(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 July 2001 (05.07.2001)

PCT

(10) International Publication Number
WO 01/47466 A1

(51) International Patent Classification[7]: A61J 7/04

(21) International Application Number: PCT/US00/34729

(22) International Filing Date:
21 December 2000 (21.12.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/474,319 29 December 1999 (29.12.1999) US

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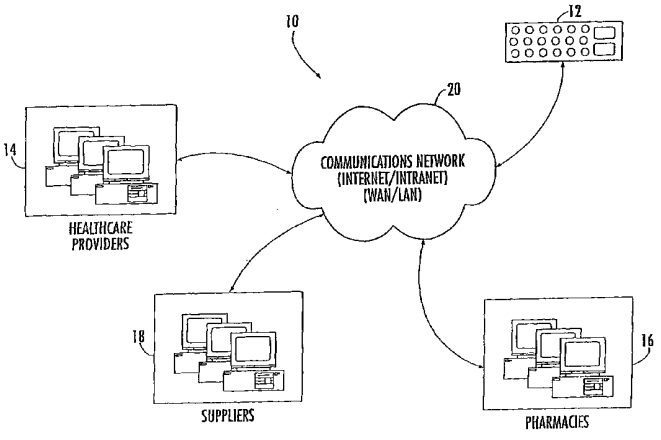
(81) Designated States *(national)*: AU, CA, CN, JP, SG.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: SYSTEMS AND METHODS FOR MONITORING PATIENT COMPLIANCE WITH MEDICATION REGIMENS



(57) Abstract: Systems and methods are provided for facilitating effective self-management of medication treatment by patients. A Smart Tray monitors and reports to third parties a patient's compliance with various medication treatment regimens. Medication containers are provided with electromagnetic tags that provide various information about medicament contained within a respective container. A Smart Tray is equipped with a processor and reader that interrogates each respective electromagnetic tag to identify medicament(s) contained within each container. Using the retrieved information, a Smart Tray provides visual and/or audio signals to a patient to remind the patient when and how much of various medicaments to take. A Smart Tray also monitors, via the reader, when a medication container is removed. A Smart Tray can communicate with one or more third parties, such as healthcare providers, pharmacies, and other suppliers of healthcare products and services via a computer network. In addition, a Smart Tray can communicate with various appliances and can modify medication regimens for particular medicaments in response to data received from various appliances.

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SYSTEMS AND METHODS FOR MONITORING PATIENT COMPLIANCE WITH MEDICATION REGIMENS

Field of the Invention

The present invention relates generally to healthcare systems and methods and, more particularly, to systems and methods for monitoring healthcare treatment.

Background of the Invention

According to the National Medical Expenditure Survey of 1987, 90 million Americans suffer from one or more chronic conditions. Treatment of these chronic conditions represents over 76% of health care expenditures and the total direct costs of treating these chronic conditions is estimated to rise to $798 billion by the year 2030.

Many patients with chronic conditions are treated at home. Unfortunately, many patients may be unable to reliably manage their treatment, such as medication regimens, at home without the supervision of a healthcare provider. To be effective, medications often must follow various scheduling and dietary guidelines. For example, some medications are to be taken with food, others are not. Some medications are to be taken only once a day, others multiple times per day. Remembering when to take a medication and how much of it can become difficult as the number of concurrent

medications increases.

Various devices for assisting patients in following medication regimens are known. For example, U.S. Patent No. 4,837,719 to McIntosh describes a medication clock for signaling the times that dosages of a medication should be taken. The McIntosh device also provides a record of when each medicine was taken for comparison with the medication schedule. In addition, the McIntosh device can monitor and record temperature, blood pressure and pulse rate of the user.

U.S. Patent No. 5,020,037 to Raven discloses an alarm pill box which cancels the alarm when a compartment lid is opened. A visual display is used to indicate the number of times that the lid has been opened within one day.

U.S. Patent No. 4,911,327 to Shepherd et al., describes a dispenser for providing scheduled dosages of pills according to a predetermined medication program. A housing contains a plurality of pill containers from which dosages of pills may be released into a user-accessible pill receiver. The release of pills is controlled such that pills are released at predetermined intervals as dictated by the medication program. On release of a dosage of pills, an alarm is activated to indicate to a user that a dosage is due to be taken, the alarm being deactivated when the user accesses the pill receiver to remove the dosage of pills. If the user does not access the pill receiver within a predetermined time interval from release of the dosage, an optional remote alarm may be activated to alert a supervisor.

U.S. Patent No. 4,616,316 to Hanpeter et al. describes a medication compliance monitoring system consisting of a blister pack having an array of plastic blisters defining compartments for medication. The

blister pack has a frangible non-conductive backing sheet including conductive traces behind the compartments which are respectively ruptured when the medication doses are removed. An electronic memory circuit detects when individual compartments are ruptured and stores this information.

U.S. Patent No. 5,408,443 to Weinberger describes a medication-dispensing system that includes a prescribing data entry station for use by a physician to store prescription information in a portable prescribing module, a dispensing data entry station for use by a pharmacy to store dispensing information in a portable dispensing data storage unit, and a medication dispenser responsive to information stored in the portable prescribing module to describe use of medication in the dispenser in accordance with a regimen prescribed by the physician and to the dispensing data storage unit to control dispensing of the medication. One embodiment has two medication drawers, each having a plurality of compartments with indicating lights selectively indicating the compartment from which medication is to be taken, a screen for displaying instructions regarding loading of the medication compartments and taking of the medication, and a keyboard including a confirming entry key for actuation by the user to confirm compliance with the instructions. Another embodiment has a series of medication-containing compartments, each covered by a separate sliding or folding cover.

U.S. Patent No. 5,239,491 to Mucciacciaro describes a holder having a plurality of recesses for holding a plurality of medication containers, each fitting into a unique recess. The geometry of the bottom of each medication container is unique and only matches one recess in the holder. A sensor in each

recess signals the presence or absence of the dedicated container to a microprocessor. The microprocessor is programmed with the prescribed dose administration schedule for each of the different medications in the different containers. A real time clock cooperates with the microprocessor and the program to signal audibly and visibly by a light at the appropriate container when a particular pill is to be administered. The signals stop when the appropriate container is removed from its recess. A different, warning sound indicates when the wrong container is lifted.

E-pill (www.epill.com) offers a pager system that sends reminders to patients to take their medication at specific times of the day. Carebridge (www.carebridge.net) provides an electronic timing device that patients can use to help them to remember to take their medication.

IBV Technologies (1500 Westlake Avenue North, Seattle, WA 98109) provides a medication vial that records the time a patient takes his/her medication when a button is pressed by the patient. When returned to a pharmacy for a refill, the pharmacy can download and review a compliance report from the vial and counsel the patient regarding medication compliance.

APREX (30112 Eigenbrodt Way, Union City, CA) provides a telemedicine service for monitoring medication compliance. Patients take their medication from medication containers outfitted with caps that have a mini-computer therein. When patients remove the cap from a bottle to take a dose of the medication contained therein, the mini-computer records the time and date of the dosing event. At the end of the day, patients place their medication bottles on a specially configured modem that transmits daily dosing information to a selected healthcare provider. If the

healthcare provider detects a problem in how or when patients are taking their medication, those patients are called the next day by specially trained healthcare providers.

The MediMonitor®, available from InforMedix, Inc. (5920 Hubbard Dr., Rockville MD 20852), is configured to retain a month's supply of up to five medications in individual compartments and alerts patients when and how to take the medications. The MediMonitor® also monitors medication use and health status by providing a date and time-stamped record of a patient's medication-taking behavior, together with patient responses to specific questions. The MediMonitor® can transmit information via an Internet-accessible server and database to clinical drug trial sites, physicians, pharmacies and other healthcare providers. Healthcare providers can communicate information, as well as reminders and specific instructions, directly to patients via the MediMonitor®.

Szeto et al. describe a holder having receptacles for five standard sized medication containers, a four-line 20-character alphanumeric LCD, and connectors for power supply and data communications. A microswitch embedded in a wall of each receptacle detects whether the receptacle is occupied or empty.

Unfortunately, existing devices for assisting patients in following medication regimens can be somewhat expensive and complex in design. Furthermore, existing devices for assisting patients in following medication regimens can seem somewhat intrusive to a user.

Summary of the Invention

The present invention is directed to systems and methods for facilitating effective self-management of medication treatment by patients. A "Smart Tray" is provided that is capable of monitoring and reporting to third parties a patient's compliance with various treatment regimens, including medication regimens. Medication containers are provided with electromagnetic tags or other identifiers that provide various information about one or more medicaments contained within a respective container. A Smart Tray is equipped with a reader that interrogates each respective electromagnetic tag to identify medicament(s) contained within each container. The reader may also retrieve other information as well, such as dosage regimens. Using this retrieved information, a Smart Tray can provide visual and/or audio signals to a patient to remind the patient when and how much of one or more medicaments to take. A Smart Tray also monitors, via a reader, when a medication container is removed and stores this information. This can provide an indication of whether or not medication was taken in accordance with one or more medication regimens.

A Smart Tray according to the present invention can be configured to communicate with one or more third parties, such as healthcare providers, pharmacies, and other suppliers of healthcare products and services via a computer network such as the internet (or an intranet), a wide area network (WAN), or a local area network (LAN). For example, a Smart Tray, upon sensing that a supply of a particular medicament is low, can place an order for more of the medicament directly with a pharmacy or via a healthcare provider.

In addition, a Smart Tray can communicate with various appliances and devices including, but not

limited to, personal computers, Web TVs, weight scales, refrigerators, exercise devices, and scanners. A Smart Tray can modify medication regimens for particular medicaments in response to data received from various appliances. For example, if a Smart Tray receives data from an exercise device that a patient has increased his/her exercise regimen, a processor within the Smart Tray may adjust one or more of the patient's medication regimens. In addition, data can be retrieved from various health monitoring devices, such as blood pressure monitors and the like. Retrieved data may also be utilized by a Smart Tray to modify various medication regimens.

