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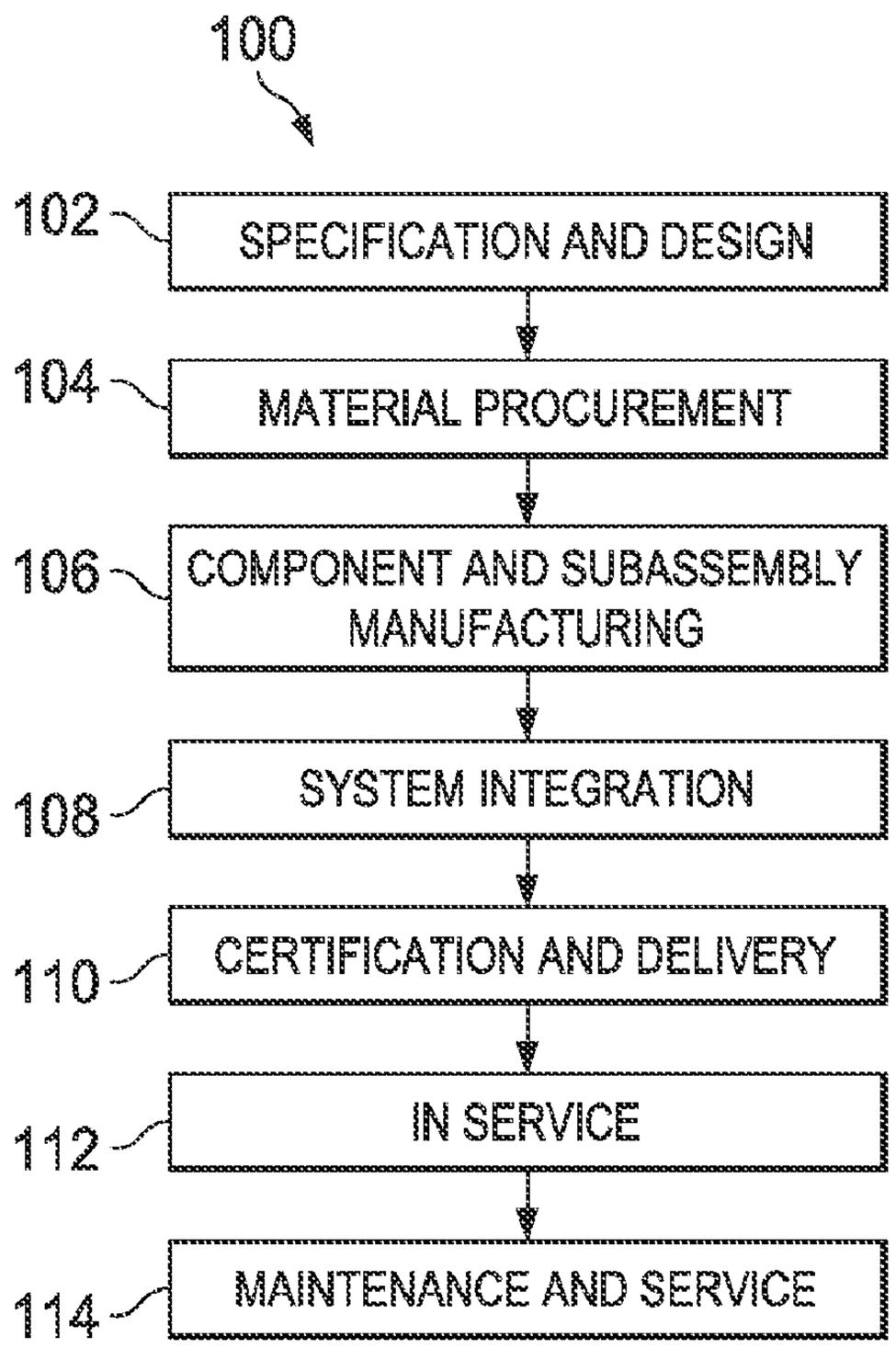
(54) **Titre : GESTION DE PLURALITE DE DISPOSITIFS D'IDENTIFICATION RADIOFREQUENCE**
(54) **Title: MANAGING A PLURALITY OF RADIO FREQUENCY IDENTIFICATION DEVICES**



(57) **Abrégé/Abstract:**
A method and apparatus for managing identification devices on an aircraft. An occurrence of an event is identified using information for a plurality of identification devices. Each of the plurality of identification devices (308) is associated with a plurality of

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(57) **Abrégé(suite)/Abstract(continued):**
components (314) on the aircraft (304). The information (33) for the plurality of identification devices (308) comprises data (402) received from the plurality of identification devices and specification data (404) for the plurality of identification devices. In response to identifying the occurrence of the event (800), a number of operations for the plurality of identification devices are initiated (802).

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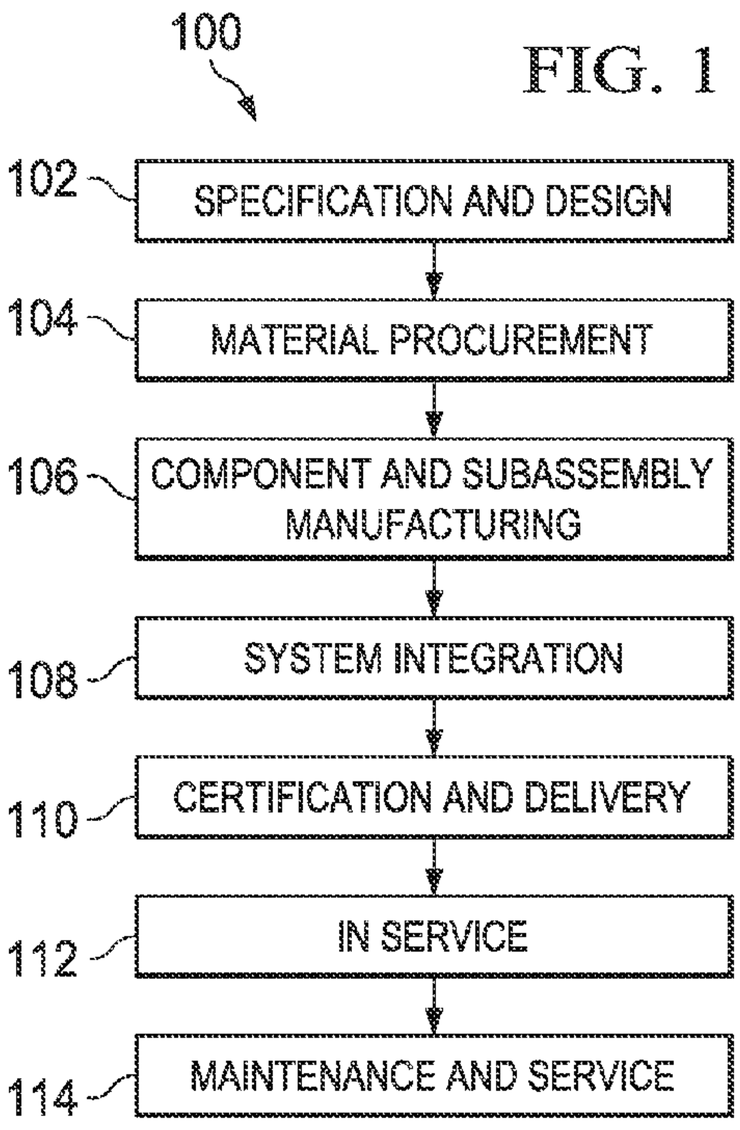
(54) **Title**: MANAGING A PLURALITY OF RADIO FREQUENCY IDENTIFICATION DEVICES



