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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
25 October 2001 (25.10.2001)

PCT

(10) International Publication Number
WO 01/80146 A1

(51) International Patent Classification[7]: G06F 17/60, G06K 7/00

(21) International Application Number: PCT/US01/12663

(22) International Filing Date: 18 April 2001 (18.04.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/198,028 18 April 2000 (18.04.2000) US

(71) Applicant: INTERNATIONAL PAPER COMPANY [US/US]; 1422 Long Meadow Road, Tuxedo, NY 10987 (US).

(72) Inventor: AVNI, Eitan; 9219 Johnston Lane, Cincinnati, OH 45242 (US).

(74) Agent: STEWART, Richard, C., II; 1422 Long Meadow Road, Tuxedo, NY 10987 (US).

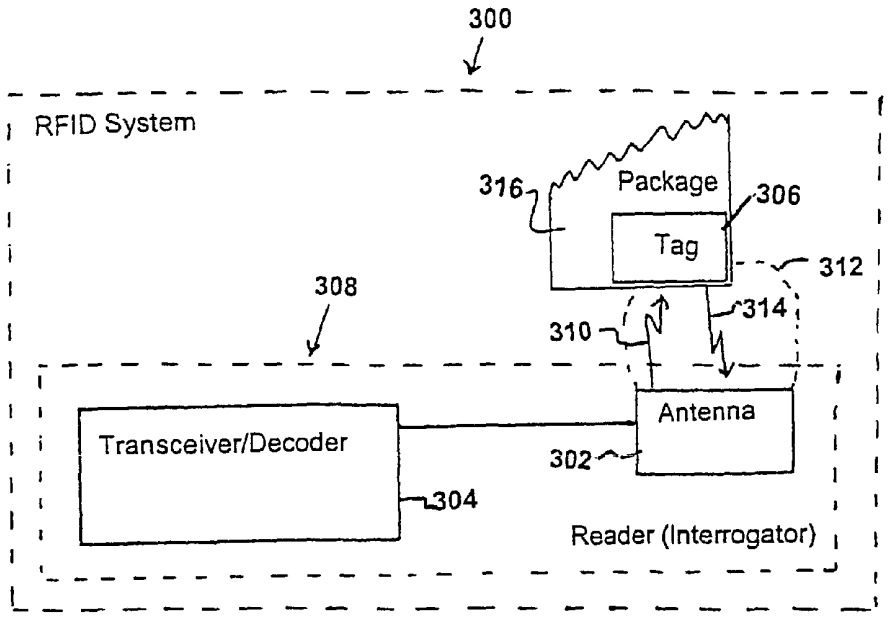
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

**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: PRODUCT AND MATERIAL INFORMATION COMMUNICATION IN MANUFACTURING PROCESSES




(57) Abstract: A product and material information communication system (300) particularly for use in manufacturing processes comprises a product package (316) or support having an RFID tag (306) including data memory means for storing at least a unique identification code for the product and at least dynamic and/or static data associated with characteristics of the product which are related to use of the product in an intended manufacturing process and an interrogator (308) for retrieving the identification code and product characteristic information and providing such product information to process control equipment for optimizing the operation thereof.

WO 01/80146 A1

# PRODUCT AND MATERIAL INFORMATION COMMUNICATION IN MANUFACTURING PROCESSES

## RELATED APPLICATIONS

This application claims the priority of U. S. Provisional Application No. 60/198,028, filed April 18, 2000 which is incorporated herein by reference.

## FIELD OF THE INVENTION

This invention relates to the field of packaging, and more particularly to a product container or support which is provided with information and communications capabilities to interface with manufacturing systems, computer systems and database systems to facilitate tracking and control of the application of the product. More specifically, the invention is particularly applicable in connection with the use of paper products in the printing industry.