According to another embodiment of the present invention, a Smart Tray can be configured to determine whether two or more medicaments are contraindicated. The electromagnetic tags associated with two or more medication containers can be interrogated to identify medicaments contained within the respective containers. The Smart Tray can then determine, based on information retrieved from each respective electromagnetic tag, whether or not medicaments contained within the respective containers are contraindicated. If two or more medicaments are determined to be contraindicated, a patient can be alerted by the Smart Tray. Similarly, a third party healthcare provider may be alerted by the Smart Tray.

The present invention may facilitate compliance with medication regimens, especially complex regimens involving multiple medications. As such, the present invention may reduce medication errors made by patients, such as taking the wrong drug, taking the wrong dose, taking a dose at the wrong time, or various combinations thereof. Furthermore, the present invention may reduce the need for patients to remember

when and how much of a particular medication to take.

In addition, the present invention may facilitate prescription refills such that a patient receives a new prescription without a lapse in medication occurring.

Brief Description of the Drawings

Fig. 1 schematically illustrates a system for interactively managing medication regimens of patients, according to an embodiment of the present invention.

Fig. 2 schematically illustrates a system for interactively managing medication regimens of patients, according to another embodiment of the present invention wherein the Smart Tray of **Fig. 1** is configured to communicate with one or more appliances and devices.

Fig. 3 is a perspective view of a Smart Tray according to one embodiment of the present invention wherein multiple medication containers are removably received within respective receptacles. In addition, a blood pressure monitor is removably received within another receptacle referred to as a sensing surface.

Fig. 4 schematically illustrates various electronic components included within a Smart Tray according to an embodiment of the present invention.

Fig. 5 is a side elevation view of an exemplary medication container having an RFID tag affixed to a bottom surface thereof.

Fig. 6 is a side elevation view of an exemplary medication container having an RFID tag affixed to a bottom surface thereof and having a piezoelectric element affixed to, and in communication with, the RFID tag.

Figs. 7-10 illustrate operations for monitoring compliance with medication regimens according to various aspects of the present invention.

Fig. 11 illustrates a person having an identification tag attached thereto that allows a Smart Tray to identify the person when placing objects on the Smart Tray or when removing objects from the Smart Tray, according to another embodiment of the present invention.

Fig. 12 illustrates a pill having an identifying tag or indicia attached thereto, according to another embodiment of the present invention.

Fig. 13 is a perspective view of a Smart Tray according to another embodiment of the present invention wherein receptacles are not utilized and wherein visual indication of the presence of an object is utilized.

Fig. 14 illustrates operations for identifying a person tagged via an electromagnetic tag according to another embodiment of the present invention.

Detailed Description of the Invention

The present invention now is described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout the description of the drawings.

As will be appreciated by one of skill in the

art, the present invention may be embodied as methods and systems. The present invention may take the form of an entirely hardware embodiment, or an embodiment combining software and hardware aspects. Throughout the description of the present invention, the terms medicament, medicine, drug, and medication may be used interchangeably.

System Overview

Referring now to **Fig. 1**, a system **10** according to an embodiment of the present invention for facilitating effective self-management of medication treatment by patients is schematically illustrated. The illustrated system **10** includes an electronic apparatus **12**, referred to as a "Smart Tray", that is capable of monitoring and reporting to third parties a patient's compliance with various treatment regimens, including medication regimens. The Smart Tray **12** can be configured to remind patients of medication they are to take at a given time of day and to record whether or not the medication was taken.

The Smart Tray **12** can also be configured to communicate with one or more third parties, such as healthcare providers **14**, pharmacies **16**, and other suppliers **18** of healthcare products and services via a computer network **20** such as the internet (or an intranet), a wide area network (WAN), or a local area network (LAN). The Smart Tray **12** may be configured to communicate with various data processing systems and computing devices of third parties in order to transfer and receive various information. For example, the Smart Tray **12**, upon sensing that a supply of a particular medicament is low, can place an order for more of the medicament directly with a pharmacy **16** or via a healthcare provider **14**. Preferably, the Smart Tray **12**

utilizes a modem that is configured to communicate with external computing devices via a communications network.

According to another embodiment of the present invention illustrated in **Fig. 2**, a system **10'** includes a Smart Tray **12** that can communicate with various appliances (**22a-22f**). Exemplary appliances may include, but are not limited to, personal computers **22a**, Web TVs **22b**, weight scales **22c**, refrigerators **22d**, exercise devices **22e**, and scanners **22f**. The Smart Tray **12** preferably contains a processor that is configured to modify medication regimens for particular medicaments in response to data received from various appliances. For example, if the Smart Tray **12** receives data from an exercise device **22e** that a patient has increased his/her exercise regimen, a processor within the Smart Tray **22** may adjust one or more of the patient's medication regimens. Similarly, medication regimens may be modified pursuant to data received from a weight scale **22c** that a patient's weight has changed. A patient's food intake (as well as chemical intake, such as sodium) may also be monitored when a Smart Tray is in communication with a refrigerator **22d**, or with a scanner that is configured to scan packages of food. It will be understood that although communications between the Smart Tray **12** and the other devices in **Figs. 1** and **2** are illustrated as wired communications, wireless communications also may be used.

Smart Tray

Referring now to **Fig. 3**, a Smart Tray **12**, according to a preferred embodiment of the present invention is illustrated. The illustrated Smart Tray **12** has an elongated configuration with a generally flat

surface **30**. Disposed within the surface **30** are a plurality of receptacles **32** configured to removably receive a plurality of medication containers **34** therein. In the illustrated embodiment, the receptacles **32** have a cylindrical configuration for removably receiving cylindrical medication containers **34** (*i.e.*, conventional pill bottles). However, it is understood that the Smart Tray **12** may have receptacles with various configurations for removably receiving medication containers of various configurations and is not limited to the illustrated embodiment. For example, custom medication containers containing "cocktails" (*i.e.*, multiple medicaments) that are for one-time use may be utilized with a Smart Tray according to the present invention. These custom medication containers may have various shapes and sizes.

The illustrated Smart Tray **12** also includes a display **35**, such as an LCD (liquid crystal display), located adjacent the plurality of receptacles **32**. Various types of displays may be utilized. The Smart Tray **12** is not limited to an LCD. The display **35** is configured to display various types of information to a patient. For example, and as will be described below, when it is time for a patient to take a particular medicament, or combination of medicaments, instructions can be displayed to the patient.

The illustrated Smart Tray **12** also includes a sensing surface **37** located adjacent the plurality of receptacles **32** and display **35**. As will be described below, the sensing surface **35** is a receptacle that is configured to removably receive and interact with various objects that patients may use to perform a healthcare functions. Exemplary "objects" include, but are not limited to, blood pressure monitors,

thermometers, pagers, glucometers, prothrombin and coagulation monitors.

As illustrated schematically in **Fig. 4**, the Smart Tray **12** may include a processor **40**. An RF coil array **41**, multiplexer **42**, and a modem **43** are in communication with the processor **40**. The RF coil array **41** serves as an electromagnetic tag reader that can rapidly identify electromagnetic tags associated with objects disposed within a receptacle in the Smart Tray **12**. The RF coils within the array **41** are switched by the multiplexer **42** in order to allow the position of multiple objects within the Smart Tray **12** to be tracked concurrently. Multiplexers are understood by those of skill in the art and need not be described further herein.

Preferably, the RF coil array **41** can identify electromagnetic tags resonating within a range of about 55 kHz to about 85 kHz. However, it is understood that electromagnetic tags resonating at other frequencies may also be identified using an RF coil array according to the present invention. Moreover, it also will be understood that various other types of identifiers may be used on the containers **34** including, but not limited to, one and two dimensional bar codes, graphical indicia, and other electronic tags. Corresponding sensors including optical, magnetic, and capacitive sensors also may be provided. Moreover, the identifiers and sensors need not be of the same type.

The processor **40** may be virtually any type of processor, such as an 8-bit processor, and controls electromagnetic tag reading and display functions. In addition, the processor **40** preferably retains a history of events within memory, as will be described in detail below. Dosage regimens for various medicaments may be stored within processor memory. In addition, dosage

regimens may be read from electromagnetic tags attached to medicament containers and stored within processor memory. It will be understood that general purpose processors or special purpose processors may be used. Moreover, an Application Specific Integrated Circuit (ASIC) may be provided to integrate one or more of the elements of **Fig. 4**. The ASIC can include a processor and/or logic circuits to control operations.

The modem **43** is configured to communicate with external computing devices so that data stored within processor memory can be transmitted to healthcare providers and other third parties, including medicament suppliers (*e.g.*, pharmacies), and so that information can be received from healthcare providers and other third parties.

In the embodiment of **Fig. 4**, each RF coil within the array **41** is associated with (and is preferably positioned adjacent to) a respective receptacle **32**. An RF coil in the array **41** is also associated with (and positioned adjacent to) the sensing surface **37**. Each RF coil is configured to independently sense the presence of an object having an electromagnetic tag, such as a radio frequency identification (RFID) tag, secured thereto. For example, an RF coil associated with a particular receptacle **32** can sense the presence of an object having an electromagnetic tag disposed within the receptacle. It will also be understood that one RF coil can sense multiple RFID tags on one or more containers. As such, one RF coil may be utilized for more than one receptacle **32**.

In addition, each RF coil in the array **41** is configured to communicate with an electromagnetic tag attached to an object in the vicinity of the RF coil. Preferably, each RF coil serves as a "reader" that can

"interrogate" an electromagnetic tag (or other identifier) to obtain information stored within the electromagnetic tag (or other identifier). When attached to a medication container, an electromagnetic tag may contain information that identifies one or more medicaments contained within the container, and information about dosage rates and frequency of dosages. Other information relevant to a patient's treatment may also be stored within an electromagnetic tag. For example, information about whether a medicament needs to be taken with food, whether a patient should avoid sunlight may be included, and other similar types of information may be included. Information obtained from an electromagnetic tag by an RF coil may be stored within the processor memory.