(57) **Abstract**: A method and apparatus for managing identification devices on an aircraft. An occurrence of an event is identified using information for a plurality of identification devices. Each of the plurality of identification devices (308) is associated with a plurality of components (314) on the aircraft (304). The information (33) for the plurality of identification devices (308) comprises data (402) received from the plurality of identification devices and specification data (404) for the plurality of identification devices. In response to identifying the occurrence of the event (800), a number of operations for the plurality of identification devices are initiated (802).

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MANAGING A PLURALITY OF RADIO FREQUENCY IDENTIFICATION DEVICES

BACKGROUND INFORMATION

Field:

The present disclosure relates generally to managing identification devices and, in particular, to managing radio frequency identification devices. Still more particularly, the present disclosure relates to a method and apparatus for managing radio frequency identification devices for an aircraft.

Background:

Aircraft include various types of components. These components may include, for example, without limitation, overhead stowage bins, seats, food carts, safety devices, doors, windows, sections of the aircraft, computers in the cockpit of the aircraft, engines, control surfaces, spars, and/or other suitable types of components in the aircraft.

Keeping track of the different components installed in an aircraft may take more time and/or effort than desired as the number of components in the aircraft increases. Further, over time, operations, such as, for example, maintenance, repair, replacement, inspection, and/or other suitable types of operations may need to be performed for these components. These types of operations may also make keeping track of the different components more time-consuming and more difficult than desired.

Currently, one system for keeping track of these components includes using automated identification technology (AIT). Automated identification technology is a group of technologies for storing and transferring data. In particular, automated identification technology includes devices that allow data to be captured, aggregated, and/or transferred from the devices. These devices may be referred to as identification devices. Automated identification technology (AIT) is increasingly being introduced into aircraft.

For example, automated identification technology in an aircraft may include a number of identification devices that are used to mark or "tag" components in the aircraft. The identification devices used to tag the different components may include, for

example, without limitation, radio frequency identification (RFID) tags, magnetic strips, bar codes, optical memory cards, and/or other suitable types of devices.

As the number of identification devices used in an aircraft increases, managing information about the identification devices may become more difficult and more time-consuming than desired.

SUMMARY

In accordance with one disclosed aspect there is provided a method for managing identification devices on an aircraft. The method involves identifying, by a processor unit, an occurrence of an event for an identification device in a plurality of identification devices using information about the plurality of identification devices. Each of the plurality of identification devices are associated with a plurality of components on the aircraft and the information about the plurality of identification devices includes data stored on the plurality of identification devices that is received from the plurality of identification devices and specification data associated with the plurality of identification devices. The method also involves, responsive to identifying the occurrence of the event, generating, by the processor unit, a notification to a user that indicates an operation to be performed. The operation is selected from replacing the identification device, removing the identification device, and repairing the identification device.

The plurality of identification devices may include a plurality of radio frequency identification devices.

The method may involve attaching each of the plurality of identification devices to one of a plurality of locations on the plurality of components on the aircraft.

The method may involve receiving the data stored on the plurality of identification devices using radio frequency signals.

The method may involve obtaining the specification data about the plurality of identification devices from a manufacturer of the plurality of identification devices.

The method may involve at least one of attaching the plurality of identification devices prior to installing the plurality of components on the aircraft, and attaching the plurality of identification devices after installing the plurality of components on the aircraft.

Identifying the event may involve determining whether a period of time during which data is not received from the identification device in the plurality of identification devices exceeds a selected threshold.

The data stored on the plurality of identification devices may include a memory available to the identification device and identifying the event may involve determining that the memory available for the identification device is less than a selected threshold.

Identifying the event may involve determining that a version of the identification device in the plurality of identification devices is expiring.

The method may involve generating, by the processor unit, an alert for display indicating that the event has occurred.

The method may involve performing a number of queries to retrieve requested information from the information without requiring user input, and generating a number of reports in response to retrieving the requested information.

The plurality of identification devices may include at least one of a radio frequency identification device, an optical memory card, a barcode, and a magnetic strip.

In accordance with another disclosed aspect there is provided an apparatus including a plurality of identification devices associated with a plurality of components on an aircraft, and a computer system configured to identify an occurrence of an event for an identification device in the plurality of identification devices using information about the plurality of identification devices. The information about the plurality of identification devices includes data stored on the plurality of identification devices that is received from the plurality of identification devices and specification data associated with the plurality of identification devices. The computer system is further configured to, in response to identifying the occurrence of the event, generate a notification to a user that indicates an operation to be performed. The operation is selected from replacing the identification device, removing the identification device, and repairing the identification device.

The plurality of identification devices may include a plurality of radio frequency identification devices.

Each of the plurality of identification devices may be attached to one of a plurality of locations on the plurality of components on the aircraft.

The computer system may be configured to receive the data stored in the plurality of identification devices using radio frequency signals.

The computer system may be configured to obtain the specification data about the plurality of identification devices from a number of manufacturers for the plurality of identification devices.

The computer system may be configured to identify the occurrence of the event by determining whether a period of time in which the data is not received from the identification device in the plurality of identification devices exceeds a selected threshold.

The data stored on the plurality of identification devices may include a memory available to the identification device and the computer system may be configured to identify the occurrence of the event by determining whether the memory available to the identification device is less than a selected threshold.

The computer system may be configured to identify the occurrence of the event by determining that a version of the identification device in the plurality of identification devices is expiring.

The computer system may be configured to generate an alert for display indicating that the event has occurred.

The computer system may be further configured to perform a number of queries to retrieve requested information from the information without requiring user input and generate a number of reports in response to retrieving the requested information.