## BACKGROUND OF THE INVENTION

Currently, there often is a need to identify particular properties and qualities of a product, such as a roll or skid of paper, which is to be used in a manufacturing process such as printing. There are many industries in which information regarding the specific variable properties of a component used in the manufacturing process may affect the way in which a process is carried out. In particular, for example, specialty paper used in the printing industry may vary from lot to lot and may, in many instances, have physical and/or chemical characteristics which are optimized for a particular set of manufacturing conditions. It would be advantageous to be able to provide specific information about the characteristics of a particular item (such as a roll or

skid of paper) to the user manufacturing system (such as a printing press or the like) which could cause the manufacturing system to adjust, or be adjusted, to take into account the characteristics (such as moisture content, surface roughness, color and/or brightness, strength and the like) of the starting material. Data retrieval and association (tracking) of specific types with product items are often arduous, time consuming, error prone and sometimes impossible tasks with currently available systems.

## SUMMARY OF THE INVENTION

In accordance with the present invention, a product information and communication system for use in a manufacturing process comprises a product container or support such as a skid or a roll which is provided with an RFID (Radio Frequency IDentification) tag. The RFID tag stores particular information relating to characteristics of the product and also stores a unique identification code associated with the particular item of product. The information stored in the RFID tag may include direct information about that item and/or it may provide one or more data links, for example, either locally or via the Internet, to either dynamic or fixed information databases. The item-specific information is provided to the user manufacturing process controls to adjust for the characteristics of the product item

## BRIEF DESCRIPTION OF THE DRAWING

A more complete understanding of the present invention may be obtained from consideration of the following description in conjunction with the drawing in which:

FIG. 1 is a functional diagram of a system which is useful in connection with the present invention in which local and remotely stored product information is accessed;

FIG. 2 is a functional diagram of a system which is useful in connection with the present invention in which locally stored product information is accessed,

FIG. 3 is a functional diagram of a Radio Frequency Identification system useful in connection with the present invention, and

FIG. 4 is a stylized view of a paper roll incorporating the present invention.

## DETAILED DESCRIPTION

Although the present invention is particularly well suited for use in connection with a paper roll or skid of paper used in a printing process, and shall be so described in a specific embodiment hereinafter, the present invention is equally well suited for use where accurate and up to date information of other types is to be associated with a particular product type or item in a different manufacturing process.

Referring to FIG. 3, a Radio Frequency Identification (RFID) system 300 useful in employing the present invention comprises a coil or other type of antenna 302, a transceiver (with decoder) 304, and a transponder (commonly called an RFID tag) 306 programmed with unique stored information (data). The identification tag 306 contains encoded data corresponding to a unique item identification code along with a limited amount of other product related and/or "lookup" data.

The antenna 302 typically receives and sends radio frequency signals to activate tag 306 and to read and write data to and from the tag 306. Antenna 302 may be anyone of a variety of shapes and sizes. For example, antenna 302 can be built into a doorway to receive tag data from or to write data to product containers, supports, packages or other things passing through the

doorway. In the case where data is to be supplied to a machine such as a printing press or the like, antenna 302 can be mounted on or adjacent to such machine. Antenna 302 can also be associated with a hand held device as will be described below.

An electromagnetic field produced by antenna 302 can be constantly present when multiple tags may be expected to pass through the field in a more or less continuous or regular stream. If constant interrogation is not required, a sensor device may be provided to activate the field when required (for example, when an item approaches the threshhold). Often the antenna 302 is configured with the transceiver/decoder 304 to become a reader (interrogator) 308, which can be configured, for example, as a hand held or a fixed-mount device. The reader 308 emits radio frequency waves 310 across distances of anywhere from one inch to one hundred feet or more, depending on the signal power output and the operational radio ftequency used. When an RFID tag 306 passes through an electromagnetic sensing zone 312, tag 306 detects the activation signal of reader 308 and responds by emitting code-containing radio frequency waves 314. Tag 306 itself may include an antenna (see, for example. FIG. 1 and related discussion below). The reader 308 decodes the data encoded in an integrated circuit 15 (memory) of RFID tag 306 and the data is passed to a host computer (see FIG. 1) for processing.

RFID tag 306 may come in a wide variety of shapes and sizes. RFID tag 306 may be characterized as either passive or active. Active RFID tags 306 may be powered by an internal battery (not shown) and typically have read/write capabilities; i.e. tag data can be rewritten or modified. The memory capacity of an active tag 306 will differ according to application requirements. Some RFID systems operate, for example, with 1 MB of internal memory .In a typical read/write RFID system 300, a tag 306 can provide a set of instructions or information

and the tag 306 can receive and store encoded information. This encoded information or data then becomes part of the recorded history of the tagged product 316. The battery power of an active tag 306 generally gives it a greater read range. The trade off is greater size, higher cost and a more limited operating life.