RF coils and their use in detecting the proximity of electromagnetic tags and for interrogating electromagnetic tags for information are understood by those of skill in the art and need not be discussed further herein. A particularly preferred Smart Tray having an array of RF coils for detecting the proximity of objects tagged with electromagnetic tags and for interrogating electromagnetic tags for information is disclosed in a co-assigned and co-pending U.S. Provisional Application, entitled *Platform for Item Sensing and Identification* (Attorney Docket Number 109026-77) which was filed December 29, 1999, and which is incorporated herein by reference, in its entirety.

RFID tags typically contain circuitry that stores and transmits information about the item attached to the tag in cooperation with a compatible RFID reader/writer. Conventional RFID circuitry does not require a battery or an external energy source. However, a battery may be included. RF energy is typically transmitted by an RF reader specifically

adapted to interact with the RF circuitry of an RFID tag. RFID tags are described in U.S. Patent No. 5,528,222 which is incorporated herein by reference in its entirety.

Referring now to **Fig. 5**, an exemplary medication container **34** has an RFID tag **50** affixed to the bottom surface **34a** thereof. An RF coil (**39**, **Fig. 6**) associated with a respective receptacle **32** is configured to detect the presence of a medicine container **34** disposed therein via the RFID tag **50**. In addition, an RF coil is also configured to interrogate the circuitry of the RFID tag **50** to obtain information therefrom. Although the illustrated RFID tag **50** is attached to the bottom surface **34a** of the medicine container, it is understood that RFID tags can be attached to (or incorporated within) medication containers in various locations, and the RF coil may be located at various locations.

Referring back to **Fig. 3**, the illustrated Smart Tray **12** includes an LED (light emitting diode) **36** adjacent each respective receptacle **32**. Each LED **36** serves as a visual indicator for displaying visual signals to a patient. For example, when a medication container **34** is placed within a respective receptacle **32**, the LED **36** adjacent the receptacle **32** may display a green color. When a medicament within a medication container **34** disposed within a receptacle **32** is to be taken by a patient, the LED **36** may display a red color, or may flash in order to gain the attention of the patient. In the illustrated embodiment of **Fig. 3**, five medication containers **34** are disposed within five respective receptacles **32**. An LED **36** adjacent each of these receptacles is illuminated to indicate the presence of a medication container therewithin.

In addition, the Smart Tray **12** may include an audio indicator that can audibly signal a patient as to which medications should be taken in accordance with a medication regimen. Exemplary audio signals may include, but are not limited to, voice commands and signals such as bells, whistles, beepers, buzzers, and the like.

The number of flashes and/or audio signals can be used to indicate the number of pills (dosage amount) to be taken. For example, three flashes (or audio signals) can indicate three pills, two flashes (or audio signals) can indicate two pills, and so forth. In addition, voice commands may also be utilized to specify medicament quantity.

Each time a tagged medication container **34** is placed within a receptacle **32**, or a tagged object is placed on the sensing surface **37**, the event is recorded by a processor **40** or other device within the Smart Tray **12**. Similarly, each time a medication container **34** is removed from a receptacle **32**, or an object is removed from the sensing surface **37**, the removal event is recorded by the Smart Tray processor **40** or other device. Each event is stored and can be communicated to other computing devices via a communications network **20**.

The Smart Tray **12** may be configured to communicate with computing devices via communications networks that conform to various standards and protocols including, but not limited to, the Bluetooth standard. As is well known to those having skill in the art, Bluetooth technology provides a universal radio interface in the 2.45 GHz frequency band that enables portable electronic devices to connect and communicate wirelessly via short-range ad hoc networks. Bluetooth technology is described for example in Haartsen,

"Bluetooth-The Universal Radio Interface for Ad Hoc, Wireless Connectivity", Ericsson Review No. 3, 1998, pp. 110-117, the disclosure of which is hereby incorporated herein by reference. In addition, a serial data connection may be provided to allow the exchange of data with external appliances and other devices.

When a medication container **34** is placed within a receptacle **32**, an RF coil associated with the receptacle **32** can interrogate an RFID tag **50** attached to the medication container to obtain information about the medicament(s) within the container **34**. Exemplary information includes the name of the medicament(s) and a dosage regimen for the medicament(s). A dosage regimen typically includes an amount of a medicament and time(s) that each dose is to be taken. In addition, other information, such as whether to take a medicament with food, or whether to avoid taking a medicament in conjunction with other types of medications, can also be retrieved from an RFID tag. Preferably, a Smart Tray **12** according to the present invention can display various types of information to a patient via the display **35**.

According to another embodiment of the present invention illustrated in **Fig. 6**, one or more piezoelectric elements **60** or other weighing devices may be attached to a medicine container **34**. In the illustrated embodiment, a piezoelectric element **60** is attached to an RFID tag **50** on the bottom surface **34a** of a medication container **34**. As is understood by those of skill in the art, piezoelectric elements generate an electrical signal when a mechanical stress is applied thereto. Accordingly, by measuring an electrical signal generated by a piezoelectric element **60** stressed under the weight of the medicine container **34**, the weight

(and, thus, the amount) of medicament within the medication container **34** can be determined. By using piezoelectric elements, a Smart Tray **12** according to the present invention can monitor how much of a medicament has been taken over time, thereby facilitating monitoring user compliance with medication regimens. Piezoelectric elements according to this aspect of the present invention can communicate with an RFID tag attached to a medication container (or other object) or can communicate directly with an RF coil or other sensor within the Smart Tray **12**.

Referring back to **Fig. 3**, a blood pressure monitor **70** is disposed on the sensing surface **37**. An RF coil associated with the sensing surface **37** preferably communicates with an electromagnetic tag (not shown) attached to the blood pressure monitor **70** and downloads information therefrom. For example, after measuring his/her blood pressure with the blood pressure monitor **70**, a patient can place the blood pressure monitor **70** on the sensing surface **37** and blood pressure information can be downloaded to and stored within the Smart Tray processor **40**. This information may be transmitted to a third party healthcare provider via modem **43**. Alternatively, this information may be used to modify one or more dosage regimens for one or more medicaments as described above.

The sensing surface **37** may be used to download information from virtually any type of healthcare device having an electromagnetic tag attached thereto or embedded therewithin that a patient may use including, but not limited to, blood pressure monitors, thermometers, pagers, glucometers, prothrombin and coagulation monitors.

A Smart Tray according to the present invention passively and unobtrusively facilitates

monitoring patient compliance with medication treatment regimens. For example, the Smart Tray can remind patients which medication to take using visual and/or audio cues. In addition, the Smart Tray can record medication administration as an aid to disease management. Furthermore, the Smart Tray can facilitate disease management by providing education and motivation to patients.

A Smart Tray according to the present invention also can facilitate control over medicament inventory by automatically placing orders prior to supply depletion. A Smart Tray can be incorporated into a medicine cabinet or shelf, and can be integrated with kitchen shelf for both diet and medication management. A Smart Tray may be utilized with various medicine-dispensing regimens. For example, the Smart Tray can be utilized with dispensers of liquid medicines. A Smart Tray may also be incorporated within a refrigeration device. A portable version of a Smart Tray may be configured for travel.

According to another embodiment of the present invention, a Smart Tray can be configured to alert patients if one or more medicaments are contraindicated. As is known to those of skill in the art, the term "contraindicated" means that when administered together, two or more medicaments may cause an adverse reaction in a patient or can inhibit the effectiveness of each other. Contraindications may be signaled via a visual indicator or via an audio indicator, or some combination of audio and visual indicators.

A Smart Tray according to the present invention need not have receptacles for receiving medication containers and other objects. For example, as illustrated in **Fig. 13**, a Smart Tray **12'** may have a

generally flat surface **30** for receiving tagged objects such as medication containers **34**. An RF coil array can be configured to recognize a tagged object placed anywhere on the surface **30**. Various types of visual indicators may be utilized to indicate the presence of a tagged object. In the illustrated embodiment, portions **36'** of the surface directly beneath a tagged medication container **34** are illuminated to indicate the presence of the tagged medication containers **34**.

Operations

Referring now to **Figs. 7-10**, operations for monitoring patient compliance with medication treatment, according to various embodiments of the present invention, are illustrated. Referring initially to **Fig. 7**, a medication container containing one or more medicaments is removably received within a receptacle of a Smart Tray (Block **100**). The container has an electromagnetic tag or other indicia associated therewith (*e.g.*, attached thereto or embedded therein), such as an RFID tag, that may contain various types of information about the medicament(s) within the container. Exemplary information includes, but is not limited to, an identification of each medicament and dosage regimens for each medicament within the container.

The electromagnetic tag is interrogated by a reader, such as an RF coil, to retrieve information, such as an identification of the medicament(s) and/or a dosage regimen(s), from the electromagnetic tag (Block **110**). A patient is then alerted via the Smart Tray to take a dose of a medicament in accordance with a dosage regimen associated with the identified medicament(s) (Block **120**). Each time the patient removes the container from the receptacle, the time of removal may

be detected by the reader and stored (Block **130**).

A patient may be alerted by the Smart Tray to take a dose of the medicament(s) via visual and/or audio indicators. For example, a light may flash to indicate that a particular medicament is to be taken (and how much is to be taken). Similarly, an audio signal may sound to indicate that a particular medicament is to be taken (and how much is to be taken). Synthesized voice instructions also may be generated. In addition, a patient may be alerted via a display that displays messages.

Each time a container is returned to a receptacle, an amount of medicament(s) remaining in the container may be determined (Block **140**). As described above, this step is preferably performed using piezoelectric elements or other weight sensors that deflect under the weight of the container and its contents.

According to another embodiment of the present invention, communications may be established between a Smart Tray and one or more external computing devices via a communications network (Block **150**). Information may then be transmitted from the Smart Tray to the external computing device(s) (Block **160**). For example, communications may be established with one or more healthcare providers that use data from the Smart Tray to determine whether a patient is in compliance with a medication (or other treatment) regimen. A healthcare provider can communicate with a patient by sending messages that can be displayed to a patient via the Smart Tray display (Block **170**). In addition, a healthcare provider can modify a dosage regimen by transmitting commands to the Smart Tray. As another example, communications may be established with a medicament supplier such that additional medicament may

be supplied to a patient.