The plurality of identification devices may include at least one of a radio frequency identification device, an optical memory card, a barcode, and a magnetic strip.

The features and functions can be achieved independently in various embodiments of the present disclosure or may be combined in yet other embodiments

in which further details can be seen with reference to the following description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In drawings which illustrate embodiments of the invention:

Figure 1 is an illustration of an aircraft manufacturing and service method in accordance with an advantageous embodiment;

Figure 2 is an illustration of an aircraft in which an advantageous embodiment may be implemented;

Figure 3 is an illustration of a tag management environment in accordance with an advantageous embodiment;

Figure 4 is an illustration of information for a plurality of identification devices in accordance with an advantageous embodiment;

Figure 5 is an illustration of a data processing system in accordance with an advantageous embodiment;

Figure 6 is an illustration of an inside of an aircraft in accordance with an advantageous embodiment;

Figure 7 is an illustration of a tag management module in accordance with an advantageous embodiment;

Figure 8 is an illustration of a flowchart of a process for managing a plurality of identification devices on an aircraft in accordance with an advantageous embodiment;

Figure 9 is an illustration of a flowchart of a process for identifying the occurrence of an event in accordance with an advantageous embodiment; and

Figure 10 is an illustration of a flowchart of a process for forming information for a plurality of identification devices in accordance with an advantageous embodiment.

DETAILED DESCRIPTION

Referring more particularly to the drawings, embodiments of the disclosure may be described in the context of aircraft manufacturing and service method **100** as shown in **Figure 1** and aircraft **200** as shown in **Figure 2**.

Turning first to **Figure 1**, an illustration of an aircraft manufacturing and service method is depicted in accordance with an advantageous embodiment. During pre-production, aircraft manufacturing and service method **100** may include specification and design **102** of aircraft **200** in **Figure 2** and material procurement **104**.

During production, component and subassembly manufacturing **106** and system integration **108** of aircraft **200** in **Figure 2** takes place. Thereafter, aircraft **200** in **Figure 2** may go through certification and delivery **110** in order to be placed in service **112**. While in service **112** by a customer, aircraft **200** in **Figure 2** is scheduled for routine maintenance and service **114**, which may include modification, reconfiguration, refurbishment, and other maintenance or service.

Each of the processes of aircraft manufacturing and service method **100** may be performed or carried out by a system integrator, a third party, and/or an operator. In these examples, the operator may be a customer. For the purposes of this description, a system integrator may include, without limitation, any number of aircraft manufacturers and major-system subcontractors; a third party may include, without limitation, any number of vendors, subcontractors, and suppliers; and an operator may be an airline, leasing company, military entity, service organization, and so on.

With reference now to **Figure 2**, an illustration of an aircraft is depicted in which an advantageous embodiment may be implemented. In this example, aircraft **200** is produced by aircraft manufacturing and service method **100** in **Figure 1** and may include airframe **202** with a plurality of systems **204** and interior **206**. Examples of systems **204** include one or more of propulsion system **208**, electrical system **210**, hydraulic system **212**, and environmental system **214**. Any number of other systems may be included. Although an aerospace example is shown, different advantageous embodiments may be applied to other industries, such as the automotive industry.

Apparatuses and methods embodied herein may be employed during at least one of the stages of aircraft manufacturing and service method **100** in **Figure 1**. As

used herein, the phrase "at least one of", when used with a list of items, means that different combinations of one or more of the listed items may be used and only one of each item in the list may be needed. For example, "at least one of item A, item B, and item C" may include, for example, without limitation, item A or item A and item B. This example also may include item A, item B, and item C or item B and item C.

In one illustrative example, components or subassemblies produced in component and subassembly manufacturing **106** in **Figure 1** may be fabricated or manufactured in a manner similar to components or subassemblies produced while aircraft **200** is in service **112** in **Figure 1**. As yet another example, a number of apparatus embodiments, method embodiments, or a combination thereof may be utilized during production stages, such as component and subassembly manufacturing **106** and system integration **108** in **Figure 1**. A number, when referring to items, means one or more items. For example, a number of apparatus embodiments is one or more apparatus embodiments. A number of apparatus embodiments, method embodiments, or a combination thereof may be utilized while aircraft **200** is in service **112** and/or during maintenance and service **114** in **Figure 1**. The use of a number of the different advantageous embodiments may substantially expedite the assembly of and/or reduce the cost of aircraft **200**.

The different advantageous embodiments recognize and take into account a number of different considerations. For example, the different advantageous embodiments recognize and take into account that managing information about identification devices in an aircraft may take more time and/or effort than desired as the number of identification devices increases. These identification devices may be, for example, radio frequency identification tags that form a network and are attached to components in the aircraft.

The different advantageous embodiments recognize and take into account that it may be desirable to have a system for managing information about the radio frequency identification tags and making decisions based on this information. For example, the different advantageous embodiments recognize and take into account that it may be desirable to have a system that makes decisions and/or generates alerts regarding the maintenance, repair, and/or replacement of the radio frequency identification devices based on information about the radio frequency identification devices.

Thus, the different advantageous embodiments provide a method and apparatus for managing identification devices on an aircraft. An occurrence of an event is identified using information for a plurality of identification devices. Each of the plurality of identification devices is associated with a plurality of components on the aircraft. The information for the plurality of identification devices comprises data received from the plurality of identification devices and specification data for the plurality of identification devices. In response to identifying the occurrence of the event, a number of operations for the plurality of identification devices are initiated.

With reference now to **Figure 3**, an illustration of a tag management environment is depicted in accordance with an advantageous embodiment. In these illustrative examples, tag management environment **300** is an example of one environment in which tags **302** for aircraft **304** may be managed. Aircraft **304** may be an example of one implementation for aircraft **200** in **Figure 2**.

Tags **302** are devices configured to store data and allow data to be transferred from the tags. For example, without limitation, tags **302** may include radio frequency identification tags, magnetic strips, bar codes, optical memory cards, and/or other suitable types of devices.

In these illustrative examples, tags **302** take the form of plurality of identification devices **308**. Plurality of identification devices **308** is devices configured to store data and transmit data. Plurality of identification devices **308** may not include, for example, bar codes, magnetic strips, and other devices that are not configured to transmit data.

Further, plurality of identification devices **308**, in these illustrative examples, is plurality of wireless identification devices **310**. A wireless identification device is a device configured to store data and transmit data wirelessly using, for example, without limitation, radio frequency signals, optical signals, and/or other suitable types of wireless signals. Radio frequency identification devices are examples of wireless identification devices.