Passive RFID tags 306 operate without a separate external power source and obtain operating power from the reader 308. Passive tags 306 consequently are usually lighter in weight than active tags 306, are less expensive and offer a theoretically unlimited operational lifetime. A trade off is that passive tags 306 generally have a smaller read range than active tags and typically require a higher powered reader.

Read-only tags 306 typically are passive and are programmed with a unique set of data (usually 32 to 128 bits) that cannot be modified (write once). Read-only tags 306 most often serve as a key or index into a database in much the same way as a barcode references a database which contains modifiable product-specific information.

Frequency ranges also distinguish RFID systems 300. Low frequency (30 KHz to 500 KHz) systems typically have short reading ranges and lower system costs. These low frequency systems are most commonly used in security, access, asset tracking and animal identification applications. Higher frequency (850 MHz to 950 MHz and 2.4 GHz to 2.5 GHz ) systems typically offer long read ranges (greater than ninety feet) anc higher reading rates.

A significant advantage of RFID systems 300 is the non-contact. non-line-of-sight nature of the technology. Tags 306 can be read through a variety of conditions such as snow, fog. ice. paint, crusted grime, and other visually and environmentally challenging conditions where barcodes or other optically read technologies would be at a disadvantage. RFID tags 300 can also be read in challenging situations at high rates., responding in typical cases in on the order of

one hundred milliseconds.

The range that can be achieved with an RFID system 300 is determined essentially by power available at the reader/interrogator 308 to communicate with tag 306, power available within the tag 306 to respond and environmental conditions, including surrounding structures.

In FIG. I, a materials handling, tracking and control system of a type which is useful in connection with one paper handling system which is useful according to the present invention is illustrated. As is shown in FIG. 1, an RFID tag 102 is attached to a product support or package or container 101. 'The RFID tag 102 contains a stored, unique identification code and stored product reference information. The latter may be used to trigger a database query in the form of an HTML (Hyper Text Markup Language) link via the Internet to a remotely located product-related information database 105 stored in one or more Internet web servers or database servers 104. Database 105 contains, for example, product name and/or number, manufacturer's name, item serial number, quantity in the package 101, shipping history (which is updated over time), detailed product information, manufacturing data and such other information as may be of value to a manufacturer (e.g., a printer) who makes use of the particular product (e.g., paper) in the chain of commerce. As indicated, the data in database 105 can be updated and maintained accurate, in contrast to physical documents attached to a product at the time of manufacture which is current, at best, as of the date of printing, if they are provided at all. By means of an interrogator/reader 103, the RFID tag 102 is activated so that the information in database 105 may be accessed quickly as the product is introduced into a manufacturing (e.g., printing) process. The information can be accessed without physical contact or undue proximity to the package or container 101.

As part of the labeling process, Internet URL (Uniform Resource Locater) data pertaining to each package (item) 101 is stored in a database or in the RFID tag 102 itself.

Thus, the RFID tag 102 typically contains a unique identification number, a URL address, a "From" field to identify the source of the package 101 and a "To" field to identify its destination. When interrogated, the URL address on tag 102 via an interrogater (such as 308) will automatically connect a user to a website which provides the desired information specific to the item at hand. With respect to manufacturing data, items such as date of manufacture, plant location and number, line number, lot number, warranty information and of the order of ten to twenty user customizable fields for additional information may be provided. Additional information such as product specifications, quality control testing, directions for use, all may be included, all within the storage capabilities of the system.

Machine operators and other customers will be able to interrogate RFID tag 101 using, for example, at least two different types of hand held terminals 103 (HHT). A "basic" HHT 103 is contemplated as a wireless terminal having a display and the capability to connect to the Internet.

HHT 103 also contains an RFID reader/interrogater. Such a terminal 103 is particularly useful in a manufacturing site. Such a basic HHT 103 displays a number of fields. An "advanced" HHT is also contemplated which has all of the features of the basic HHT and, in addition, can access the full Internet database for information such as product information, tracking, manufacturing data, specifications and quality control data.