In addition, a patient may establish communications with an external computing device via the Smart Tray, such as a Web site, and retrieve information therefrom (Block **170**). For example, information about a particular medicament may be displayed to a patient, either via the Smart Tray or via a PC or Web TV in communication with the Smart Tray.

According to another embodiment of the present invention illustrated in **Fig. 8**, a Smart Tray can be configured to communicate with one or more appliances including, but not limited to, exercise devices, refrigerators, scanners, and weight scales. According to this embodiment, communications are established between a Smart Tray and an appliance (Block **200**). Data is then retrieved from the appliance (Block **210**). For example, a patient's weight is retrieved from a scale, or a patient's intake of sodium is retrieved from a "smart" refrigerator that monitors food obtained therefrom by the patient. A medication (or other) regimen associated with one or more medicaments can then be modified in response to data received from one or more of the appliances (Block **220**).

A patient may be alerted by the Smart Tray of modified medication regimens (Block **230**). In addition, third parties, such as healthcare providers, may be notified of modified medication regimens (Block **240**). As described above, the Smart Tray may notify third parties by establishing communications with external computing devices and transmitting information therebetween.

According to another embodiment of the present invention, a Smart Tray can be configured to

modify a dosage regimen based upon data retrieved from a health monitoring device. Referring to **Fig. 9**, a medication container containing one or more medicaments is removably received within a receptacle of a Smart Tray (Block **300**). The container has an electromagnetic tag associated therewith, as described above, that may contain various types of information about the medicament(s) within the container. The electromagnetic tag is interrogated by a reader, such as an RF coil, to retrieve information, such as an identification of the medicament(s) and/or dosage regimen(s), from the electromagnetic tag (Block **310**).

A health monitoring device is placed within a receptacle (*e.g.*, the sensing surface **37** described above) of a Smart Tray (Block **320**). The health monitoring device has an electromagnetic tag attached thereto that identifies the health monitoring device. Data is then retrieved from the health monitoring device (Block **330**). For example, the health monitoring device may be a blood pressure monitor that a patient has just used to measure his/her blood pressure. The patient places the blood pressure monitor within the receptacle and blood pressure data is retrieved by the Smart Tray.

A medication (or other) regimen associated with one or more medicaments can be modified in response to data received from a health monitoring device (Block **340**). A patient may be alerted by the Smart Tray of modified medication regimens (Block **350**). In addition, third parties, such as healthcare providers, may be notified of modified medication regimens (Block **360**). As described above, the Smart Tray may notify third parties by establishing communications with external computing devices and transmitting information therebetween.

According to another embodiment of the present invention, a Smart Tray can be configured to determine whether two or more medicaments are contraindicated. Referring to **Fig. 10**, two or more medication containers are removably received within respective receptacles of a Smart Tray (Block **400**). As described above, each medication container includes an electromagnetic tag or other identifier/indicator that contains various information about medicament(s) contained within the respective container. The electromagnetic tag of each container is then interrogated (Block **410**) as described above. A determination is made, based on information retrieved from each respective electromagnetic tag, whether or not medicaments contained within the respective containers are contraindicated (Block **420**). If two or more medicaments are determined to be contraindicated, a patient is alerted by the Smart Tray (Block **430**). As described above, visual and/or audio signals may be utilized to alert a patient.

Tagging Persons and Medications

According to additional embodiments of the present invention, persons and medications can be "tagged." In the illustrated embodiment of **Fig. 11**, a person **70** is wearing a bracelet **72**. The bracelet **72** contains an identification tag that can be recognized by a sensor of the Smart Tray **12**. Preferably, the identification tag is an electromagnetic tag, such as an RFID tag that can be interrogated by an RF coil array as described above. According to this embodiment, a Smart Tray **12** can identify a particular person that is placing or removing objects on the Smart Tray **12** or removing objects from the Smart Tray **12**.

As illustrated in **Fig. 14**, a Smart Tray

reader is configured to interrogate an electromagnetic tag, such as an RFID tag, attached to a person and retrieve information therefrom, such as the person's identity, when the person accesses an object on the Smart Tray (Block **500**). The term "accessing" can mean placing a medication container on a Smart Tray and removing a medication container from a Smart Tray. In addition, the term "accessing" can mean placing on a Smart Tray and/or removing from a Smart Tray various other tagged objects including, but not limited to, blood pressure monitors and other monitoring devices. Preferably, a Smart Tray according to this embodiment of the present invention stores in the Smart Tray (or elsewhere) a time when a person accesses an object held by the Smart Tray (Block **510**).

Referring to **Fig. 12**, a comestible medicament **80** includes a non-toxic electromagnetic tag **82** thereon that allows a Smart Tray to identify the individual comestible medicament **80**. The illustrated comestible medicament **80** is in pill form; however, it is understood that other types of comestible medicament forms may be utilized, such as caplets, capsules and the like. In addition, it is understood that a non-toxic electromagnetic tag may be disposed within a comestible medicament.

By tagging individual units of medication, a Smart Tray according to the present invention can accurately track whether a particular dose of a medication has been taken by a patient at a prescribed time. In addition, tagging individual medication units can facilitate control over medication inventories.

The foregoing is illustrative of the present invention and is not to be construed as limiting thereof. Although a few exemplary embodiments of this invention have been described, those skilled in the art

will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims. Therefore, it is to be understood that the foregoing is illustrative of the present invention and is not to be construed as limited to the specific embodiments disclosed, and that modifications to the disclosed embodiments, as well as other embodiments, are intended to be included within the scope of the appended claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

THAT WHICH IS CLAIMED IS:

1. A method of monitoring patient compliance with medication treatment, the method comprising the steps of:

removably receiving a container within a receptacle in an apparatus, wherein the container contains a medicament, wherein the container has an electromagnetic tag attached thereto, wherein the electromagnetic tag contains information about the medicament, and wherein the apparatus includes a reader that is configured to interrogate the electromagnetic tag and retrieve information therefrom;

interrogating the electromagnetic tag via the reader to retrieve information therefrom, wherein the retrieved information comprises an identification of the medicament;

alerting a patient to take a dose of the medicament in accordance with a dosage regimen associated with the identified medicament; and

storing in the apparatus a time when removal of the container from the receptacle is detected by the reader.

2. The method according to Claim 1 wherein the electromagnetic tag is a radio frequency identification (RFID) tag and wherein the reader comprises an RFID tag reader.

3. The method according to Claim 1 wherein the step of alerting a patient to take a dose of the medicament comprises providing a visual signal adjacent the receptacle.

4. The method according to Claim 1 wherein the step of alerting a patient to take a dose of the medicament comprises providing an audio signal to the patient via the apparatus.

5. The method according to Claim 1 wherein the apparatus comprises a display, and wherein the step of alerting a patient to take a dose of the medicament comprises displaying a message via the display.

6. The method according to Claim 1 wherein the step of alerting a patient to take a dose of the medicament comprises providing an indication of medicament quantity.

7. The method according to Claim 6 wherein the step of providing an indication of medicament quantity comprises providing at least one of a visual signal and audio signal via the apparatus.

8. The method according to Claim 1 wherein the apparatus includes a processor in communication with the reader and wherein the dosage regimen associated with the medicament is stored within processor memory.

9. The method according to Claim 1 wherein the information retrieved from the electromagnetic tag comprises a dosage regimen associated with the medicament.

10. The method according to Claim 1 further comprising the step of measuring an amount of medicament in the container when the container is removably received within the receptacle.

11. The method according to Claim 10 wherein the step of measuring an amount of medicament in the container comprises measuring an electric signal generated by a weight sensor positioned between the container and the receptacle.

12. The method according to Claim 1 further comprising the steps of:

establishing communications between the apparatus and an external computing device via a communications network; and

transmitting information from the apparatus to the external computing device.

13. The method according to Claim 12 wherein the container contains a plurality of different medicaments to be taken by a patient at a prescribed time.

14. The method according to Claim 12 wherein the external computing device is a computing device of a supplier of the medicament and wherein the information transmitted to the external computing device comprises a request for an additional quantity of the medicament.

15. The method according to Claim 1 further comprising the steps of:

establishing communications between the apparatus and an appliance;

retrieving data from the appliance; and

modifying the medication regimen associated with the medicament in response to data received from the appliance.

16. The method according to Claim 1 further

comprising the steps of:

establishing communications between the apparatus and a third party computing device via a communications network;

retrieving information from the third party computing device about the medicament; and

displaying the retrieved information.

17. A method of monitoring patient compliance with medication treatment, the method comprising the steps of:

removably receiving a container within a first receptacle of an apparatus, wherein the container contains a medicament, wherein the container has an identifier attached thereto, wherein the identifier contains information about the medicament, and wherein the apparatus includes a reader that is configured to interrogate the identifier and retrieve information therefrom;

interrogating the identifier via the reader to retrieve information therefrom, wherein the retrieved information comprises an identification of the medicament;

placing a health monitoring device within a second receptacle of the apparatus;

retrieving data from the health monitoring device; and

modifying the dosage regimen associated with the medicament in response to data received from the health monitoring device.

18. The method according to Claim 17 further comprising the step of notifying a patient of the modified dosage regimen for the medicament.

19. The method according to Claim 17 further

comprising the step of notifying a healthcare provider of the modified dosage regimen for the medicament.

20. The method according to Claim 17 wherein the step of alerting a patient to take a dose of the medicament comprises providing a visual signal adjacent the first receptacle.

21. The method according to Claim 17 wherein the step of alerting a patient to take a dose of the medicament comprises providing an audio signal to the patient via the apparatus.

22. The method according to Claim 17 wherein the apparatus comprises a display, and wherein the step of alerting a patient to take a dose of the medicament comprises displaying a message via the display.

23. The method according to Claim 17 wherein the step of alerting a patient to take a dose of the medicament comprises providing an indication of medicament quantity.

24. The method according to Claim 23 wherein the step of providing an indication of medicament quantity comprises providing at least one of a visual signal and audio signal via the apparatus.