In these illustrative examples, plurality of identification devices **308** is attached to plurality of locations **312** on aircraft **304**. Plurality of locations **312** includes locations that are on the outside of aircraft **304**, on the inside of aircraft **304**, and/or on a component on aircraft **304**.

For example, plurality of locations **312** may be locations on plurality of components **314** on aircraft **304**. In this manner, plurality of identification devices **308** is associated with plurality of components **314**.

A first component may be considered to be associated with a second component by being secured, attached, bonded, fastened, and/or mounted to the second component. Further, the first component may be associated with the second component by being connected to the second component in some other suitable manner. Still further, the first component also may be connected to the second component by using a third component. The first component may also be considered to be associated with the second component by being formed as part of and/or an extension of the second component.

A component in plurality of components **314** on aircraft **304** may include, for example, without limitation, a seat, a wall, a fuselage, a control surface, a flap, a spoiler, a window, a serving tray, a fastener, a food cart, a vent, an air duct, a wall panel, a hallway, a placard attached to a wall, and/or some other suitable type of component on aircraft **304**.

In these illustrative examples, radio frequency identification device **316** is an example of one of plurality of identification devices **308**. Radio frequency identification device **316** may be attached to location **318** in plurality of locations **312**. Location **318** is on component **320** in plurality of components **314**. In this manner, radio frequency identification device **316** is attached to component **320**. Radio frequency identification device **316** may be attached to location **318** on component **320** to identify component **320** and distinguish component **320** from other components on aircraft **304**.

In some illustrative examples, radio frequency identification device **316** may be attached to location **318** on component **320** to identify a portion of aircraft **304** in which component **320** is present. For example, component **320** may be a wall inside the passenger cabin of aircraft **304**. Location **318** may be at an aft portion of the wall. Radio frequency identification device **316** may be attached to the location on the aft portion of the wall to identify the aft portion of the passenger cabin.

Radio frequency identification device **316** may be attached to location **318** on component **320** before or after component **320** is installed on aircraft **304**. For example, in some illustrative examples, radio frequency identification device **316** may be attached

to location **318** on component **320** when component **320** is still in a warehouse or in inventory.

In these depicted examples, each of plurality of identification devices **308** stores data **322** about the identification device. Data **322** may be obtained from plurality of identification devices **308** for processing by computer system **324**.

As depicted, computer system **324** takes the form of number of computers **326**. Number of computers **326** may be associated with aircraft **304**. Number of computers **326** may be associated with aircraft **304** in a number of different ways. In these illustrative examples, number of computers **326** may be associated with aircraft **304** by being located on aircraft **304**.

In some illustrative examples, at least a portion of number of computers **326** may be in a location remote to aircraft **304**. A portion may be one or some of number of computers **326**. At least a portion may be one, some, or all of number of computers **326**. As one illustrative example, a portion of number of computers **326** may be located remote to aircraft **304** and configured to communicate with another portion of number of computers **326** on aircraft **304** using wireless communications links.

Additionally, a portion of number of computers **326** may be handheld computers. For example, a portion of number of computers **326** may be handheld readers configured to obtain data **322** from plurality of identification devices **308**. In particular, the portion of number of computers **326** may be configured to receive data **322** that is transmitted by plurality of identification devices **308**.

As one illustrative example, operators may use handheld readers to obtain data **322** from plurality of identification devices **308** periodically. Data **322** may be obtained from an identification device in plurality of identification devices **308** when the identification device is operating within selected parameters. In other words, an identification device may not be able to transmit data **322** when the device is not working properly, does not have enough processing resources, is unable to identify the handheld reader, and/or has some other type of issue.

In these illustrative examples, data **322** for plurality of identification devices **308** may be obtained during one of component and subassembly manufacturing **106**, system integration **108**, certification and delivery **110**, in service **112**, and maintenance and service **114** in **Figure 1**, as well as other processes for aircraft **304**.

As depicted, tag management module **328** is configured to receive and process data **322** from plurality of identification devices **308**. Tag management module **328** is implemented in one or more of number of computers **326**. In particular, tag management module **328** comprises at least one of hardware components, software components, and firmware components.

In these depicted examples, tag management module **328** processes data **322** and stores the processed data in information **330**. Tag management module **328** uses information **330** to manage plurality of identification devices **308**. Information **330** may also include, for example, without limitation, information about plurality of locations **312** and/or plurality of components **314**, information about which identification device is attached to which location, information about dates and/or times for when data **322** is received from plurality of identification devices **308**, and/or other suitable types of information.

Tag management module **328** processes information **330** to identify occurrences of events **332** for plurality of identification devices **308** using event policy **334**. Event policy **334** includes a number of rules, criteria, and/or guidelines for identifying when events **332** occur based on information **330**.

As one illustrative example, event policy **334** may indicate that event **336** occurs when an amount of memory remaining for radio frequency identification device **316** is less than a selected threshold. As another illustrative example, event policy **334** may indicate that event **336** occurs when a period of time in which data **322** has been not been received from radio frequency identification device **316** exceeds a selected threshold. Further, in yet another illustrative example, event policy **334** may indicate that event **336** occurs when a version of radio frequency identification device **316** expires.

In these illustrative examples, tag management module **328** initiates number of operations **338** in response to identifying the occurrence of event **336**. Number of operations **338** may include, for example, without limitation, replacing, removing, repairing, inspecting, and/or adding an identification device.

Number of operations **338** may also include generating a number of alerts, reports, notifications, and/or queries for plurality of identification devices **308**. In some illustrative examples, tag management module **328** may initiate an operation in number

of operations **338** by generating a notification that indicates the operation to be performed to a user.

As one illustrative example, in response to identifying the occurrence of event **336**, tag management module **328** generates alert **340**. Alert **340** may be a visible and/or audible alert. In these illustrative examples, tag management module **328** displays alert **340** on display system **341** in computer system **324**.

As depicted, display system **341** may comprise number of display devices **343**. Number of display devices **343** may include, for example, without limitation, computer monitors, display screens, touch screens, and/or other suitable types of display devices. Number of display devices **343** may be in the same or different locations.

Alert **340** may be viewed by operator **342** on graphical user interface **345** on a display device in number of display devices **343**. Operator **342** may be, for example, a member of a maintenance crew for aircraft **304**, an operator of a handheld scanner used to receive data **322**, a pilot, a technician, or some other suitable operator.

In these illustrative examples, operator **342** may initiate number of queries **344** for requested information **346** using graphical user interface **345**. As one example, operator **342** may initiate number of queries **344** in response to, for example, alert **340**. Tag management module **328** performs number of queries **344** using information **330** to identify requested information **346**.