The advanced HHT may also be linked to a hard copy device, if desired. Different levels of access and ability to write or enter data can be controlled by means of operator ID information and password or PIN information in a customary manner for handling

databases.

As shown in FIG. 2, the RFID tag 102 may carry an additional amount of frequently used data, with access to other information being obtained through associated local or remote databases outside of the package, support, container or product itself.

Referring to FIG. 4, a roll of paper 10 is supported on a core 16. The roll has a face 12 and a side 14. An RFID tag 18 is attached at an appropriate place to the roll/core combination. The RFID taf may be attached to various locations with respect to the paper roll 10, depending on the required reading range of the information and the physical constraints of the interplay of the roll and any machine on which it is to be used. The RFID tag contains coded information corresponding to various paper properties which are communicated through an interrogator 20 to automated printing press equipment 22, enabling adjustments to be made immediately without operator intervention.

Interrogator 20 can be interface to a local data base or over the Internet to a remote database. Additionally, material use and movement may be tracked by monitoring the movements of the paper roll10 or skid or other package through the use of the RFID tag 18.

While the various aspects of the invention have been described in connection with certain preferred embodiments, it should also be apparent that modifications may be made within the scope of the foregoing without departing from the broadest aspects of the invention as set forth in the following claims. Accordingly, this description is to be construed as illustrative only and is for the purpose of teaching those skilled in the art the best mode of carrying out the invention as currently contemplated. Details of the structure and its operation may be varied without departing from the invention.

**WHAT IS CLAIMED IS:**

I. A product information system comprising:

a product container;

an RFID tag associated with said container having data memory means for storing at least a unique digital identification code for said container and additional code for providing additional data associated with characteristics of said product which relate to use of said product in a subsequent process; and

means for retrieving said unique digital identification code and said additional code from said memory means for modifying said subsequent process.

2. A product information system according to Claim 1 wherein:

said means for retrieving comprises an interrogator for accessing said memory of said tag and for utilizing said identification code and said additional code to retrieve information uniquely associated with said product .

3. A product information system according to Claim 2 wherein:

said uniquely associated information comprises physical characteristics of said product.

4. A product information system according to Claim 3 wherein:
at least a portion of said product information is stored remotely from said product .

5. A product information system according to Claim 4 wherein:
said interrogator is coupled via an Internet connection to at least a portion of said product information.

6. A product information system according to Claim 5 wherein:
said interrogator is coupled to at least one data processor via said Internet connection to access said product information.

7. A product information system according to Claim 3 wherein:
said product information includes physical characteristics of said product which are unique to the product associated with said container.

8. A product information system according to Claim 7 wherein:
said physical characteristics of said product are provided in a subsequent process to control said process.

9. A method of providing product related information uniquely associated with particular support containers of a product comprising:
placing an RFID tag on each product container, said tag having a unique coded identifier for each said support;

storing in said RFID tag an Internet URL code associated with the manufacturer of said product;

