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(71) Applicant and  
 (72) Inventor: STEVENS, John, K [US/CA]; eBox.com Inc.,  
 4211 Yonge St, Toronto, Ontario M2P 2A9 (CA).

(74) Agent: OPPEDAHL, Carl; Oppedahl & Larson LLP, P.O.  
 Box 5270, Frisco, CO 80443 (US).

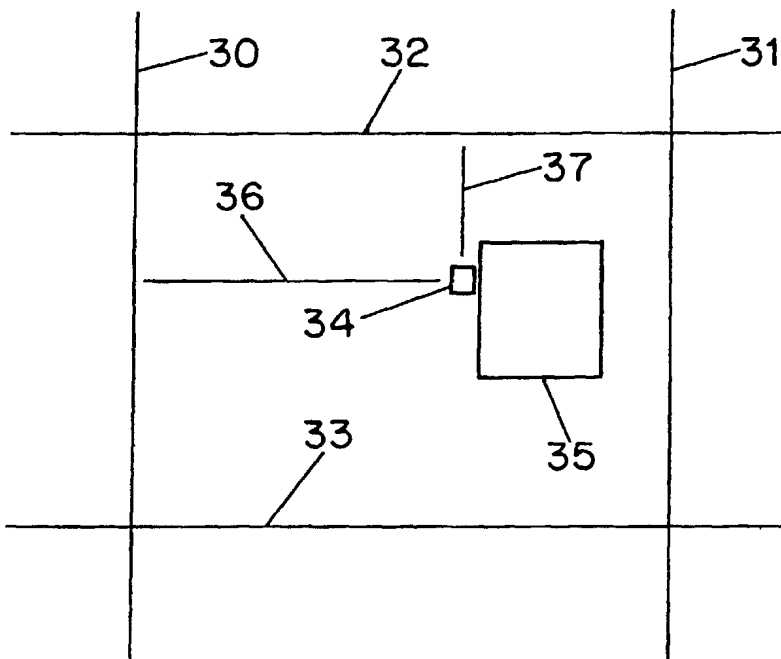
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(54) Title: IMPROVED PACKAGE DELIVERY SYSTEM



(57) Abstract: A package storage and delivery system includes electronically controlled lockers (34) disposed at or near customer locations. Each locker (34) is unlocked by a courier, preferably by means of a short-range transceiver or transmitter carried on the courier's person. The customer can unlock the locker (34) and receive the delivered package. Cryptographically signed communications are employed along with nonvolatile usage logs to minimize the risk of loss of a package or fraud by courier or customer. The lockers may be stackable, permitting a delivery courier to add lockers in the event a customer receives too many deliveries to fit into a single locker. Each box (62) has, of course, a physical location, and has associated with it an address code indicative of the physical location, for example by means of a human-readable or compressed representation of the precise latitude (32, 33) and longitude (30, 31). A package delivered to such a box preferably

bears the address code. A merchant can greatly reduce the risk of credit card fraud by requiring the use of such codes for the simple reason that a fraudulent transaction may be traced to a specific physical location.



WO 01/27740 A1

## Improved package delivery system

To the extent permitted by applicable law, this application claims priority from and incorporates by reference the following US patent applications: application no. 60/159,479  
5 filed 1999-10-14, application no. 60/160,051 filed 1999-10-18, application no. 60/165,061  
filed 1999-11-12, application no. 60/168,685 filed 1999-12-01, and application no.  
60/181,372 filed 2000-02-09.

The invention relates generally to package storage and delivery, and relates more particularly  
10 to improved systems and methods for package storage and delivery.

## Background

The Internet and other technological changes have brought about sweeping changes in  
15 communications and commerce. But just as improved communications media such as optical  
fiber have been unable to solve the problem of the “last mile” of communications to a  
particular home, so have improved ways of placing merchandise orders been unable to solve  
the problem of the “last mile” of merchandise delivery to a particular home. While overnight  
package delivery services have become commonplace in recent years (for example, Federal  
20 Express, United Parcel Service, and Airborne), these services have great difficulty delivering  
to individual homes. The occupant of the home is often not there (being at work, for  
example) and thus a carrier may have to visit the home two or more times to effect delivery.  
The occupant of the home will likely return home from work to find a note on the door  
indicating that the carrier tried to deliver a package but no one was home.

25 A related set of problems present themselves when a customer seeks to return mail-order  
merchandise. The return may be due to a variety of reasons, from incorrect size or color to  
dissatisfaction with the quality or function of the merchandise. The return can be a nuisance  
for the customer. Real or perceived difficulty of making returns prompts some would-be  
30 mail-order customers to forgo placing the mail order.

Still another problem is mail fraud. Many mail-order merchants face problems with

fraudulent orders placed using stolen credit card numbers. The losses attributable to such orders are, of course, passed back to merchants (and through them to customers) through the commissions charged for processing payments for such orders.