In these depicted examples, tag management module **328** may be configured to generate number of reports **348** containing requested information **346**. Further, tag management module **328** may be configured to display number of reports **348** on graphical user interface **345**.

In this manner, tag management module **328** is configured to manage plurality of identification devices **308** using information **330**. Tag management module **328** may allow management of plurality of identification devices **308** to be automated. In other words, tag management module **328** may identify events **332** without requiring operator input. Further, tag management module **328** allows operator **342** to initiate number of operations **338** for plurality of identification devices **308** without operator **342** needing to process information **330**.

Additionally, in some illustrative examples, operator **342** may enter user input **350** using graphical user interface **345**. User input **350** may be used in processing information **330** to identify events **332** and/or may be stored as part of information **330**.

The illustration of tag management environment **300** in **Figure 3** is not meant to imply physical or architectural limitations to the manner in which different advantageous embodiments may be implemented. Other components in addition to and/or in place of the ones illustrated may be used. Some components may be unnecessary in some advantageous embodiments. Also, the blocks are presented to illustrate some functional components. One or more of these blocks may be combined and/or divided into different blocks when implemented in different advantageous embodiments.

For example, in some illustrative examples, tag management environment **300** may include more than one of aircraft **304**. For example, tag management environment **300** may include a fleet of aircraft and/or other vehicles.

With reference now to **Figure 4**, an illustration of information for a plurality of identification devices is depicted in accordance with an advantageous embodiment. In this illustrative example, information **400** is an example of one implementation for information **330** for plurality of identification devices **308** in **Figure 3**.

As depicted, information **400** includes identification device data **402**, specification data **404**, and user input **406**. Identification device data **402** is an example of one implementation for processed data that is formed by processing, for example, data **322** received from each of plurality of identification devices **308** in **Figure 3**.

In this illustrative example, identification device data **402** includes unique identifier **407**, installation date **408**, commissioned date **410**, memory refresh cycle date **412**, date of last update **414**, time period **416**, maintenance history **418**, memory capacity **420**, memory available **422**, and/or adhesive type **423** for each identification device from which the data is received.

In this depicted example, unique identifier **407** is an identifier for the identification device that allows the identification device to be distinguished from the other identification devices in the plurality of identification devices. In other words, unique identifier **407** is different for each of the plurality of identification devices.

Installation date **408** is the date on which the identification device is attached to a particular location and/or component. Commissioned date **410** is the date on which the identification device was associated with the component and information **400** was written to the identification device.

Memory refresh cycle date **412** is the date on which identification device data **402** on the memory of the identification device needs to be refreshed. Each memory

refresh prolongs the longevity of identification device data **402** on the identification device.

Date of last update **414** is the date on which data was transmitted from the identification device to a computer, such as a handheld reader. Time period **416** is the period of time between date of last update **414** and the date on which data was transmitted from the identification device before date of last update **414**. In these illustrative examples, data is not transmitted between these two dates. In other illustrative examples, time period **416** may be the period of time between date of last update **414**.

Maintenance history **418** includes information about maintenance performed on the identification device. For example, maintenance history **418** may include a log of dates on which repairs were made to the identification device.

In this illustrative example, memory capacity **420** is the total memory capacity for the identification device. In other words, memory capacity **420** is the total amount of memory available for storing data on the identification device. Memory available **422** is the amount of memory remaining and available for use. In other words, memory available **422** is the memory that is not already in use by the identification device.

Adhesive type **423** includes information about the type of adhesive used to attach the identification device to the component. In these illustrative examples, adhesive type **423** may indicate the adhesive is a thermal adhesive or a conductive adhesive. In other illustrative examples, adhesive type **423** may indicate the adhesive is another type of adhesive and/or the brand name of the adhesive.

In this depicted example, specification data **404** is data about the plurality of identification devices that may be obtained from a number of manufacturers for the plurality of identification devices. For example, specification data **404** may include device model **424**, version number **426**, manufacturer name **428**, and/or other suitable types of specification data.

Device model **424** is the device model for an identification device. Device model **424** may be the same for multiple identification devices. Version number **426** indicates the version of the identification device. Manufacturer name **428** is the manufacturer of the identification device and the provider of specification data **404**.

Of course, specification data **404** may include other types of information, such as, for example, a frequency range for an identification device, type of memory,

classification, how often an identification device needs to be scanned to retain data, an identification of interchangeable parts for the identification device, security information, temperature restrictions, adhesive restrictions, and/or other suitable types of information.

In this illustrative example, user input **406** includes any input that is entered by an operator for the plurality of identification devices. User input **406** may include, for example, without limitation, corrections to identification device data **402** and/or specification data **404**, updates, a query for all the identification devices that have specific specification data **404** such as manufacturer name **428**, and/or other suitable types of information.

With reference now to **Figure 5**, an illustration of a data processing system is depicted in accordance with an advantageous embodiment. Data processing system **500** is an example of one implementation for a computer in number of computers **326** in computer system **324** in **Figure 3**. Data processing system **500** is a computer in which computer usable program code or instructions implementing the processes may be located for the advantageous embodiments.

In this illustrative example, data processing system **500** includes communications fabric **502**, which provides communications between processor unit **504**, memory **506**, persistent storage **508**, communications unit **510**, input/output (I/O) unit **512**, and display **514.**

Processor unit **504** serves to execute instructions for software that may be loaded into memory **506**. Processor unit **504** may be a set of one or more processors or may be a multi-processor core, depending on the particular implementation. Further, processor unit **504** may be implemented using one or more heterogeneous processor systems in which a main processor is present with secondary processors on a single chip. As another illustrative example, processor unit **504** may be a symmetric multi-processor system containing multiple processors of the same type.

Memory **506** and persistent storage **508** are examples of storage devices **516**. A storage device is any piece of hardware that is capable of storing information, such as, for example, without limitation, data, program code in functional form, and/or other suitable information either on a temporary basis and/or a permanent basis. Memory **506**, in these examples, may be, for example, a random access memory or any other suitable volatile or non-volatile storage device. Persistent storage **508** may take various

forms, depending on the particular implementation. For example, persistent storage **508** may contain one or more components or devices. For example, persistent storage **508** may be a hard drive, a flash memory, a rewritable optical disk, a rewritable magnetic tape, or some combination of the above. The media used by persistent storage **508** also may be removable. For example, a removable hard drive may be used for persistent storage **508**.

Communications unit **510**, in these examples, provides for communications with other data processing systems or devices. In these examples, communications unit **510** is a network interface card. Communications unit **510** may provide communications through the use of either or both physical and wireless communications links.