25. A method of monitoring patient compliance with multiple medication dosage regimens, the method comprising the steps of:

removably receiving a plurality of containers within a respective plurality of receptacles in an apparatus, wherein each container contains a medicament, wherein each container has an electromagnetic tag attached thereto, wherein each

electromagnetic tag contains information about the medicament within a respective container, and wherein the apparatus includes a reader that is configured to interrogate the electromagnetic tag of each container and retrieve information therefrom;

interrogating each of the electromagnetic tags via the reader to retrieve information therefrom, wherein the retrieved information comprises an identification of medicament contained within each respective container;

alerting a patient to take a dose of medicament from respective ones of the containers in accordance with a respective dosage regimen associated with each of the identified medicaments; and

storing in the apparatus a time when removal of each container from a respective receptacle is detected by the reader.

26. The method according to Claim 25 wherein each electromagnetic tag is a radio frequency identification (RFID) tag and wherein the reader comprises an array of RFID tag readers, wherein each RFID tag reader is associated with one or more receptacles.

27. The method according to Claim 25 wherein the step of alerting a patient to take a dose of medicament from respective ones of the containers comprises providing visual signals adjacent respective ones of the receptacles.

28. The method according to Claim 25 wherein the step of alerting a patient to take a dose of medicament from respective ones of the containers comprises providing an audio signal to the patient via the apparatus.

29. The method according to Claim 25 wherein the apparatus comprises a display, and wherein the step of alerting a patient to take a dose of medicament from respective ones of the containers comprises displaying at least one message via the display.

30. The method according to Claim 25 wherein the step of alerting a patient to take a dose of medicament from respective ones of the containers comprises providing an indication of medicament quantity.

31. The method according to Claim 30 wherein the step of providing an indication of medicament quantity comprises providing at least one of a visual signal and audio signal.

32. The method according to Claim 25 wherein the apparatus includes a processor in communication with the reader and wherein a dosage regimen associated with each medicament is stored within processor memory.

33. The method according to Claim 25 wherein information retrieved from each electromagnetic tag comprises a dosage regimen associated with a respective medicament.

34. A method of monitoring patient compliance with medication treatment, the method comprising the steps of:

removably receiving first and second containers within respective first and second receptacles of an apparatus, wherein the first and second containers contain respective different first and second medicaments, wherein the first and second containers have respective first and second identifiers

attached thereto, wherein the first and second identifiers contain information about the respective first and second medicaments, and wherein the apparatus includes a reader that is configured to interrogate each identifier and retrieve information therefrom;

interrogating the first and second identifiers via the reader to retrieve information therefrom, wherein the retrieved information comprises an identification of the first and second medicaments; and

determining whether the first and second medicaments are contraindicated.

35. The method according to Claim 34 further comprising the step of alerting a patient if the first and second medicaments are contraindicated.

36. The method according to Claim 34 wherein each identifier is a radio frequency identification (RFID) tag and wherein the reader comprises an RFID tag reader.

37. The method according to Claim 34 wherein the step of alerting a patient comprises providing a visual signal adjacent at least one of the first and second receptacles.

38. The method according to Claim 34 wherein the step of alerting a patient comprises providing an audio signal.

39. The method according to Claim 34 wherein the apparatus comprises a display, and wherein the step of alerting a patient comprises displaying a message via the display.

40. The method according to Claim 34 wherein the information retrieved from the respective first and second identifiers comprises dosage regimens associated with the respective first and second medicaments.

41. The method according to Claim 34 further comprising the steps of:

establishing communications between the apparatus and a third party computing device via a communications network;

retrieving information from the third party computing device about the contraindication of the first and second medicaments; and

displaying the retrieved information.

42. A method of monitoring patient compliance with medication treatment, wherein a patient has an electromagnetic tag attached thereto that contains information about the patient, and wherein an apparatus for holding a medication container includes a reader that is configured to interrogate the electromagnetic tag and retrieve information therefrom, the method comprising the step of interrogating the electromagnetic tag via the reader to identify the patient when the patient accesses a medication container held by the apparatus.

43. The method according to Claim 42 further comprising the step of storing in the apparatus a time when the patient accesses a medication container held by the apparatus.

44. The method according to Claim 42 wherein the electromagnetic tag is a radio frequency identification (RFID) tag and wherein the reader comprises an RFID tag reader.

45. An apparatus that monitors patient compliance with medication treatment, comprising:

a receptacle for removably receiving a container therein, wherein the container contains a medicament, and wherein the container has an electromagnetic tag attached thereto that contains information about the medicament including an identification of the medicament;

a reader that is configured to interrogate the electromagnetic tag and identify the medicament;

an indicator that alerts a patient to take a dose of the medicament in accordance with a dosage regimen associated with the identified medicament; and

memory associated with the apparatus that stores a time when removal of the container from the receptacle is detected by the reader.

46. The apparatus according to Claim 45 wherein the electromagnetic tag is a radio frequency identification (RFID) tag and wherein the reader comprises an RFID tag reader.

47. The apparatus according to Claim 45 wherein the indicator is a visual indicator positioned adjacent the receptacle.

48. The apparatus according to Claim 45 wherein the indicator comprises an audio indicator.

49. The apparatus according to Claim 45 wherein the indicator comprises a display.

50. The apparatus according to Claim 47 wherein the visual indicator is configured to provide an indication of medicament quantity.

51. The apparatus according to Claim 48 wherein the audio indicator is configured to provide an indication of medicament quantity.

52. The apparatus according to Claim 45 further comprising a processor in communication with the reader and wherein the dosage regimen associated with the medicament is stored within the processor memory.

53. The apparatus according to Claim 45 wherein the information retrieved from the electromagnetic tag comprises a dosage regimen associated with the medicament.

54. The apparatus according to Claim 45 wherein the container comprises a weight sensor that generates an electric signal when the container is removably received within the receptacle, and wherein the apparatus reader is configured to measure an electrical signal generated by the weight sensor to measure an amount of medicament in the container.

55. The apparatus according to Claim 45 further comprising a modem that is configured to communicate with external computing devices via a communications network.

56. The apparatus according to Claim 45 further comprising a plurality of receptacles for receiving a respective plurality of medicament containers.

57. A system for monitoring patient compliance with medication treatment, comprising:

a container that contains a medicament,

wherein the container has an identifier attached thereto that contains information about the medicament including an identification of the medicament;

an apparatus, comprising:

a receptacle for removably receiving the container therein;

a reader that is configured to interrogate the identifier and retrieve information therefrom;

an indicator that alerts a patient to take a dose of the medicament in accordance with a dosage regimen associated with the identified medicament;

memory associated with the apparatus for storing a time when removal of the container from the receptacle is detected by the reader; and

a modem that is configured to communicate with external computing devices via a communications network; and

a computing device in communication with the apparatus via a communications network, wherein the computing device transmits and receives information to and from the apparatus.

58. The system according to Claim 57 wherein the identifier is a radio frequency identification (RFID) tag and wherein the reader comprises an RFID tag reader.

59. The system according to Claim 57 wherein the indicator comprises a visual indicator positioned adjacent the receptacle.

60. The system according to Claim 57 wherein the indicator comprises an audio indicator.

61. The system according to Claim 57 wherein the apparatus comprises a display.

62. The system according to Claim 59 wherein the visual indicator is configured to provide an indication of medicament quantity.

63. The system according to Claim 60 wherein the audio indicator is configured to provide an indication of medicament quantity.

64. The system according to Claim 57 wherein the apparatus includes a processor in communication with the reader and wherein the dosage regimen associated with the medicament is stored within processor memory.

65. The system according to Claim 57 wherein the information retrieved from the identifier comprises a dosage regimen associated with the medicament.

66. The system according to Claim 57 wherein the container comprises a weight sensor that generates an electric signal when the container is removably received within the receptacle, and wherein the apparatus reader is configured to measure an electrical signal generated by the weight sensor to measure an amount of medicament in the container.

67. A system for monitoring patient compliance with medication treatment, comprising:

a container that contains a medicament, wherein the container has an identifier attached thereto that contains information about the medicament including an identification of the medicament;

an apparatus, comprising:

a receptacle for removably receiving the container therein;

a reader that is configured to interrogate the identifier and retrieve information therefrom; and

memory associated with the apparatus that stores a time when removal of the container from the receptacle is detected by the reader; and

an appliance in communication with the apparatus, wherein the appliance is configured to transfer data to the apparatus.

68. The system according to Claim 67 wherein the apparatus is configured to modify a medication regimen associated with the medicament in response to data received from the appliance.

69. The system according to Claim 67 wherein the appliance comprises at least one of an exercise device, a weight scale, a scanner, and a refrigerator.

70. The system according to Claim 67 wherein the identifier comprises a radio frequency identification (RFID) tag and wherein the reader comprises an RFID tag reader.

71. The system according to Claim 67 wherein the apparatus further comprises at least one of a visual indicator and audio indicator that alerts a patient to take a dose of the medicament in accordance with a dosage regimen associated with the identified medicament.

72. A system for monitoring patient compliance with medication treatment, comprising:

a container that contains a medicament, wherein the container has an identifier attached thereto that contains information about the medicament; and

an apparatus, comprising:

a first receptacle for removably receiving the container therein;

a second receptacle for removably receiving a health monitoring device therein;

a reader that is configured to interrogate the identifier and retrieve information therefrom, and wherein the reader is configured to retrieve data from a health monitoring device within the second receptacle; and

wherein the apparatus is configured to modify a dosage regimen associated with the medicament in response to data retrieved from the health monitoring device.

73. The system according to Claim 72 wherein the identifier comprises a radio frequency identification (RFID) tag and wherein the reader comprises an RFID tag reader.

74. The system according to Claim 72 wherein the apparatus further comprises memory that stores a time when removal of the container from the receptacle is detected by the reader.

75. The system according to Claim 72 wherein the apparatus further comprises at least one of a visual indicator and audio indicator, wherein the visual indicator is configured to alert a patient to take a dose of the medicament in accordance with a dosage regimen associated with the identified

medicament.

