aspects of the present invention. Such shipping containers conventionally utilize several latching assemblies to maintain the container door or doors 8 in a closed state, and such latching assemblies frequently include a hasp mechanism 16.

[062] FIG. 2 is a schematic perspective illustration of a first variation of the electronic locking system 10 of FIG. 1. The system 10 includes an electronic locking device 12, a standard bolt seal 14, and the container hasp 16 to which the locking device 12 is secured. The electronic locking device 12 includes a rugged mechanical housing 18 supporting an upper pivot arm 22 and a lower pivot arm 24. Each of these will be described in greater detail hereinbelow.

[063] FIGS. 3 and 4 are more detailed schematic illustrations of the electronic locking system 10 of FIG. 1, shown in a locked configuration and an unlocked configuration, respectively. As shown therein, the housing 18 includes a pivot arm support carriage 20, which is preferably enclosed except for the pivot arms 22,24 extending therefrom, a sealed compartment 26 containing sensor electronics 42 and one or more batteries 44, and a barrier 28 to prevent access to the electronics compartment 26 from the pivot arm support carriage 20. The housing 18 may be attached to the container 6 by any conventional means, such as by magnetic force, adhesive, bolts, or the like, but is preferably attached in a way so as not to damage the integrity of the container wall to which it is attached.

[064] The upper pivot arm 22 has a proximal end, which is located within the pivot arm support carriage 20, and a distal end. The upper pivot arm 22 pivots about a point located on or near its proximal end. In the first variation of the system 10, the upper pivot arm 22 includes the following features along its length, from proximal end to distal end: a pivot or
swivel 46, a sensing contact 30, preferably disposed within the pivot arm support carriage 20, that closes a circuit when the electronic locking device 12 is in the locked configuration (as shown in FIGS. 2 and 3) and opens the circuit when the electronic locking device 12 is in the unlocked configuration (as shown in FIG. 4), a bolt or pin 32 that is inserted through the container hasp 16 to secure the container 6, and a hole 34 adapted to receive the bolt of a standard bolt seal 14 therethrough.

[065] The lower pivot arm 24 has a proximal end, which is located within the pivot arm support carriage 20, and a distal end. Like the upper pivot arm 22, the lower pivot arm 24 pivots about a point located on or near its proximal end. In the first variation of the system 10, the lower pivot arm 24 includes the following features along its length, from proximal end to distal end: a pivot or swivel 46, a sensing contact 30, preferably disposed within the pivot arm support carriage 20, that closes the pivot arm circuit, by making contact or coming in close proximity with the sensing contact 30 on the upper pivot arm 22, when the electronic locking device 12 is in the locked configuration (as shown in FIGS. 2 and 3) and opens the circuit when the electronic locking device 12 is in the unlocked configuration (as shown in FIG. 4), a bolt receptacle 36 that receives the bolt or pin 32 inserted through the container hasp 16, and a hole 34 adapted to receive the bolt of a standard bolt seal 14 therethrough.

[066] In the locked configuration, shown in FIGS. 2 and 3, the bolt seal 14 has been inserted through the holes 34 of the pivot arms 22,24. Furthermore, because the pivot arms 22,24 have been rotated toward each other, the security bolt or pin 32 has been inserted through the container hasp 16 and engaged with the bolt receptacle 36, and the sensing contacts 30 are placed in contact or close disposition with each other, thereby closing the pivot arm circuit and indicating that the locking arms 22, 24 are closed. In the unlocked configuration, shown in FIG. 4, no bolt seal 14 has been inserted through the holes 34 of the pivot arms 22,24, or the bolt seal has been cut (not shown) and removed. Furthermore, because the pivot arms 22,24 have been rotated away from each other, the security bolt or pin 32 has been removed from the bolt receptacle 36 and from the container hasp 16, and the sensing contacts 30 are no longer in contact or close disposition with one another, thereby opening the pivot arm circuit and indicating that the locking arms 22, 24 are open. This, in turn, may be interpreted by the sensor electronics 42, or by a human operator, to mean that the bolt seal 14 has been removed.

[067] The pivot arm circuit, of which the contacts 30 form a part, may be any circuitry adapted to detect, via the sensing contacts 30, an "open" state and a "closed" state. The sensing contacts 30 may be or include electrical contacts, optoelectronic contacts or sensors,
magnetic reed switch contacts, proximity sensor or any other suitable electrical, mechanical, electromechanical, optoelectrical sensor or contact. The circuitry for detecting the binary ("open" or "closed") state may vary according to the sensor or contact design, based on power, space or circuit technology, or the like, so long as a binary input (representing "open" or "closed") is passed along to the sensor electronics 42.