Input/output unit **512** allows for input and output of data with other devices that may be connected to data processing system **500**. For example, input/output unit **512** may provide a connection for user input through a keyboard, a mouse, and/or some other suitable input device. Further, input/output unit **512** may send output to a printer. Display **514** provides a mechanism to display information to a user.

Instructions for the operating system, applications, and/or programs may be located in storage devices **516**, which are in communication with processor unit **504** through communications fabric **502**. In these illustrative examples, the instructions are in a functional form on persistent storage **508**. These instructions may be loaded into memory **506** for execution by processor unit **504**. The processes of the different embodiments may be performed by processor unit **504** using computer implemented instructions, which may be located in a memory, such as memory **506**.

These instructions are referred to as program code, computer usable program code, or computer readable program code that may be read and executed by a processor in processor unit **504**. The program code in the different embodiments may be embodied on different physical or tangible computer readable media, such as memory **506** or persistent storage **508**.

Program code **518** is located in a functional form on computer readable media **520** that is selectively removable and may be loaded onto or transferred to data processing system **500** for execution by processor unit **504**. Program code **518** and computer readable media **520** form computer program product **522** in these examples. In one example, computer readable media **520** may be computer readable storage media **524** or computer readable signal media **526**. Computer readable storage media

524 may include, for example, an optical or magnetic disk that is inserted or placed into a drive or other device that is part of persistent storage **508** for transfer onto a storage device, such as a hard drive, that is part of persistent storage **508**. Computer readable storage media **524** also may take the form of a persistent storage, such as a hard drive, a thumb drive, or a flash memory, that is connected to data processing system **500**. In some instances, computer readable storage media **524** may not be removable from data processing system **500**.

Alternatively, program code **518** may be transferred to data processing system **500** from computer readable media **520** through a communications link to communications unit **510** and/or through a connection to input/output unit **512**. The communications link and/or the connection may be physical or wireless in these illustrative examples. Computer readable media **520** also may take the form of non-tangible media, such as communications links or wireless transmissions containing the program code.

In some advantageous embodiments, program code **518** may be downloaded over a network to persistent storage **508** from another device or data processing system for use within data processing system **500**. For instance, program code stored in a computer readable storage medium in a server data processing system may be downloaded over a network from the server to data processing system **500**. The data processing system providing program code **518** may be a server computer, a client computer, or some other device capable of storing and transmitting program code **518.**

The different components illustrated for data processing system **500** are not meant to provide architectural limitations to the manner in which different advantageous embodiments may be implemented. The different advantageous embodiments may be implemented in a data processing system including components in addition to or in place of those illustrated for data processing system **500**. Other components shown in **Figure 5** can be varied from the illustrative examples shown. The different advantageous embodiments may be implemented using any hardware device or system capable of executing program code. As one example, data processing system **500** may include organic components integrated with inorganic components and/or may be comprised entirely of organic components excluding a human being. For example, a storage device may be comprised of an organic semiconductor.

As another example, a storage device in data processing system **500** is any hardware apparatus that may store data. Memory **506**, persistent storage **508**, and computer readable media **520** are examples of storage devices in a tangible form.

In another example, a bus system may be used to implement communications fabric **502** and may be comprised of one or more buses, such as a system bus or an input/output bus. Of course, the bus system may be implemented using any suitable type of architecture that provides for a transfer of data between different components or devices attached to the bus system. Additionally, a communications unit may include one or more devices used to transmit and receive data, such as a modem or a network adapter. Further, a memory may be, for example, memory **506**, or a cache, such as found in an interface and memory controller hub that may be present in communications fabric **502**.

With reference now to **Figure 6**, an illustration of a portion of an aircraft is depicted in accordance with an advantageous embodiment. In this illustrative example, aircraft **600** is an example of one implementation for aircraft **304** in **Figure 3**. The portion of aircraft **600** depicted is a portion of passenger cabin **601** for aircraft **600**.

As depicted, aircraft **600** has radio frequency identification tags **602, 604, 606, 608, 610,** and **612**. Radio frequency identification tags **602, 604, 606, 608, 610,** and **612** are examples of implementations for plurality of identification devices **308** in **Figure 3**.

In this illustrative example, radio frequency identification tags **602, 604, 606, 608, 610,** and **612** are attached to locations on overhead bin **614**, seat **616**, seat **618**, seat **620**, seat **622**, and wall **624**, respectively, on aircraft **600**. Radio frequency identification tags **602, 604, 606, 608, 610,** and **612** are attached to overhead bin **614**, seat **616**, seat **618**, seat **620**, seat **622**, and wall **624** to uniquely identify these components on aircraft **600**.

As depicted in this example, radio frequency identification tag **604** is attached to a location on seat **616** to uniquely identify seat **616**. Of course, in other illustrative examples, additional radio frequency identification tags may be attached to different locations on seat **616** such that the different radio frequency identification tags uniquely identify different portions of seat **616**.

In this illustrative example, operator **626** uses handheld reader **628** to obtain data from radio frequency identification tags **602, 604, 606, 608, 610,** and **612**. Handheld

reader **628** may be implemented using data processing system **500** in **Figure 5**. Further, handheld reader **628** is a computer configured to receive data that is transmitted from the different radio frequency identification devices.

Additionally, handheld reader **628** may be configured to send the data received from radio frequency identification tags **602, 604, 606, 608, 610,** and **612** to a tag management module, such as tag management module **328** in **Figure 3**, for processing. In particular, in these examples, the data may be sent using a wireless communications link.

With reference now to **Figure 7**, an illustration of a tag management module is depicted in accordance with an advantageous embodiment. In this illustrative example, tag management module **700** is an example of one implementation for tag management module **328** in **Figure 3**. Tag management module **700** is configured to manage tags, such as tags **302** in **Figure 3**. In particular, tag management module **700** is configured to manage a plurality of identification devices, such as plurality of identification devices **308** in **Figure 3**.

Additionally, tag management module **700** is configured to manage radio frequency identification devices, such as radio frequency identification tags **602, 604, 606, 608, 610,** and **612** as well as any other radio frequency identification tags on aircraft **600** as shown in **Figure 6**.

As depicted, tag management module **700** includes information retrieval process **702**, number of databases **704**, and tag management process **706**. Information retrieval process **702** is configured to retrieve information **708** from system database **703** using system interface **710**. System database **703** is a database that may be managed by an entity, such as, for example, without limitation, an airline, an organization, a maintenance crew, an aircraft owner, or some other suitable type of entity. In this illustrative example, system database **703** may be in a location remote to tag management module **700**.