5 A related but distinct concern is simply the delivery cost of the “last mile”. A substantial part of the price charged by a carrier to deliver a package is due to the “last mile”.

10 There is thus a great need for package storage and delivery systems which overcome the difficulties described above. Such a system would deal with the problem that customers are often not at home. Such a system would make returns easier and would reduce risk of credit card fraud. Such a system would be less expensive than existing systems for last-mile delivery.

15 Many individuals and companies have devoted time, energy, and ingenuity to these problems. The typical approach is to provide lockers which are geographically nearby to customers and which are intended to remove the need for the customer to be home when the carrier arrives. Prior-art locker systems include those described in US Pat. No. 5,645,215 for “Security mailbox”; US Pat. No. 5,475,378 for “Electronic access control mail box system”; US Pat. No. 5,223,829 for “Electric locker apparatus with automatic locker box designation  
20 device”; US Pat. No. 5,074,135 for “System for the use of lockers or the like”; US Pat. No. 4,894,717 for “Delivered article storage control system”; US Pat. No. 4,048,926 for “Safe”; and US Pat. No. 5,774,053 for “Storage device for the delivery and pickup of goods”.

25 No prior art approach known to applicants herein succeeds in solving all of the problems discussed above.

### Summary of the invention

30 A package storage and delivery system includes electronically controlled lockers disposed at or near customer locations. Each locker is unlocked by a courier, preferably by means of a short-range transceiver or transmitter carried on the courier’s person. The customer can unlock the locker and receive the delivered package. Cryptographically signed

communications are employed along with nonvolatile usage logs to minimize the risk of loss of a package or fraud by courier or customer. The lockers may be stackable, permitting a delivery courier to add lockers in the event a customer receives too many deliveries to fit into a single locker. Each box has, of course, a physical location, and has associated with it an address code indicative of the physical location, for example by means of a human-readable or compressed representation of the precise latitude and longitude. A package delivered to such a box preferably bears the address code. A merchant can greatly reduce the risk of credit card fraud by requiring the use of such codes for the simple reason that a fraudulent transaction may be traced to a specific physical location.

### Detailed description

Delivery of packages may be performed with respect to package lockers that are located according to a coordinate system. Fig. 1 shows a typical locker 34 attached to a home 35. The home has a location relative to lines of latitude 32, 33 and lines of longitude 30, 31 which define a grid. Lines 36, 37 define the position of the locker within the grid.

In the usual case, the location of the locker 34 is determined at the time of installation, for example using a GPS (global positioning system) receiver. The GPS receiver provides the latitude and longitude, expressed in a suitable notation such as degrees, minutes and seconds or degrees and decimal fractions of a degree. When SA (selective availability) is off, the receiver will provide a spatial resolution of typically ten or twenty feet. If SA is on, it is desirable to use DGPS (differential GPS) to provide a position of comparable accuracy.

A traditional numerical representation of a location by latitude and longitude is rather wasteful of characters. The only characters used are digits, and many of the digits are not used. Unused digits happen because, for example, the number of minutes in a degree is never more than sixty, so the first digit of a "minutes" value is never 7 or 8 or 9. Unused digits also happen because some combinations of digits correspond to geographic locations (e.g. in the Arctic or the middle of the ocean) that are unlikely to be referred to as a package delivery location.

It is a straightforward matter to devise functions which permit expressing geographic locations with far fewer characters than decimally expressed latitudes and longitudes. Letters can be used along with all ten digits to provide locations expressed in perhaps six or eight characters depending on the desired resolution. Some economy of effort can be accomplished by selecting a reference point such as the airport which might be used to deliver a courier package for an address. Once the airport reference point is selected, it is a straightforward matter to define latitude and longitude relative to that point rather than relative to the usual global origin.

It is thus helpful to consider expressing a locker location by means of an airport code followed by some letters and numbers which communicate the precise position of the locker relative to the reference point of the airport code. Such an expression can be extremely helpful to a courier delivery service. It tells which airport to send the package to, as well as the position relative to that airport.

Fig. 2 shows a package addressed according to the invention. A Zip code 47 may appear on the package but is fundamentally unrelated to the position code just described. The position code may consist of an airport code 45 as well as a character string 46 which conveys the location relative to the airport. Importantly, when a locker is installed, the installer will take a GPS reading, and with appropriate software will convert the latitude and longitude information into the character string 46.

When a would-be customer places an order for delivery of goods, the customer provides the entire "ebox" code 45, 46 to the merchant. The merchant uses the code 45, 46 to address the package.