[068] The sensor electronics 42 may be any electronics adapted to relay or pass along state information about the pivot arm circuit to an external recipient, whether through digital or analog, wired or wireless signal or transmission, by audio or visual signal for perception by appropriate personnel, or the like, such as by electrical, optical or magnetic data link. The state information may include the existence of an "open" state in the pivot arm circuit, the existence of a "closed" state in the pivot arm circuit, or both; the transition from a "closed" state to an "open" state in the pivot arm circuit, an "open" state to a "closed" state in the pivot arm circuit, or both; or the like. In at least some embodiments, the state information alternatively or additionally includes information related to any of the foregoing, and may include information about multiple occurrences of any of the foregoing. Such information may include, but is not limited to, the time of such transition, the duration of a state, the location of the device 12 at the time, or other conditions at the device 12 or within or without the container 6. Such information and conditions may be determined, detected, or the like using built-in or integrated circuitry or technology or may be relayed or reported to the sensor electronics 42 from separate components. In at least some embodiments, such information and conditions may be relayed through one or more communication device, such as by "hopping." Various aspects of sensor electronics, sensors, and the like, suitable for use in the present invention, are disclosed in the aforementioned U.S. patent application 11/460,976, published as US 2008-0315596 A1.

[069] In particular, the device may be used to detect any opening or closing of the pivot arms 22,24, thus providing a strong indication as to whether the container door hasp 16 is secure. In particular, if the pivot arms 22,24 are opened (or are no longer closed), there is an excellent likelihood that the container door 8 has been opened. This, in turn, may indicate to an operator that contents have been added to or removed from the container 6. The sensor electronics 42 preferably sense every opening and closing of the pivot arms 22,24, record the time of the event, and if within range of a corresponding radio link, report the event, or else store the information until such a radio link is available and the information can be reported.

[070] In an exemplary method of use, a human operator installs the electronic locking device 12 by opening the pivot arms 22,24 of the device 12 and positioning them above and below
the staple portion of the hasp mechanism such that the bolt or pin 32 may be inserted through
the hasp 16. Once the bolt or pin 32 is aligned with the hasp 16, the pivot arms 22,24 may be
rotated toward each other such that the bolt or pin 32 is guided through the hasp 16. The
rotation of the pivot arms 22,24 also brings the contacts 30 together, placing them in contact
or close disposition with each other and closing the pivot arm circuit, as described previously.
The bolt of a conventional bolt seal 14 may then be installed through the holes 34 in the distal
ends of the pivot arms 22,24, and conventional procedures for such installations are carried
out. Finally, if not already activated, the locking device 12 is activated by activating the
sensor electronics 42.

[071] When the container is to be opened, conventional procedures may be carried out with
regard to the removal of the bolt seal 14. Once the bolt seal is removed, the pivot arms 22,24
of the device 12 may be opened once again, thereby retracted the bolt or pin 32 from the hasp
and permitting the device 12 to be removed therefrom. With the device 12 removed, the hasp
may be manipulated normally, thereby permitting the door 8 to be unlatched and opened.

[072] It will be appreciated that, in order to prevent tampering, the bolt or pin 32 and the
receptacle 36 may be designed so as to minimize the possibility that the bolt or pin 32 is cut,
broken, destroyed or its integrity is otherwise damaged, thereby permitting the device 12
from being removed from the hasp 16 without opening the pivot arms 22,24. The design may
include particular geometries, materials, and the like to make it very difficult for an
individual to gain access in this way.

[073] FIG. 5 is a schematic illustration of a second variation of an electronic locking system
110 for securing a shipping container 6 in a locked configuration in accordance with one or
more aspects of the present invention. The system 110 includes an electronic locking device
112, a standard seal 14, and the container hasp 16 to which the locking device 112 is secured.
The electronic locking device 112 includes a rugged mechanical housing 118 supporting an
upper pivot arm 122 and a lower pivot arm 124. The rugged mechanical housing 118
includes a pivot arm support carriage 120, which is preferably enclosed except for the pivot
arms 122,124 extending therefrom, a sealed compartment 126 containing sensor electronics
42 and one or more batteries 44, and a barrier 128 to prevent access to the electronics
compartment 126 from the pivot arm support carriage 120.

[074] The upper pivot arm 122 has a proximal end, which is located within the pivot arm
support carriage 120, and a distal end. The upper pivot arm 122 pivots about a point located
on or near its proximal end. In the second variation of the system 110, the upper pivot arm
122 includes the following features along its length, from proximal end to distal end: a pivot
or swivel 146, a sensing contact 130, preferably disposed within the pivot arm support carriage 120, that closes a circuit when the electronic locking device 112 is in a locked configuration (as shown in FIG. 5) and opens the circuit when the electronic locking device 112 is in an unlocked configuration (not shown), a hole 134 adapted to receive the bolt of a standard bolt seal 14 therethrough, and a bolt or pin 132 that is inserted through the container hasp 16 to secure the container 6.