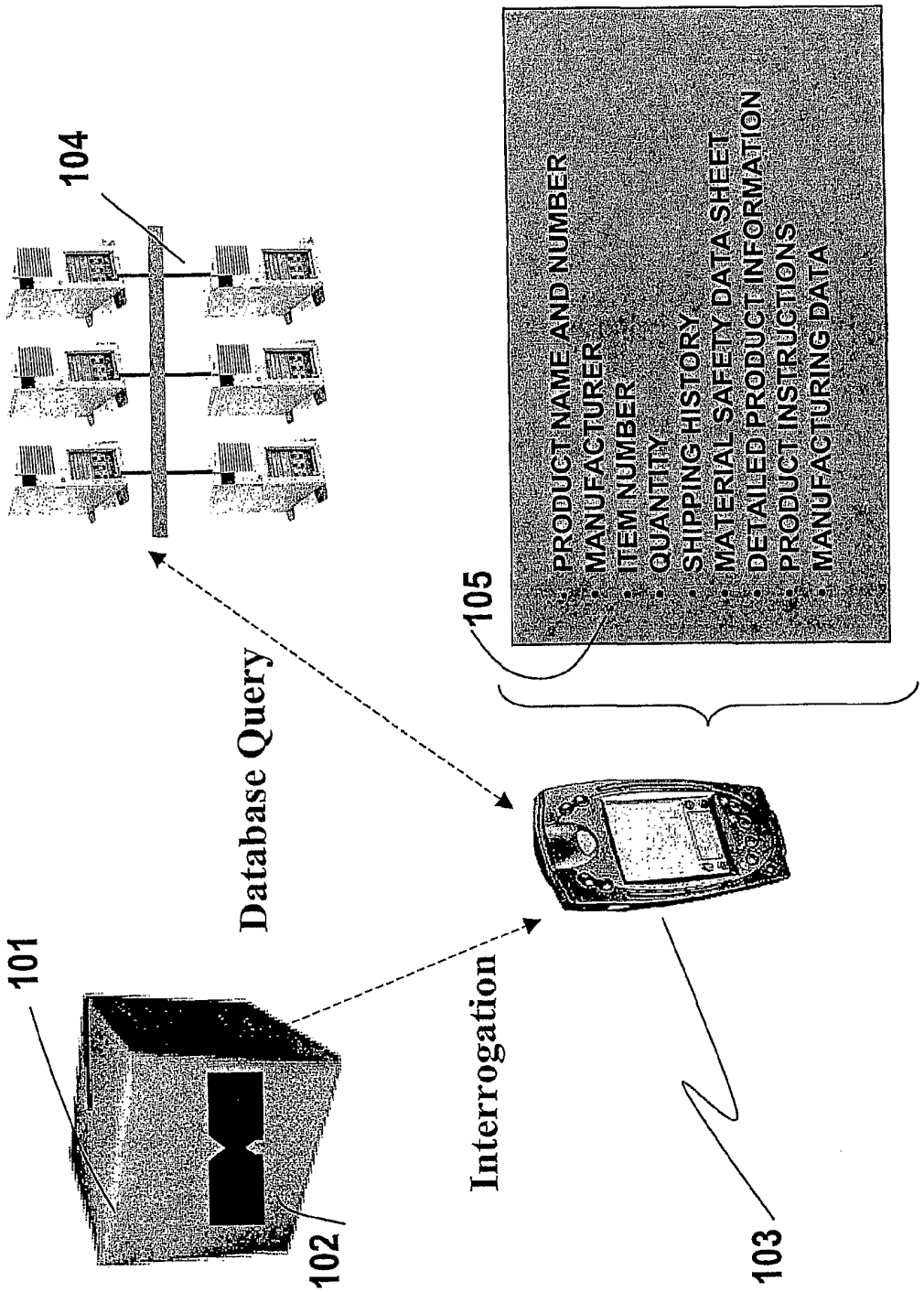
storing in said RFID tag additional information regarding characteristics unique to said product; and

interrogating said RFID tag and an Internet connection to provide unique characteristics relating to the specific container and its associated product.

10. A method of providing product information according to Claim 9 wherein:

said product is paper and said characteristics are selected from the group consisting of moisture content, strength, brightness, smoothness and weight.

FIG. 1


104
105
PRODUCT NAME AND NUMBER
MANUFACTURER
ITEM NUMBER
QUANTITY
SHIPPING HISTORY
MATERIAL SAFETY DATA SHEET
DETAILED PRODUCT INFORMATION
PRODUCT INSTRUCTIONS
MANUFACTURING DATA
Database Query
Interrogation
101
102
103