The courier company will necessarily perform sorts on packages and will also need to load trucks efficiently. A traditional truck-loading approach is to group the packages by Zip code value. This has the advantage of being simple to do, and has the disadvantage that it may pass up opportunities for trucks to be packed optimally. Two destinations might be very near each other and yet have quite different Zip codes, for example. Sorting packages by Zip code in numerical order will not necessarily place packages near to each other that represent

delivery locations that are near to each other.

The position code 45, 46 offers benefits for the trucking and delivery companies. When a truck is being packed, packages that are intended for locations that are suitably nearby to reach other can be easily identified by visual review of the position codes.

In accordance with the invention, what happens next is that a delivery carrier takes the package to the geographic location defined by the location code, and identifies a delivery box 60 (Fig. 3). This box 60 has a lid 61 which locks and unlocks under control of a microprocessor. The carrier transmits a wireless signal to the box that prompts the box to open, and lifts the lid 61 as shown in lifted position 63. The package may then be placed in the box 62. The lid is closed, and the customer is notified that there is a package in the box.

Later, the customer causes the box to unlock, preferably by a second wireless signal, and the lid is opened. The package is removed and the lid is closed. Preferably a log is kept of the openings and closings of the box, and the log may be stored in nonvolatile memory in the box for later study in the event of some question as to the delivery of a package.

Importantly, if a merchant ships a package using a position code of the type described here, it is likely that credit card fraud losses could be reduced substantially. If a shipment turns out to have been an order placed by a fraudulent party, the position code permits the authorities to go directly to the place where the package was delivered. This pinpoint locating ability will reduce fraud by making it easier to find the fraudulent party, but also serves as preventive measure since many would-be fraudulent parties will be deterred by the increased risk of being caught.

On a very practical level a merchant that uses position-coded addresses as described above will have a lower rate of credit card fraud, and credit card merchant banks will likely offer reduced credit card commissions or other incentives to attract the business of such a merchant.

It should also be appreciated that a storage locker such as is described above can be an

important part of a delivery system that includes delivery trucks dispatched to deliver during off-peak times. In many areas a suitable off-peak time will be late at night, for example between 10 PM and 7 AM. A typical delivery driver and truck operating during off-peak hours and using lockers such as are described above will be able to perform many more  
5 deliveries per hour than a driver and truck operating during peak times (such as during daylight hours) and without such lockers.

In an off-peak approach, the packages may be addressed with location codes as described above. Alternatively, the addresses may be traditional postal service addresses. In either  
10 case, some means is required for securely unlocking and locking the lockers. One approach is to receive an order from a customer and to establish a unique identifier in connection with the order. When the carrier reaches the locker, a message is communicated to the locker, preferably by wireless means such as radio or infrared. The locker tests for a predetermined relationship between the message and the identifier, and if the relationship is satisfied the  
15 locker unlocks and the lid can be opened. The package is placed in the locker and the lid is closed and locked. The user is then notified that there is a package in the locker.

Those skilled in the art will have no difficulty devising myriad obvious improvements and enhancements to the invention described, all of which are to be considered with the scope of  
20 the invention as defined by the claims which follow.

## Claims

1. A method of delivering a package from a sender to a destination comprising the steps of:
- 5 determining a physical location of the destination within a coordinate system to within a predetermined accuracy;
- representing the physical location of the destination by means of an address code indicative of the physical location;
- 10 communicating to a sender a request requesting delivery of a package by a sender and communicating the address code to the sender in the request;
- addressing the package with information indicative of the address code;
- 15 reading the information and deriving the address code therefrom;
- proceeding to the actual location defined by the address code;
- 20 electronically performing a first unlocking of a locker at the actual location;
- locking the locker after the electronic unlocking;
- performing a second unlocking of the locker;
- 25 removing the package from the locker; and
- logging the first and second unlocking.
- 30 2. The method of claim 1 wherein the coordinate system is latitude and longitude and the predetermined accuracy is that obtainable through a satellite global positioning system.



3. A method of installing a locker at a destination of a customer comprising the steps of:

determining a physical location of the destination within a coordinate system to within a predetermined accuracy;

5

representing the physical location of the destination by means of an address code indicative of the physical location;

communicating the address code to the customer.

10

4. The method of claim 3 wherein the coordinate system is latitude and longitude and the predetermined accuracy is that obtainable through a satellite global positioning system.

5. A method for delivery of parcels with respect to peak and off-peak times, the method comprising

15

receiving an order for a parcel from a customer located at a premises;

establishing, in connection with the order, a unique identifier;

20

communicating the unique identifier to a locker located at the premises;

transporting the parcel to the premises, the parcel arriving at the premises during an off-peak time;

25

entering a message to the locker;

testing for a predetermined relationship between the message and the unique identifier;

30

opening the locker in the event the predetermined relationship is found;

placing the parcel in the locker;

annunciating to the customer the placing of the parcel in the locker.