[075] The lower pivot arm 124 has a proximal end, which is located within the pivot arm support carriage 120, and a distal end. Like the upper pivot arm 122, the lower pivot arm 124 pivots about a point located on or near its proximal end. In the second variation of the system 110, the lower pivot arm 124 includes the following features along its length, from proximal end to distal end: a pivot or swivel 146, a sensing contact 130, preferably disposed within the pivot arm support carriage 120, that closes the pivot arm circuit, by making contact or coming in close proximity with the sensing contact 130 on the upper pivot arm 122, when the electronic locking device 112 is in a locked configuration (as shown in FIG. 5) and opens the circuit when the electronic locking device 112 is in an unlocked configuration (not shown), a hole 134 adapted to receive the bolt of a standard bolt seal 14 therethrough, and a bolt receptacle 136 that receives the bolt or pin 132 inserted through the container hasp 16.

[076] In the locked configuration, shown in FIG. 5, the bolt seal 14 has been inserted through the holes 134 of the pivot arms 122,124. Furthermore, because the pivot arms 122,124 have been rotated toward each other, the security bolt or pin 132 has been inserted through the container hasp 16 and engaged with the bolt receptacle 136, the sensing contacts 130 are placed in contact or close disposition with each other, thereby closing the pivot arm circuit and indicating that the locking arms 122,124 are closed.

[077] FIG. 6 is a schematic illustration of a third variation of an electronic locking system 210 for securing a shipping container 6 in a locked configuration in accordance with one or more aspects of the present invention. The system 210 includes an electronic locking device 212, a standard seal 14, and the container hasp 16 to which the locking device 212 is secured. The electronic locking device 212 includes a rugged mechanical housing 218 supporting an upper pivot arm 222 and a lower pivot arm 224. The rugged mechanical housing 218 includes a pivot arm support carriage 220, which is preferably enclosed except for the pivot arms 222,224 extending therefrom, a sealed compartment 226 containing sensor electronics 42 and one or more batteries 44, and a barrier 228 to prevent access to the electronics compartment 226 from the pivot arm support carriage 220.
[078] The upper pivot arm 222 has a proximal end, which is located within the pivot arm support carriage 220, and a distal end. The upper pivot arm 222 pivots about a point located on or near its proximal end. In the third variation of the system 210, the upper pivot arm 222 includes the following features along its length, from proximal end to distal end: a sensing contact 230 within the pivot arm support carriage 220 that closes a circuit when the electronic locking device 212 is in a locked configuration (as shown in FIG. 6) and opens the circuit when the electronic locking device 212 is in an unlocked configuration (not shown), a pivot or swivel 246, a bolt or pin 232 that is inserted through the container hasp 16 to secure the container 6, and a hole 234 adapted to receive the bolt of a standard bolt seal 14 therethrough.

[079] The lower pivot arm 224 has a proximal end, which is located within the pivot arm support carriage 220, and a distal end. Like the upper pivot arm 222, the lower pivot arm 224 pivots about a point located on or near its proximal end. In the third variation of the system 210, the lower pivot arm 224 includes the following features along its length, from proximal end to distal end: a sensing contact 230 within the pivot arm support carriage 220 that closes the pivot arm circuit, by making contact or coming in close proximity with the sensing contact 230 on the upper pivot arm 222, when the electronic locking device 212 is in a locked configuration (as shown in FIG. 6) and opens the circuit when the electronic locking device 212 is in an unlocked configuration (not shown), a pivot or swivel 246, a bolt receptacle 236 that receives the bolt or pin 232 inserted through the container hasp 16, and a hole 234 adapted to receive the bolt of a standard bolt seal 14 therethrough.

[080] In the locked configuration, shown in FIG. 6, the bolt seal 14 has been inserted through the holes 234 of the pivot arms 222,224. Furthermore, because the pivot arms 222,224 have been rotated toward each other, the security bolt or pin 232 has been inserted through the container hasp 16 and engaged with the bolt receptacle 236, the sensing contacts 230 are placed in contact or close disposition with each other, thereby closing the pivot arm circuit and indicating that the locking arms 222, 224 are closed.

[081] In at least some embodiments, in order to make it possible to open the pivot arms 222,224 a sufficient distance to permit the bolt or pin 232 to be inserted through the hasp 16, the respective contacts 230 may be offset from one another such that rotation of the pivot arms 222,224 into the closed position causes adjacent sides of the contacts 230, rather than ends thereof, to be placed in abutment or proximity with each other, in a motion that in some ways may be similar to the closing of a pair of scissors. Suitable geometry for such an arrangement will be apparent to the Ordinary Artisan.
FIG. 7 is a schematic illustration of a fourth variation of an electronic locking system 310 for securing a shipping container 6 in a locked configuration in accordance with one or more aspects of the present invention. The system 310 includes an electronic locking device 312, a standard seal 14, and the container hasp 16 to which the locking device 312 is secured. The electronic locking device 312 includes a rugged mechanical housing 318 supporting an upper pivot arm 322 and a lower fixed arm 324. The rugged mechanical housing 318 includes a pivot arm support carriage 320, which is preferably enclosed except for the upper pivot arm 322, and lower fixed arm 324 extending therefrom, a sealed compartment 326 containing sensor electronics 42 and one or more batteries 44, and a barrier 328 to prevent access to the electronics compartment 326 from the pivot arm support carriage 320.