Information **708** in system database **703** includes identification device data **712**, location information **714**, and/or other suitable information for a number of aircraft. Identification device data **712** may be, for example, identification device data **402** in **Figure 4**. Identification device data **712** is data that is obtained from the plurality of identification devices. Location information **714** identifies which identification devices are attached to which locations and/or components on the number of aircraft.

In this illustrative example, information retrieval process **702** processes information **708** to form processed information **716** using filtering and processing agent **718**. Filtering and processing agent **718** is configured to use retrieval policy **720** to process information **708**.

Retrieval policy **720** includes a number of rules, criteria, and/or guidelines for processing information **708**. As one illustrative example, retrieval policy **720** may include a number of guidelines for formatting information **708** received from system database **704** into a desired format for processed information **716**.

For example, information retrieval process **702** is configured to retrieve information from system databases for different entities. These different entities may not format their information in the same manner. Filtering and processing agent **718** may use retrieval policy **720** to format the information retrieved from the different system databases.

In some illustrative examples, retrieval policy **720** may include a number of criteria for filtering information **708** such that only a portion of information **708** is used to form processed information **716**. In other illustrative examples, retrieval policy **720** may include a number of rules for selecting portions of information **708** to form processed information **716**.

As depicted, filtering and processing agent **718** stores processed information **716** in operational database **722** in number of databases **704**. Number of databases **704** also includes tag specification database **724** and tag management database **726**.

Tag specification database **724** contains specification data **728**. Specification data **728** may be, for example, specification data **404** in **Figure 4**. Specification data **728** includes specification data obtained from a number of manufacturers for different types of identification devices.

In this illustrative example, tag management process **706** comprises aggregation process **730** and event identification process **732**. Aggregation process **730** is configured to retrieve, combine, and process the information stored in operational database **722** and tag specification database **724** to form information **734**. Information **734** may be, for example, information **330** in **Figure 3** and/or information **400** in **Figure 4**.

In some illustrative examples, aggregation process **730** forms information **734** in response to selected event **731**. Selected event **731** may be a periodic event and/or a

non-periodic event. For example, without limitation, selected event **731** may be a non-periodic event, such as the receipt of a service bulletin, a notification, user input, or some other non-periodic event. Selected event **731** may be a periodic event, such as a lapse of time or some other suitable periodic event.

Aggregation process **730** stores information **734** in tag management database **726** in number of databases **704**. Information **734** may also include other types of information. For example, information **734** may include information formed from processing user input.

In this illustrative example, event identification process **732** in tag management process **706** is configured to identify an occurrence of an event, such as event **336** in **Figure 3**, using event policy **735**. Event policy **735** may be, for example, event policy **334** in **Figure 3**.

Event identification process **732** processes information **734** in tag management database **726** to identify when an event occurs. For example, event identification process **732** may be configured to retrieve information **734** periodically to determine whether an event has occurred. In some illustrative examples, event identification process **732** may be configured to retrieve information **734** in response to user input.

In other illustrative examples, event identification process **732** identifies the occurrence of an event any time that information retrieval process **702** retrieves information **708** from system database **703**.

In response to identifying the occurrence of an event, event identification process **732** generates a notification indicating that an event has occurred and information about the event. This notification is sent to alert process **736**. Alert process **736** uses alert policy **738** to determine whether or not alerts **740** are to be generated in response to the occurrence of the event. Alert policy **738** may indicate, for example, that an alert needs to be sent to an operator when certain events occur. For example, when the amount of memory on an identification device exceeds a desired threshold, an alert may be sent to an operator to replace the identification device.

In this illustrative example, alerts **740** indicate that a number of operations may need to be performed for a number of identification devices. For example, an alert in alerts **740** may indicate that a radio frequency identification tag needs to be replaced or repaired. A different alert may indicate that an operator needs to use a handheld reader to perform another retrieval of data from an identification device.

In this illustrative example, tag management module **700** also includes query engine **742**. Query engine **742** is configured to receive user input for requested information from tag management database **726** entered through graphical user interface **744**. In these illustrative examples, graphical user interface **744** may be in a location remote to tag management module **700**.

For example, a user may want to generate a report indicating a current status for a plurality of identification devices on a particular aircraft. The user enters user input using graphical user interface **744**. Query engine **742** receives the user input and queries tag management database **726** for the requested information.

In response to obtaining the requested information, query engine **742** generates a report containing the requested information. Further, query engine **742** sends the report to graphical user interface **744** for display to the user.

Further, in these illustrative examples, query engine **742** may also be configured to perform queries for the requested information without receiving user input. In other words, query engine **742** may be configured to perform automated queries. In this manner, reports may be generated without requiring user input.

Of course, in other illustrative examples, a user may enter user input using graphical user interface **744** to add additional information to information **734** in tag management database **726**. In still other illustrative examples, user input may be entered to change one of retrieval policy **720**, event policy **735**, and/or alert policy **738**.

In these depicted examples, graphical user interface **744** allows a user to have access to all of information **734** in tag management database **726**.

Turning now to **Figure 8**, an illustration of a flowchart of a process for managing a plurality of identification devices on an aircraft is depicted in accordance with an advantageous embodiment. The process illustrated in **Figure 8** may be implemented in tag management environment **300** in **Figure 3**. Further, this process may be implemented using tag management module **328** in **Figure 3**.

The process begins by identifying an occurrence of an event using information for a plurality of identification devices (operation **800**). The plurality of identification devices is a plurality of radio frequency identification devices in this illustrative example.

Each of the plurality of identification devices is associated with a plurality of components on the aircraft. The information for the plurality of identification devices

comprises data received from the plurality of identification devices and specification data for the plurality of identification devices.

The process then initiates a number of operations for the plurality of identification devices in response to identifying the occurrence of the event (operation **802**), with the process terminating thereafter. The number of operations may include at least one of replacing an identification device, adding the identification device, removing the identification device, and repairing the identification device. Further, the number of operations may include retrieving the data from the plurality of identification devices.

Still further, in operation **802**, the process may generate a number of alerts to be displayed to a user indicating that the event has occurred. The user may then perform the number of operations based on the occurrence of the event.

Turning now to **Figure 9**, an illustration of a flowchart of a process for identifying the occurrence of an event is depicted in accordance with an advantageous embodiment. The process illustrated in **Figure 9** may be a more-detailed process for operation **800** in **Figure 8**.

The process begins by processing information in a tag management database (operation **900**). The tag management database may be, for example, tag management database **726** in **Figure 7**. The process then determines whether a period of time in which data from at least one identification device in the plurality of identification devices has not been received exceeds a selected threshold (operation **902**).