76. A system for monitoring patient compliance with medication treatment, comprising:

a first container that contains a first medicament, wherein the container has a first identifier attached thereto that contains information about the first medicament, including an identification of the first medicament;

a second container that contains a second medicament different from the first medicament, wherein the second container has a second identifier attached thereto that contains information about the second medicament, including an identification of the second medicament;

an apparatus, comprising:

a first receptacle for removably receiving the first container therein;

a second receptacle for removably receiving the second container therein;

a reader that is configured to interrogate the first and second identifiers and retrieve information therefrom, wherein the retrieved information includes an identification of the first and second medicaments; and

wherein the apparatus is configured to determine whether the first and second medicaments are contraindicated.

77. The system according to Claim 76 wherein each of the identifiers is a radio frequency identification (RFID) tag and wherein the reader comprises an RFID tag reader.

78. The system according to Claim 76 wherein the apparatus further comprises a visual indicator that indicates the first and second medicaments are contraindicated.

79. The system according to Claim 76 wherein the apparatus further comprises an audio indicator that indicates the first and second medicaments are contraindicated.

80. The system according to Claim 76 wherein the apparatus comprises a display that displays a message that the first and second medicaments are contraindicated.

81. An apparatus that monitors patient compliance with medication treatment, comprising:

a surface for removably receiving a container thereon, wherein the container contains a medicament, and wherein the container has an electromagnetic tag attached thereto that contains information about the medicament including an identification of the medicament;

a reader that is configured to interrogate the electromagnetic tag and identify the medicament;

an indicator that alerts a patient to take a dose of the medicament in accordance with a dosage regimen associated with the identified medicament; and

memory associated with the apparatus that stores a time when removal of the container from the surface is detected by the reader.

82. The apparatus according to Claim 81 wherein the electromagnetic tag is a radio frequency identification (RFID) tag and wherein the reader comprises an RFID tag reader.

83. The apparatus according to Claim 81 wherein the indicator is at least one of a visual indicator, an audio indicator, and a display.

84. A comestible medicament comprising a non-toxic electromagnetic tag, wherein the electromagnetic tag contains information about the medicament including an identification of the medicament.

85. The comestible medicament according to Claim 84 wherein the electromagnetic tag is a radio frequency identification (RFID) tag.

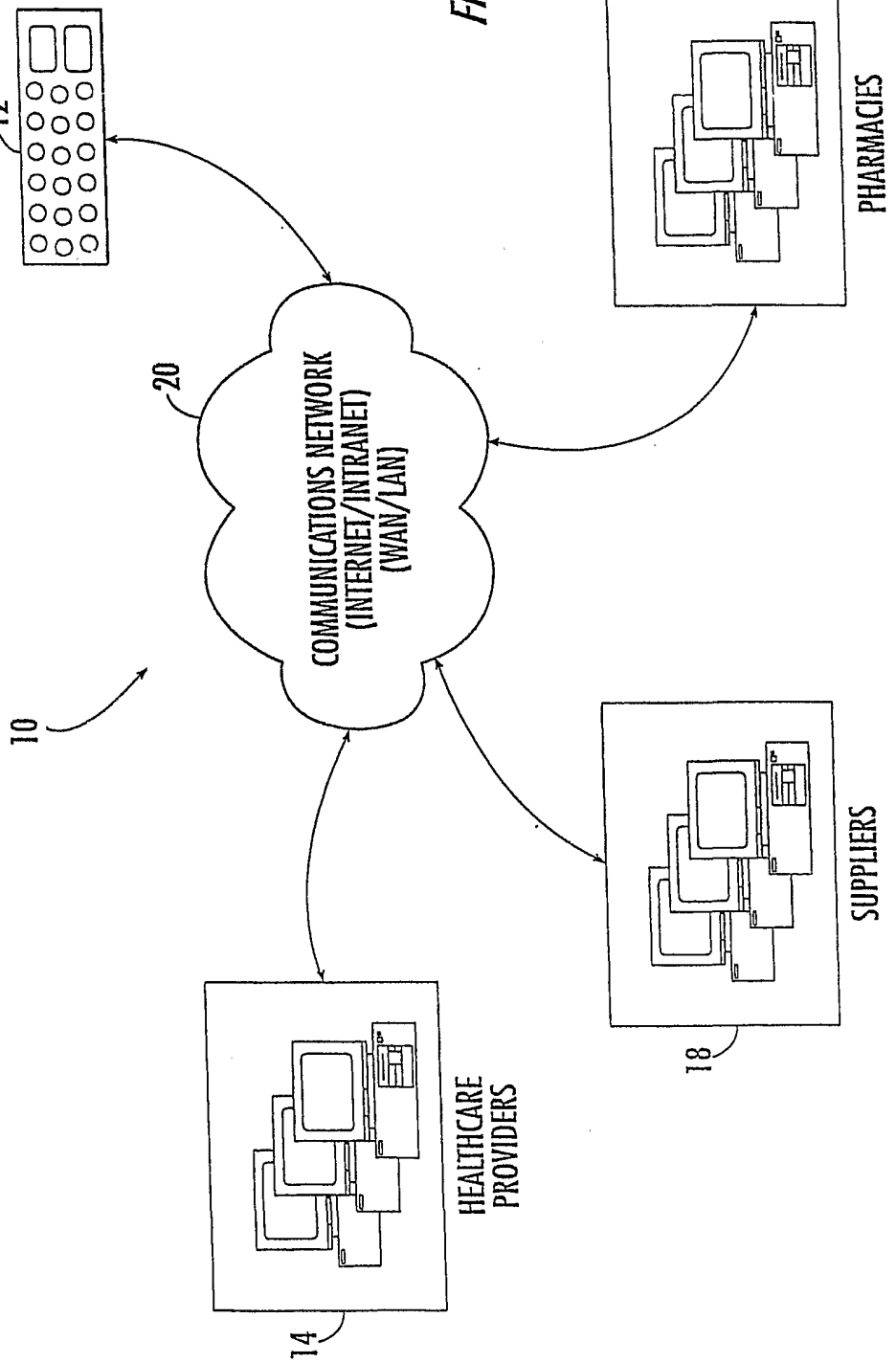
10
12
14
HEALTHCARE PROVIDERS
16
PHARMACIES
18
SUPPLIERS
20
COMMUNICATIONS NETWORK
(INTERNET/INTRANET)
(WAN/LAN)

FIG. 1

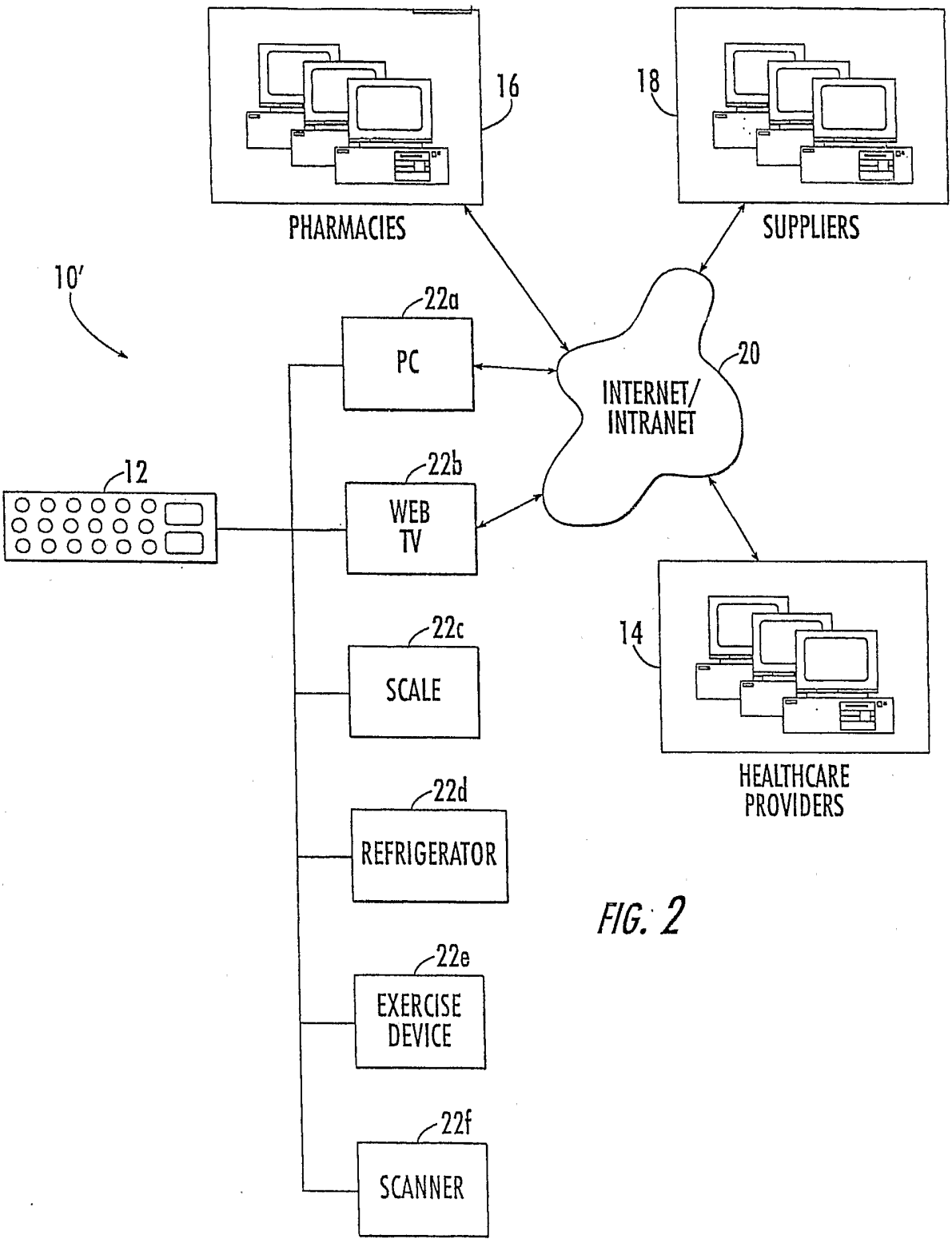
16
PHARMACIES
18
SUPPLIERS
10'
22a
PC
20
INTERNET/
INTRANET
12
22b
WEB
TV
22c
SCALE
14
HEALTHCARE
PROVIDERS
22d
REFRIGERATOR
22e
EXERCISE
DEVICE
22f
SCANNER