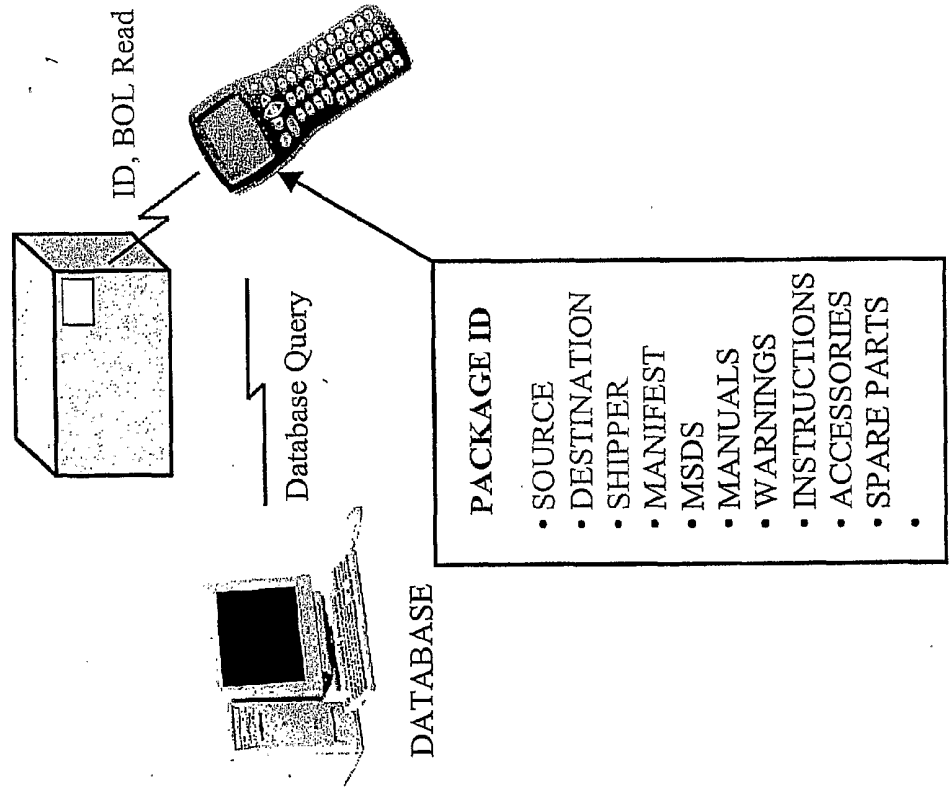

ID, BOL Read
Database Query
DATABASE
PACKAGE ID
• SOURCE
• DESTINATION
• SHIPPER
• MANIFEST
• MSDS
• MANUALS
• WARNINGS
• INSTRUCTIONS
• ACCESSORIES
• SPARE PARTS
•