The upper pivot arm 322 has a proximal end, which is located within the pivot arm support carriage 320, and a distal end. The upper pivot arm 322 pivots about a point located on or near its proximal end. In the fourth variation of the system 310, the upper pivot arm 322 includes the following features along its length, from proximal end to distal end: a pivot or swivel 346, a sensing contact 330, preferably disposed within the pivot arm support carriage 320, that closes a circuit when the electronic locking device 312 is in a locked configuration (as shown in FIG. 7) and opens the circuit when the electronic locking device 312 is in an unlocked configuration (not shown), a bolt or pin 332 that is inserted through the container hasp 16 to secure the container 6, and a hole 334 adapted to receive the bolt of a standard bolt seal 14 therethrough.

The lower fixed arm 324 has a proximal end, which is located within the pivot arm support carriage 320, and a distal end. Unlike the upper pivot arm 322, the lower pivot arm 324 does not pivots about a point located on or near its proximal end, but rather, is fixed in place. In the fourth variation of the system 310, the lower fixed arm 324 includes the following features along its length, from proximal end to distal end: a sensing contact 330, preferably disposed within the pivot arm support carriage 320, that closes the pivot arm circuit, by making contact or coming in close proximity with the sensing contact 330 on the upper pivot arm 322, when the electronic locking device 312 is in a locked configuration (as shown in FIG. 7) and opens the circuit when the electronic locking device 312 is in an unlocked configuration (not shown), a bolt receptacle 336 that receives the bolt or pin 332 inserted through the container hasp 16, and a hole 334 adapted to receive the bolt of a standard bolt seal 14 therethrough.

In the locked configuration, shown in FIG. 7, the bolt seal 14 has been inserted through the holes 334 of the upper pivot arm 322 and lower fixed arm 324. Furthermore,
because the upper pivot arm 322 has been rotated toward the lower fixed arm 324, the
security bolt or pin 332 has been inserted through the container hasp 16 and engaged with the
bolt receptacle 336, the sensing contacts 330 are placed in contact or close disposition with
each other, thereby closing the pivot arm circuit and indicating that the locking arms 322, 324
are closed.

[086] FIG. 8 is a schematic illustration of a fifth variation of an electronic locking system
410 for securing a shipping container 6 in a locked configuration in accordance with one or
more aspects of the present invention. The system 410 includes an electronic locking device
412, a standard seal 14, and the container hasp 16 to which the locking device 412 is secured.
The electronic locking device 412 includes a removable pivot arm assembly 421 supporting
an upper pivot arm 422 and a lower pivot arm 424, and a rugged mechanical housing 418.
The rugged mechanical housing 418 includes a pivot arm support carriage 420 into which the
removable pivot arm assembly 421 can be inserted, a compartment 426 containing sensor
electronics 42, one or more batteries 44, an upper pivoting member 450, and a lower pivoting
member 452, and a partial barrier 428 to limit access to the electronics compartment 426
from the pivot arm support carriage 420. The upper and lower pivoting members 450,452 are
anchored within the compartment 426 and extend across the partial barrier 428 into the pivot
arm support carriage 420 where they engage the pivot arms when the system 410 is in a
locked configuration (shown in FIG. 8).

[087] In the fifth variation of the system 410, the upper pivot arm 422 is supported by the
removable pivot arm assembly 421 and has two distal ends, both exterior to the pivot arm
assembly 421 and pivots about a point located within the removable pivot arm assembly 421.
The shorter of the ends extends into the pivot arm support carriage 420 when the pivot arm
assembly 421 is inserted into the mechanical housing 418 and engages with the upper
pivoting member 450 to secure the removable pivot arm assembly 421 within the pivot arm
support carriage 420. The longer end of the upper pivot arm 422 includes the following
features along its length, extending away from the pivot arm assembly 421: a bolt or pin 432
that is inserted through the container hasp 16 to secure the container 6, and a hole 434
adapted to receive the bolt of a standard bolt seal 14 therethrough.

[088] In the fifth variation of the system 410, the lower pivot arm 424 is supported by the
removable pivot arm assembly 421 and has two distal ends, both exterior to the pivot arm
assembly 421 and, like the upper pivot arm 422, pivots about a point located within the
removable pivot arm assembly 421. The shorter of the ends extends into the pivot arm
support carriage 420 when the pivot arm assembly 421 is inserted into the mechanical
housing 418 and engages with the lower pivoting member 452 to secure the removable pivot arm assembly 421 within the pivot arm support carriage 420. The longer end of the lower pivot arm 424 includes the following features along its length, extending away from the pivot arm assembly 421: a bolt receptacle 436 that receives the bolt or pin 432 inserted through the container hasp 16, and a hole 434 adapted to receive the bolt of a standard bolt seal 14 therethrough.