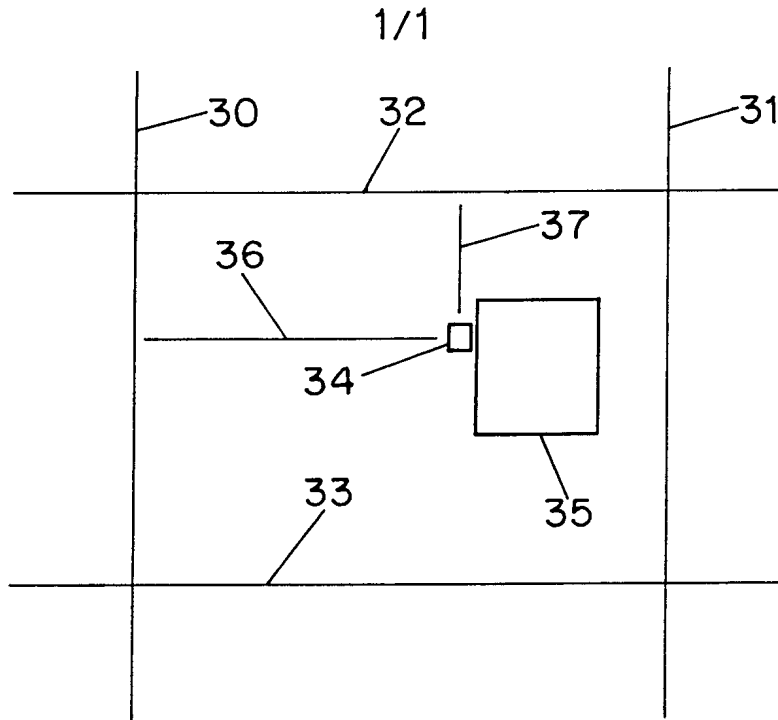


FIG. 1

JOE CUSTOMER  
E BOX ORD B3K7NP  
WINNETKA, IL 60523

45            46            47

FIG. 2

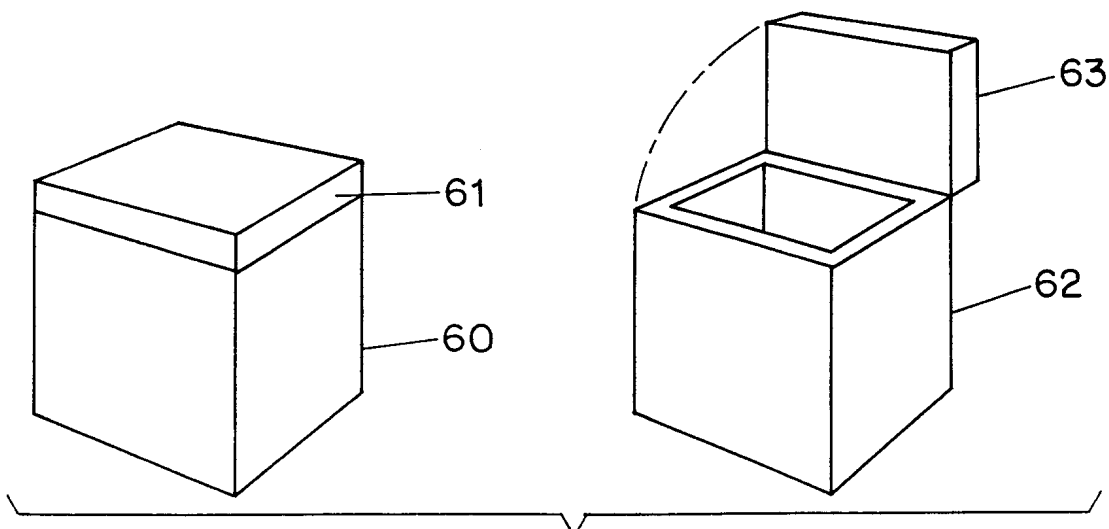


FIG. 3

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/28415

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : G06F 7/00, 7/04; G08B 5/22; H04M 1/64  
 US CL : 340/5.9, 5.64, 5.73, 825.49, 825.310, 994; 379/58

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
 U.S. : 340/5.9, 5.64, 5.73, 825.49, 825.310, 994; 379/58

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
 EAST

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,444,444 A (Ross) 22 AUGUST 1995, see whole document	1, 3, 5
Y	US 4,727,368 A (LARSON et al) 23 February 1988, see whole document.	1, 3, 5
Y	US 5,625,668 A (LOOMIS et al) 29 April 1997, see whole document	2, 4

Further documents are listed in the continuation of Box C.  See patent family annex.

* Special categories of cited documents:	
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"E" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"P" document published prior to the international filing date but later than the priority date claimed	

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