FIG. 2

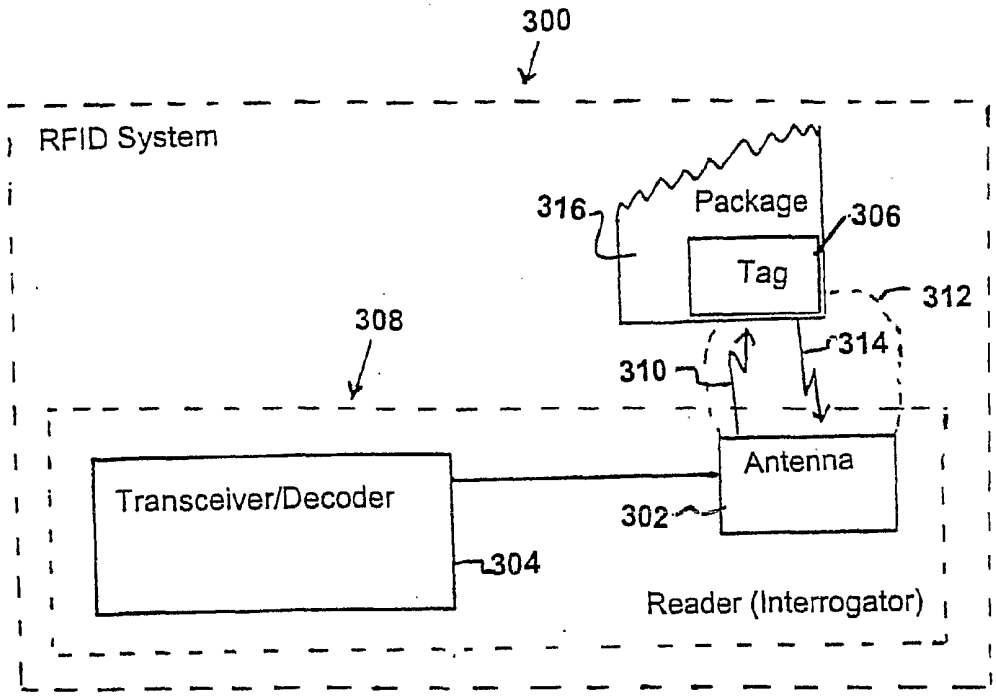

300
RFID System
316
Package
306
Tag
312
308
314
310
Antenna
Transceiver/Decoder
302
304
Reader (Interrogator)

FIG. 3

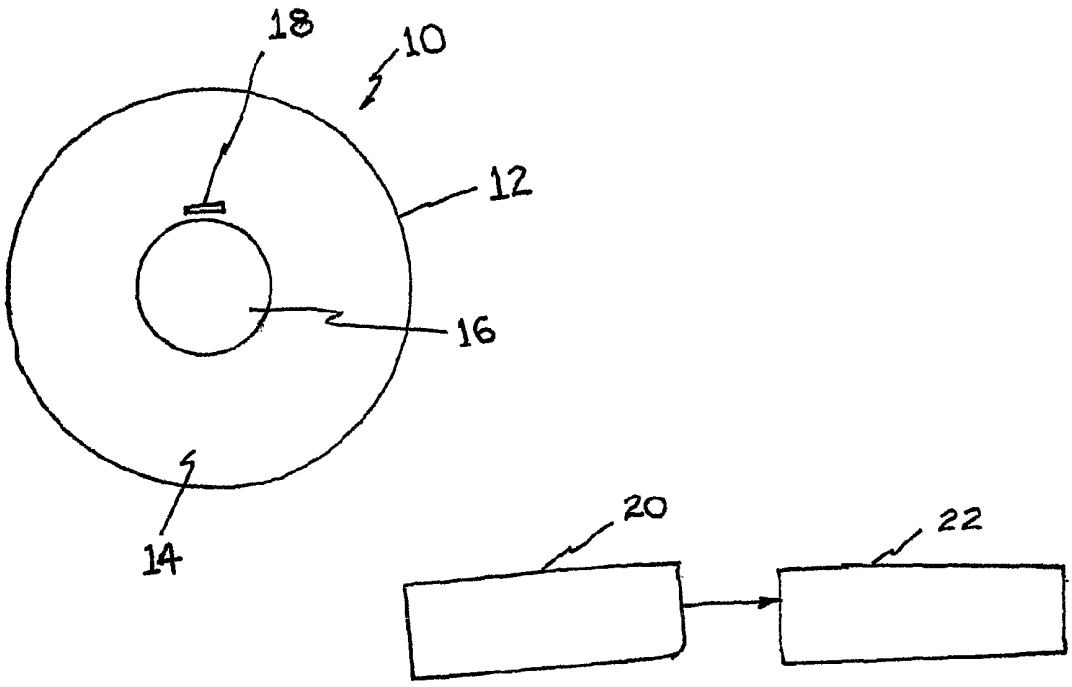



FIG. 4

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/US01/12663

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) :G06F 17/60; G06K 7/00
US CL : 705/28; 700/225
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. : 705/22, 28, 29; 700/215, 225

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)

C. *DOCUMENTS CONSIDERED TO BE RELEVANT*

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | US 6,128,549 A (SWARTZ et al.) 03 October 2000, see entire document. | 1-10 |
| Y | US 5,887,176 A (GRIFFITH et al.) 23 March 1999, see entire document. | 1-10 |
| Y | US 5,850,187 A (CARRENDER et al.) 15 December 1998, see entire document. | 4-6,9,10 |
| Y | US 4,463,251 A (KOUTONEN et al.) 31 July 1984, see entire document. | 10 |
| A | US 5,113,349 A (NAKAMURA et al.) 12 May 1992, see entire document. | 1-10 |
| A | US 5,389,769 A (YAMASHITA et al.) 14 February 1995, see entire document. | 1-10 |

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

* Special categories of cited documents:

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

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"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

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
11 JUNE 2001

Date of mailing of the international search report
09 JUL 2001

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231
Facsimile No. (703) 305-3230

Authorized officer
Peggy Harrod
DEAN J. KRAMER
Telephone No. (703) 308-2181

Form PCT/ISA/210 (second sheet) (July 1998) ★