[089] Within the electronics compartment 426, the upper and lower pivoting members 450,452 are located near sensing contacts 430. When the electronic locking device 412 is in a locked configuration (as shown in FIG. 8), the pivoting members 450,452 pivot to make contact with the sensing contacts 430 and close the circuit.

[090] FIGS. 9-11 are schematic illustrations of a further variation of an electronic locking device 512 for securing a shipping container 6 in a locked configuration in accordance with one or more aspects of the present invention. The device 512 has a rugged mechanical housing 518 supporting an upper pivot arm 522 and a lower pivot arm 522 and containing a spring 560 that forces the upper and lower pivot arms 522,524 apart from one another. The rugged mechanical housing 518 includes a pivot arm support carriage 520, which is preferably enclosed except for the pivot arms 522,524 extending therefrom, a sealed compartment 526 containing sensor electronics 42 and one or more batteries 44, and a barrier 528 to prevent access to the electronics compartment 526 from the pivot arm support carriage 520.

[091] The upper pivot arm 522 has a proximal end, which is located within the pivot arm support carriage 520, and a distal end. The upper pivot arm 522 pivots about a point located on or near its proximal end. In this variation of the device 512, the upper pivot arm 522 includes the following features along its length, from proximal end to distal end: a pivot or swivel 546, and a sensing contact 530, preferably disposed within the pivot arm support carriage 520, that closes a circuit when the electronic locking device 512 is in a locked configuration (as shown in FIG. 9) and opens the circuit when the electronic locking device 512 is in an unlocked configuration (as shown in FIG. 10).

[092] The lower pivot arm 524 has a proximal end, which is located within the pivot arm support carriage 520, and a distal end. Like the upper pivot arm 522, the lower pivot arm 524 pivots about a point located on or near its proximal end. In this variation of the device 512, the lower pivot arm 524 includes the following features along its length, from proximal end to distal end: a pivot or swivel 546, and a sensing contact 530, preferably disposed within the pivot arm support carriage 520, that closes the pivot arm circuit, by making contact or
coming in close proximity with the sensing contact 530 on the upper pivot arm 522, when the electronic locking device 512 is in a locked configuration (as shown in FIG. 9) and opens the circuit when the electronic locking device 512 is in an unlocked configuration (as shown in FIG. 10).

[093] Furthermore, due to the spring 560, the natural state of the device 512 is the unlocked configuration (as shown in FIG. 10). To bring the device 512 into the locked configuration some compressive force 562 must be applied to the upper and lower pivot arms 522,524, as depicted in FIG. 9, while this force has been removed in the configuration shown in FIG. 10. FIG. 11 illustrates a specific variant in which a bolt 564 may be used to provide the compressive force to bring the device 512 into the locked configuration.

[094] In some embodiments, the device 512 of FIGS. 9-11 may be utilized with a hasp 16 and conventional bolt seal 14, thereby forming a system akin to those of FIGS. 2-8. In other embodiments, however, the device 512 of FIGS. 9-11 may be utilized in other ways, such as in combination with a lid or other element of a shipping conveyance.

[095] It will be apparent to the Ordinary Artisan that the various features, variations, methods of use, implementations, sensor electronics functionality, and the like, described previously with regard to FIGS. 2-4, are equally applicable, except where by their nature such applicability is inappropriate, to the other variations described herein with reference to FIGS. 5-11.

[096] Based on the foregoing description, it will be readily understood by those persons skilled in the art that the present invention is susceptible of broad utility and application. Many embodiments and adaptations of the present invention other than those specifically described herein, as well as many variations, modifications, and equivalent arrangements, will be apparent from or reasonably suggested by the present invention and the foregoing descriptions thereof, without departing from the substance or scope of the present invention.

[097] Accordingly, while the present invention has been described herein in detail in relation to one or more preferred embodiments, it is to be understood that this disclosure is only illustrative and exemplary of the present invention and is made merely for the purpose of providing a full and enabling disclosure of the invention. The foregoing disclosure is not intended to be construed to limit the present invention or otherwise exclude any such other embodiments, adaptations, variations, modifications or equivalent arrangements, the present invention being limited only by the claims appended hereto and the equivalents thereof.
What is claimed is:

1. An electronic locking device for securing a shipping container, comprising:
   (a) a housing enclosing a support carriage, an electronics compartment, and a barrier to prevent access to the electronics enclosure from the support carriage;
   (b) a pair of arms, extending from the support carriage and adapted to couple to a hasp on a shipping container, wherein at least one of the arms is capable of pivoting, relative to the other of the arms, between a locked configuration and an unlocked configuration, relative to the hasp, and wherein the arms are adapted to receive a bolt seal only when placed in the locked configuration;
   (c) a sensing circuit, including two sensing contacts, that is placed in a "closed" state when the at least one arm is pivoted into the locked configuration and is placed in an "open" state when the at least one arm is pivoted into the unlocked configuration; and
   (d) electronics, housed in the electronics compartment and coupled to the sensing circuit, that recognize, when active, whether the sensing circuit is in the "closed" state or the "open" state and generate an output indicating the state of the sensing circuit;
   (e) wherein the output of the electronics represents an indication as to whether the arms are in the locked configuration or the unlocked configuration.