FIG. 2

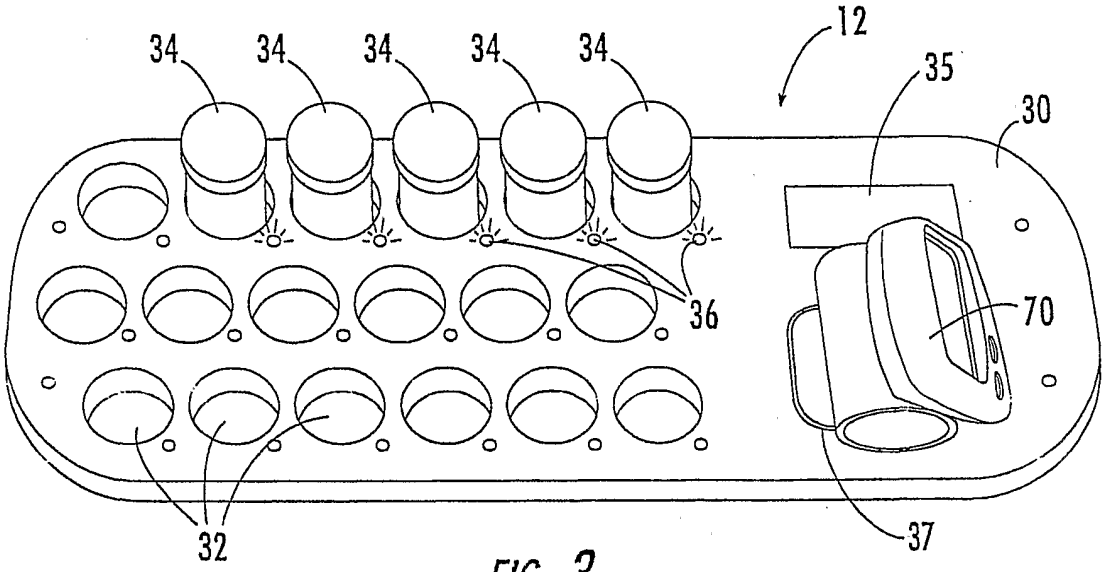

FIG. 3

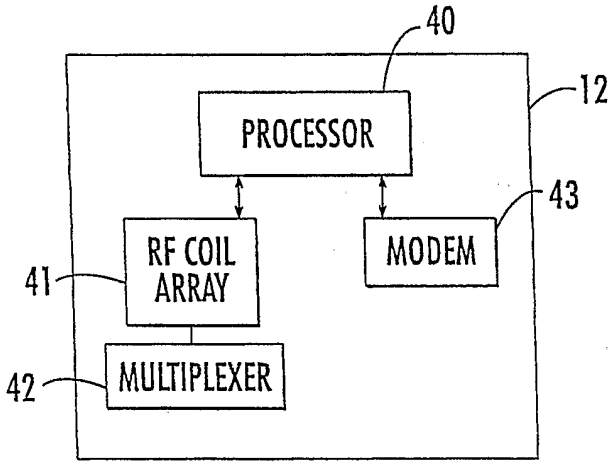

FIG. 4

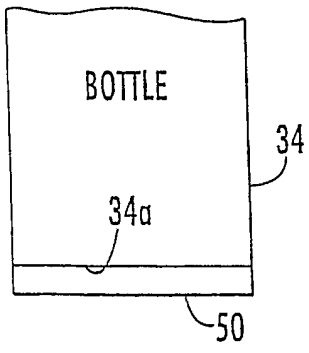

FIG. 5

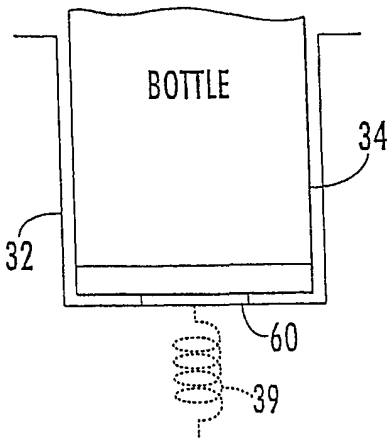

FIG. 6

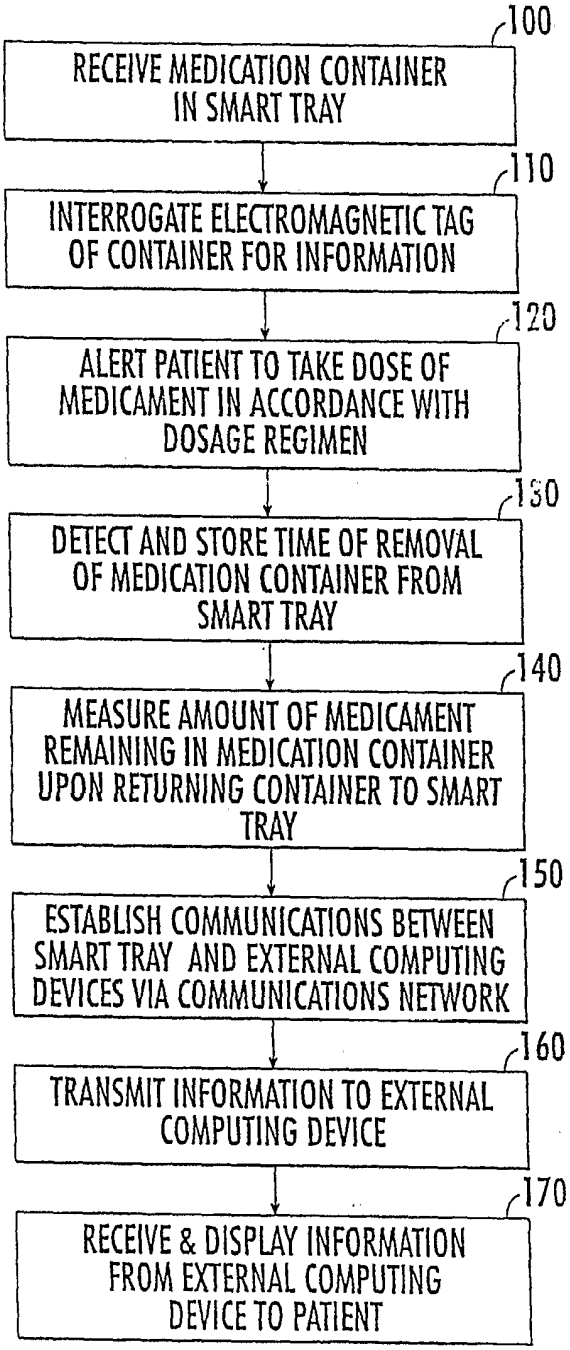
100
RECEIVE MEDICATION CONTAINER IN SMART TRAY
110
INTERROGATE ELECTROMAGNETIC TAG OF CONTAINER FOR INFORMATION
120
ALERT PATIENT TO TAKE DOSE OF MEDICAMENT IN ACCORDANCE WITH DOSAGE REGIMEN
130
DETECT AND STORE TIME OF REMOVAL OF MEDICATION CONTAINER FROM SMART TRAY
140
MEASURE AMOUNT OF MEDICAMENT REMAINING IN MEDICATION CONTAINER UPON RETURNING CONTAINER TO SMART TRAY
150
ESTABLISH COMMUNICATIONS BETWEEN SMART TRAY AND EXTERNAL COMPUTING DEVICES VIA COMMUNICATIONS NETWORK
160
TRANSMIT INFORMATION TO EXTERNAL COMPUTING DEVICE
170
RECEIVE & DISPLAY INFORMATION FROM EXTERNAL COMPUTING DEVICE TO PATIENT

FIG. 7

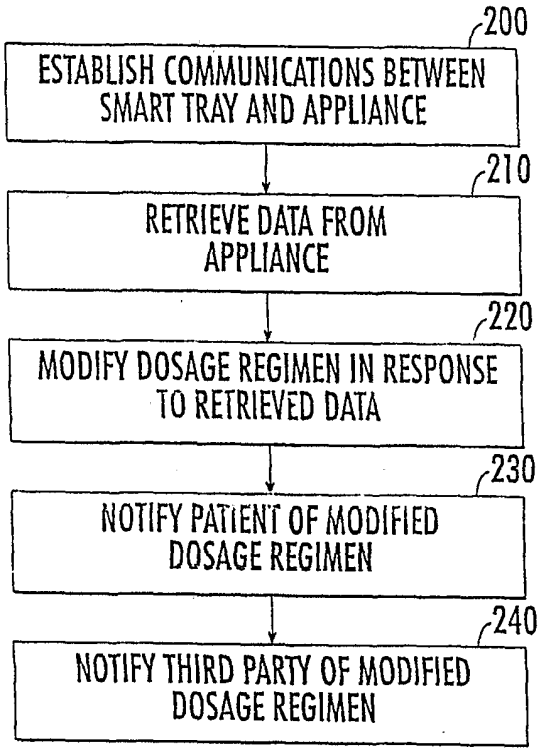
200
ESTABLISH COMMUNICATIONS BETWEEN SMART TRAY AND APPLIANCE
210
RETRIEVE DATA FROM APPLIANCE
220
MODIFY DOSAGE REGIMEN IN RESPONSE TO RETRIEVED DATA
230
NOTIFY PATIENT OF MODIFIED DOSAGE REGIMEN
240
NOTIFY THIRD PARTY OF MODIFIED DOSAGE REGIMEN