2. The electronic locking device of claim 1, wherein the electronics compartment and the support carriage are contained within a rugged mechanical housing.

3. The electronic locking device of claim 2, wherein a pin extends from a first arm, of the pair of arms, and is adapted to extend through the hasp.

4. The electronic locking device of claim 3, wherein, in the locked configuration, the presence of the pin, extending through the hasp, prevents the hasp from being opened.

5. The electronic locking device of claim 4, wherein the pin has a distal end that is disposed adjacent a second arm, of the pair of arms, when the device is in the locked configuration, thereby preventing the hasp from being opened.

6. The electronic locking device of claim 5, wherein the second arm includes a pin receptacle adapted to receive and secure the distal end of the pin and wherein, in the locked configuration, the distal end of the pin is disposed within the pin receptacle.

7. The electronic locking device of claim 3, wherein, in the unlocked configuration, the pin is withdrawn from the hasp, thereby permitting the hasp to be opened.
8. The electronic locking device of claim 3, wherein the pin is a bolt.

9. The electronic locking device of claim 3, wherein the arms are adapted to be maintained in the locked configuration by the bolt seal.

10. The electronics locking device of claim 9, wherein the arms are prevented from pivoting, relative to each other, by the bolt seal, thereby maintaining the arms in the locked configuration.

11. The electronic locking device of claim 3, wherein each sensing contact is disposed in or on a respective arm of the pair of arms.

12. The electronics locking device of claim 11, wherein the sensing contact on the at least one pivoting arm is moved toward the sensing contact on the other of the arms when the at least one pivoting arm is pivoted toward the other arm.

13. The electronic locking device of claim 3, wherein:

   (f) one arm pivots around a point within the support carriage;
   (g) the other arm is fixed in place;
   (h) the sensing contacts extend from portions of the arms interior the support carriage;
   (i) the pin is located exterior the support carriage;
   (j) the second arm includes a pin receptacle adapted to receive and secure the distal end of the pin, and the pin receptacle is located exterior the support carriage; and
   (k) each of the arms has a hole adapted to receive a bolt seal.

14. The electronic locking device of claim 3, wherein

   (f) the arms pivot around respective points within the support carriage;
   (g) the sensing contacts extend from portions of the arms interior the support carriage;
   (h) the pin is located exterior the pivot arm support carriage;
   (i) the second arm includes a pin receptacle adapted to receive and secure the distal end of the pin, and the pin receptacle is located exterior the pivot arm support carriage; and
   (j) each of the arms has a hole adapted to receive the bolt seal.

15. The electronic locking device of claim 14, wherein the bolt seal holes are further from the support carriage than are the pin and pin receptacle.

16. The electronic locking device of claim 14, wherein the pin and pin receptacle are further from the support carriage than are the bolt seal holes.
17. The electronic locking device of claim 3, wherein both arms have a pivot point within the support carriage and wherein the pivot points are located between the sensing contacts and the pin and pin receptacle.

18. The electronic locking device of claim 1, wherein the arms are carried by a pivot arm assembly that is removable from the support carriage.

19. The electronic locking device of claim 18, wherein pivoting the at least one arm into the locked configuration while the removable pivot arm assembly is within the support carriage mechanically secures the removable pivot arm assembly.

20. The electronic locking device of claim 19, wherein securing the removable pivot arm assembly by pivoting the arms into the locked configuration places the sensing circuit in the "closed" state.

21. The electronic locking device of claim 1, further comprising a spring situated between the arms, wherein the spring biases the arms away from one another and a force must be applied to hold the arms in proximity to one another.

22. The electronic locking device of claim 21, wherein:
   (f) a pin extends from a first arm, of the pair of arms, and is adapted to extend through the hasp;
   (g) in the locked configuration, the presence of the pin, extending through the hasp, prevents the hasp from being opened;
   (h) the second arm includes a pin receptacle adapted to receive and retain the distal end of the pin; and
   (i) the securement of the pin within the pin receptacle provides the force to hold the arms in proximity to one another.
23. An electronic system for securing a shipping container, comprising:
   (a) a hasp adapted for use in securing a shipping container;
   (b) a bolt seal; and
   (c) an electronic locking device, including:
      (i) a housing enclosing a support carriage, an electronics compartment, and a barrier to prevent access to the electronics enclosure from the support carriage;
      (ii) a pair of arms, extending from the support carriage and adapted to couple to the shipping container hasp, wherein at least one of the arms is capable of pivoting, relative to the other of the arms, between a locked configuration and an unlocked configuration, relative to the hasp, and wherein the arms are adapted to receive the bolt seal only when placed in the locked configuration;
      (iii) a sensing circuit, including two sensing contacts, that is placed in a "closed" state when the at least one arm is pivoted into the locked configuration and is placed in an "open" state when the at least one arm is pivoted into the unlocked configuration; and
      (iv) electronics, housed in the electronics compartment and coupled to the sensing circuit, that recognize, when active, whether the sensing circuit is in the "closed" state or the "open" state and generate an output indicating the state of the sensing circuit;
      (v) wherein the output of the electronics represents an indication as to whether the arms are in the locked configuration or the unlocked configuration.

24. The electronic system of claim 23, wherein the electronics compartment and the support carriage are contained within a rugged mechanical housing.

25. The electronic system of claim 24, wherein a pin extends from a first arm, of the pair of arms, and is adapted to extend through the hasp.

26. The electronic system of claim 25, wherein, in the locked configuration, the presence of the pin, extending through the hasp, prevents the hasp from being opened.

27. The electronic system of claim 26, wherein the pin has a distal end that is disposed adjacent a second arm, of the pair of arms, when the device is in the locked configuration, thereby preventing the hasp from being opened.
28. The electronic system of claim 27, wherein the second arm includes a pin receptacle adapted to receive and secure the distal end of the pin and wherein, in the locked configuration, the distal end of the pin is disposed within the pin receptacle.

29. The electronic system of claim 25, wherein, in the unlocked configuration, the pin is withdrawn from the hasp, thereby permitting the hasp to be opened.

30. The electronic system of claim 25, wherein the pin is a bolt.

31. The electronic system of claim 25, wherein the arms are adapted to be maintained in the locked configuration by the bolt seal.

32. The electronic system of claim 31, wherein the arms are prevented from pivoting, relative to each other, by the bolt seal, thereby maintaining the arms in the locked configuration.

33. The electronic system of claim 25, wherein each sensing contact is disposed in or on a respective arm of the pair of arms.

34. The electronic system of claim 33, wherein the sensing contact on the at least one pivoting arm is moved toward the sensing contact on the other of the arms when the at least one pivoting arm is pivoted toward the other arm.

35. The electronic system of claim 25, wherein:

   (f) one arm pivots around a point within the support carriage;
   (g) the other arm is fixed in place;
   (h) the sensing contacts extend from portions of the arms interior the support carriage;
   (i) the pin is located exterior the support carriage;
   (j) the second arm includes a pin receptacle adapted to receive and secure the distal end of the pin, and the pin receptacle is located exterior the support carriage; and
   (k) each of the arms has a hole adapted to receive the bolt seal.

36. The electronic system of claim 25, wherein

   (f) the arms pivot around respective points within the support carriage;
   (g) the sensing contacts extend from portions of the arms interior the support carriage;
   (h) the pin is located exterior the pivot arm support carriage;
   (i) the second arm includes a pin receptacle adapted to receive and secure the distal end of the pin, and the pin receptacle is located exterior the pivot arm support carriage; and
37. The electronic system of claim 36, wherein the bolt seal holes are further from the support carriage than are the pin and pin receptacle.

38. The electronic system of claim 36, wherein the pin and pin receptacle are further from the support carriage than are the bolt seal holes.

39. The electronic system of claim 25, wherein both arms have a pivot point within the support carriage and wherein the pivot points are located between the sensing contacts and the pin and pin receptacle.

40. The electronic system of claim 23, wherein the arms are carried by a pivot arm assembly that is removable from the support carriage.

41. The electronic system of claim 40, wherein pivoting the at least one arm into the locked configuration while the removable pivot arm assembly is within the support carriage mechanically secures the removable pivot arm assembly.

42. The electronic system of claim 41, wherein securing the removable pivot arm assembly by pivoting the arms into the locked configuration places the sensing circuit in the "closed" state.

43. The electronic system of claim 23, further comprising a spring situated between the arms, wherein the spring biases the arms away from one another and a force must be applied to hold the arms in proximity to one another.

44. The electronic system of claim 43, wherein:
   (f) a pin extends from a first arm, of the pair of arms, and is adapted to extend through the hasp;
   (g) in the locked configuration, the presence of the pin, extending through the hasp, prevents the hasp from being opened;
   (h) the second arm includes a pin receptacle adapted to receive and retain the distal end of the pin; and
   (i) the securement of the pin within the pin receptacle provides the force to hold the arms in proximity to one another.