FIG. 8

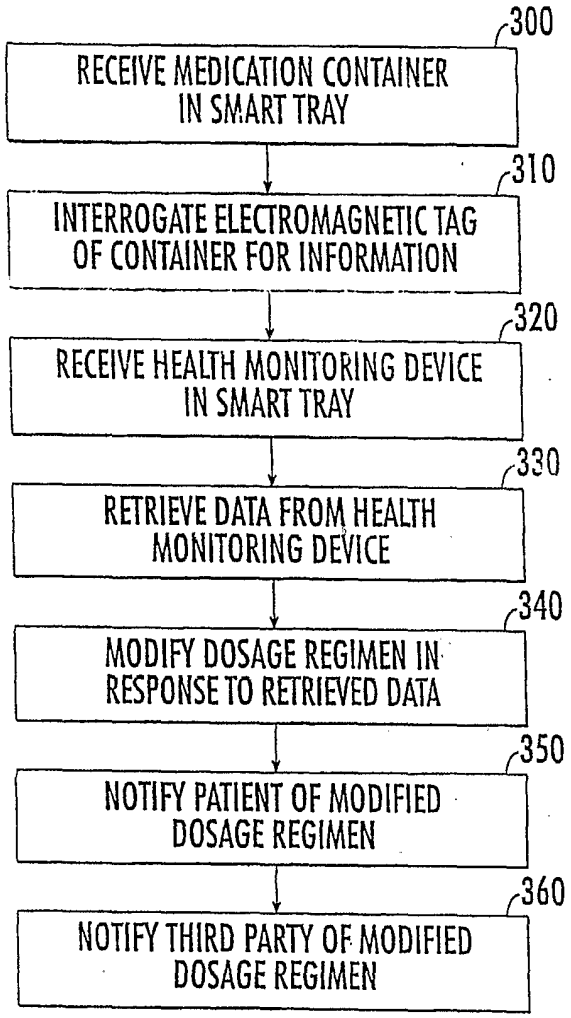
300
RECEIVE MEDICATION CONTAINER IN SMART TRAY
310
INTERROGATE ELECTROMAGNETIC TAG OF CONTAINER FOR INFORMATION
320
RECEIVE HEALTH MONITORING DEVICE IN SMART TRAY
330
RETRIEVE DATA FROM HEALTH MONITORING DEVICE
340
MODIFY DOSAGE REGIMEN IN RESPONSE TO RETRIEVED DATA
350
NOTIFY PATIENT OF MODIFIED DOSAGE REGIMEN
360
NOTIFY THIRD PARTY OF MODIFIED DOSAGE REGIMEN

FIG. 9

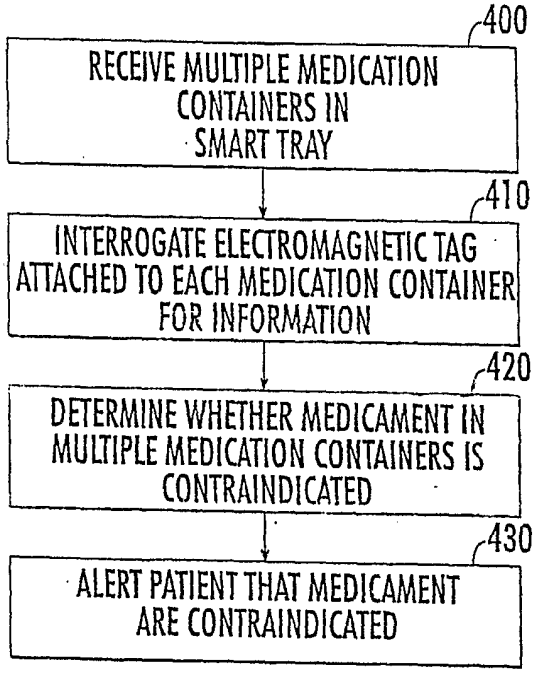
400
RECEIVE MULTIPLE MEDICATION CONTAINERS IN SMART TRAY
410
INTERROGATE ELECTROMAGNETIC TAG ATTACHED TO EACH MEDICATION CONTAINER FOR INFORMATION
420
DETERMINE WHETHER MEDICAMENT IN MULTIPLE MEDICATION CONTAINERS IS CONTRAINDICATED
430
ALERT PATIENT THAT MEDICAMENT ARE CONTRAINDICATED

FIG. 10

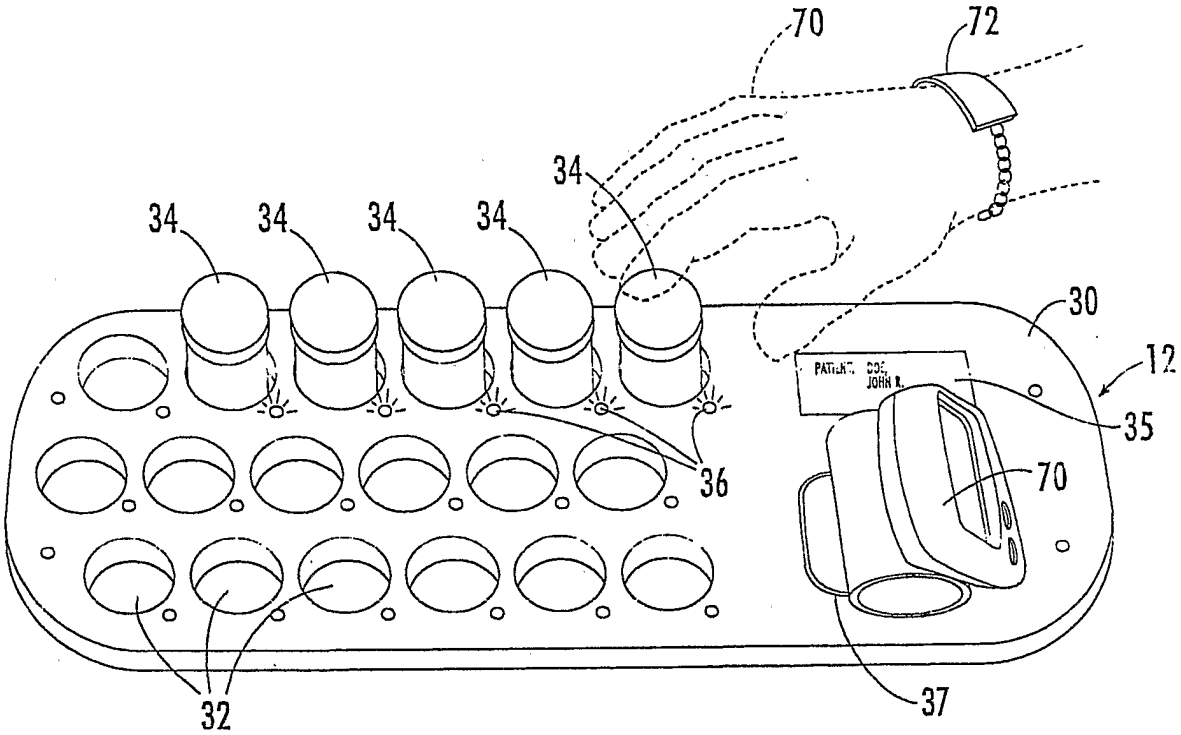

FIG. 11

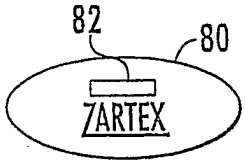

FIG. 12

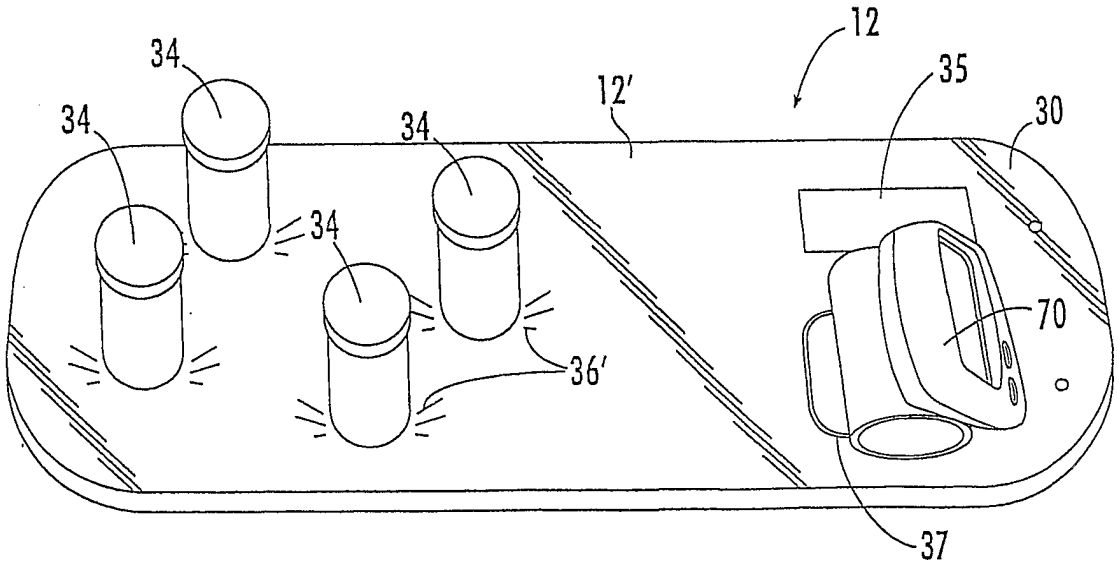

FIG. 13

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/US 00/34729

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61J7/04

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)
IPC 7 A61J G06F

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 774 865 A (GLYNN KENNETH P) 30 June 1998 (1998-06-30) the whole document	1-16, 25-83
Y X	US 5 963 136 A (O'BRIEN CHARLES TERRENCE) 5 October 1999 (1999-10-05) column 12, line 43 - line 51; figure 7	1-16, 25-83 84,85
X	DE 195 44 294 A (SIMON UDO ;HAFNER DIETER DIPL PHYS DR RER (DE)) 5 June 1997 (1997-06-05) column 5, line 10 - line 29 column 7, line 41 -column 8, line 4; figures	17-24, 57,67, 72,76,81

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"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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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 February 2001	01/03/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Godot, T

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INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/US 00/34729

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 298 627 A (MCINTOSH KENNETH BROWNE) 11 January 1989 (1989-01-11) cited in the application page 19, line 38 - line 52; figures	1-85
P,X	NL 1 010 391 C (GOOD CLINICAL PRACTICE HOLDING) 27 April 2000 (2000-04-27) the whole document	1-10,12, 14-16, 25-53, 55-65, 67-83

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int ional Application No
PCT/US 00/34729

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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		EP 1023711 A	02-08-2000
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NL 1010391 C	27-04-2000	NONE	