(j) each of the arms has a hole adapted to receive the bolt seal.
45. A method for securing a shipping container, comprising:
   (a) providing an electronic locking device, comprising:
       (i) a housing enclosing a support carriage, an electronics compartment,
           and a barrier to prevent access to the electronics enclosure from the
           support carriage;
       (ii) a pair of arms, extending from the support carriage;
       (iii) a sensing circuit; and
       (iv) electronics, housed in the electronics compartment and coupled to the
           sensing circuit;
   (b) configuring the electronic locking device from a locked configuration to an
       unlocked configuration by pivoting at least one of the arms away from the
       other arm;
   (c) as a function of the at least one arm being pivoted away from the other arm,
       placing the sensing circuit in an "open" state;
   (d) recognizing, by the electronics, the "open" state of the sensing circuit;
   (e) generating, by the electronics, an output indicating the "open" state of the
       sensing circuit;
   (f) positioning the electronic locking device in proximity to a hasp on a shipping
       container;
   (g) coupling the arms to the hasp on the shipping container by pivoting at least
       one of the arms towards the other arm from the unlocked configuration into
       the locked configuration;
   (h) as a function of the at least one arm being pivoted toward the other arm,
       placing the sensing circuit in a "closed" state;
   (i) recognizing, by the electronics, the "closed" state of the sensing circuit; and
   (j) generating, by the electronics, an output indicating the "closed" state of the
       sensing circuit.

46. The method of claim 45, further comprising a step of locking the electronic locking
    device in the locked configuration with a standard bolt seal.

47. The method of claim 46, further comprising a step of translating the output to indicate
    whether the arms were in the locked configuration or the unlocked configuration.

48. The method of claim 46, wherein the step of placing the sensing circuit in an "open"
    state is effectuated by separating a sensing contact on one arm from the a sensing
    contact on the other arm.
49. The method of claim 46, wherein the step of locking the electronic locking device in the locked configuration with a standard bolt seal includes inserting a bolt of the standard bolt seal through respective openings on the arms.

50. A system for securing, monitoring and tracking shipping containers, as disclosed herein.

51. The system of claim 50, further comprising:
   (a) a hasp adapted for use in securing a shipping container;
   (b) a bolt seal; and
   (c) an electronic locking device, including:
      (i) a housing enclosing a support carriage, an electronics compartment, and a barrier to prevent access to the electronics enclosure from the support carriage;
      (ii) a pair of arms, extending from the support carriage and adapted to couple to the shipping container hasp, wherein at least one of the arms is capable of pivoting, relative to the other of the arms, between a locked configuration and an unlocked configuration, relative to the hasp, and wherein the arms are adapted to receive the bolt seal only when placed in the locked configuration;
      (iii) a sensing circuit, including two sensing contacts, that is placed in a "closed" state when the at least one arm is pivoted into the locked configuration and is placed in an "open" state when the at least one arm is pivoted into the unlocked configuration; and
      (iv) electronics, housed in the electronics compartment and coupled to the sensing circuit, that recognize, when active, whether the sensing circuit is in the "closed" state or the "open" state and generate an output indicating the state of the sensing circuit;
      (v) wherein the output of the electronics represents an indication as to whether the arms are in the locked configuration or the unlocked configuration.

52. A method of securing, monitoring and tracking shipping containers, as disclosed herein.
53. The method of claim 52, further comprising:

(a) providing an electronic locking device, comprising:

(i) a housing encasing a support carriage, an electronics compartment, and a barrier to prevent access to the electronics enclosure from the support carriage;

(ii) a pair of arms, extending from the support carriage;

(iii) a sensing circuit; and

(iv) electronics, housed in the electronics compartment and coupled to the sensing circuit;

(b) configuring the electronic locking device from a locked configuration to an unlocked configuration by pivoting at least one of the arms away from the other arm;

(c) as a function of the at least one arm being pivoted away from the other arm, placing the sensing circuit in an "open" state;

(d) recognizing, by the electronics, the "open" state of the sensing circuit;

(e) generating, by the electronics, an output indicating the "open" state of the sensing circuit;

(f) positioning the electronic locking device in proximity to a hasp on a shipping container;

(g) coupling the arms to the hasp on the shipping container by pivoting at least one of the arms towards the other arm from the unlocked configuration into the locked configuration;

(h) as a function of the at least one arm being pivoted toward the other arm, placing the sensing circuit in a "closed" state;

(i) recognizing, by the electronics, the "closed" state of the sensing circuit; and

(j) generating, by the electronics, an output indicating the "closed" state of the sensing circuit.
54. A method, comprising:
   (a) broadcasting, by a gateway of a network, a beacon including a location identification;
   (b) receiving, at a wireless communications device, the beacon;
   (c) in response to receiving the beacon, communicating, by the wireless communications device to the gateway, a registration request;
   (d) communicating, by the gateway, an acknowledgment to the wireless communications device;
   (e) receiving, at the wireless communications device, the acknowledgment; and
   (f) engaging, by the wireless communications device, a profile corresponding to the location identification.

55. A system, comprising:
   (a) a plurality of networks, each network comprising one or more gateways, and a plurality of wireless communications devices connected to the respective network via the one or more gateways;
   (b) one or more user applications running on one or more computing devices;
   (c) a management system comprising control software running on one or more servers, the management system being configured to handle requests for, and establish, connections between a network of the plurality of networks and a user application of the one or more user applications.
FIG. 11