If the period of time exceeds the threshold, the process identifies an occurrence of an event (operation **904**), with the process terminating thereafter. Otherwise, the process terminates.

Turning now to **Figure 10**, an illustration of a flowchart of a process for forming information for a plurality of identification devices is depicted in accordance with an advantageous embodiment. The process illustrated in **Figure 10** may be implemented using tag management module **328** in **Figure 3** and/or tag management module **700** in **Figure 7**.

The process begins by retrieving information from a system database (operation **1000**). The system database is managed by an entity owning an aircraft with a plurality of identification devices on the aircraft. The system database contains identification device data, such as identification device data **402** in **Figure 4**, and location information.

The location information identifies which identification device is attached to which location and/or component on the aircraft.

The process then filters and processes the information received to form processed information using a retrieval policy (operation **1002**). Thereafter, the process stores the processed information in an operational database (operation **1004**), such as operational database **722** in **Figure 7**.

Next, a tag management process retrieves, combines, and processes the information stored in the operational database and a specification database to form information (operation **1006**). The specification database is, for example, tag specification database **724** in **Figure 7**. The process stores the information formed in operation **1006** in a tag management database (operation **1008**), with the process terminating thereafter.

The flowcharts and block diagrams in the different depicted embodiments illustrate the architecture, functionality, and operation of some possible implementations of apparatus and methods in different advantageous embodiments. In this regard, each block in the flowcharts or block diagrams may represent a module, segment, function, and/or a portion of an operation or step. In some alternative implementations, the function or functions noted in the block may occur out of the order noted in the figures. For example, in some cases, two blocks shown in succession may be executed substantially concurrently, or the blocks may sometimes be executed in the reverse order, depending upon the functionality involved. Also, other blocks may be added in addition to the illustrated blocks in a flowchart or block diagram.

Thus, the different advantageous embodiments provide a method and apparatus for managing identification devices on an aircraft. An occurrence of an event is identified using information for a plurality of identification devices. Each of the plurality of identification devices is associated with a plurality of components on the aircraft. The information for the plurality of identification devices comprises data received from the plurality of identification devices and specification data for the plurality of identification devices. In response to identifying the occurrence of the event, a number of operations for the plurality of identification devices are initiated.

The different advantageous embodiments provide for managing a plurality of tags associated with a plurality of aircraft components. By storing data about the plurality of

tags and the specifications of those tags, a tag management system may use rules that define when a tag needs to be repaired or replaced.

The different advantageous embodiments may recognize and capture all tags that are not currently in the database and add the new tags to the database. By adding the tags to the database, the tags are then part of the tag management process. The advantageous embodiments may also recognize data that is different between the tag and the database and based on user or otherwise predetermined rules, will update each device accordingly.

The different advantageous embodiments may provide alerts, future alerts and maintenance, the ability to, query on specific parameters including, but not limited to the entire fleet of aircraft, part number, action taken on tag, condition noted of tag, or any information on the tag.

The different advantageous embodiments may provide data management by being able to accomplish updated information of the tags and alert if information on the tag becomes outdated.

The different advantageous embodiments can take the form of an entirely hardware embodiment, an entirely software embodiment, or an embodiment containing both hardware and software elements. Some embodiments are implemented in software, which includes, but is not limited to, forms, such as, for example, firmware, resident software, and microcode.

Furthermore, the different advantageous embodiments can take the form of a computer program product accessible from a computer-usable or computer-readable medium providing program code for use by or in connection with a computer or any device or system that executes instructions. For the purposes of this disclosure, a computer-usable or computer-readable medium can generally be any tangible apparatus that can contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device.

The computer-usable or computer-readable medium can be, for example, without limitation, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, or a propagation medium. Non-limiting examples of a computer-readable medium include a semiconductor or solid state memory, magnetic tape, a removable computer diskette, a random access memory (RAM), a read-only memory (ROM), a

rigid magnetic disk, and an optical disk. Optical disks may include compact disk – read only memory (CD-ROM), compact disk – read/write (CD-R/W), and DVD.

Further, a computer-usable or computer-readable medium may contain or store a computer-readable or usable program code such that when the computer-readable or usable program code is executed on a computer, the execution of this computer-readable or usable program code causes the computer to transmit another computer-readable or usable program code over a communications link. This communications link may use a medium that is, for example, without limitation, physical or wireless.

A data processing system suitable for storing and/or executing computer-readable or computer-usable program code will include one or more processors coupled directly or indirectly to memory elements through a communications fabric, such as a system bus. The memory elements may include local memory employed during actual execution of the program code, bulk storage, and cache memories, which provide temporary storage of at least some computer-readable or computer-usable program code to reduce the number of times code may be retrieved from bulk storage during execution of the code.

Input/output or I/O devices can be coupled to the system either directly or through intervening I/O controllers. These devices may include, for example, without limitation, keyboards, touch screen displays, and pointing devices. Different communications adapters may also be coupled to the system to enable the data processing system to become coupled to other data processing systems, remote printers, or storage devices through intervening private or public networks. Modems and network adapters are just a few non-limiting examples of the currently available types of communications adapters.

The description of the different advantageous embodiments has been presented for purposes of illustration and description and is not intended to be exhaustive or limited to the embodiments in the form disclosed. Many modifications and variations will be apparent to those of ordinary skill in the art. Further, different advantageous embodiments may provide different advantages as compared to other advantageous embodiments. The embodiment or embodiments selected are chosen and described in order to best explain the principles of the embodiments, the practical application, and to enable others of ordinary skill in the art to understand the disclosure for various

embodiments with various modifications as are suited to the particular use contemplated.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method for managing identification devices on an aircraft, the method comprising:

identifying, by a processor unit, an occurrence of an event for an identification device in a plurality of identification devices using information about the plurality of identification devices, wherein each of the plurality of identification devices are associated with a plurality of components on the aircraft and wherein the information about the plurality of identification devices comprises data stored on the plurality of identification devices that is received from the plurality of identification devices and specification data associated with the plurality of identification devices; and

responsive to identifying the occurrence of the event, generating, by the processor unit, a notification to a user that indicates an operation to be performed, wherein the operation is selected from replacing the identification device, removing the identification device, and repairing the identification device.

2. The method of claim **1**, wherein the plurality of identification devices comprises a plurality of radio frequency identification devices.

3. The method of claim **1** further comprising:

attaching each of the plurality of identification devices to one of a plurality of locations on the plurality of components on the aircraft.

4. The method of claim **1** further comprising:

receiving the data stored on the plurality of identification devices using radio frequency signals.

5. The method of claim **1** further comprising:

obtaining the specification data about the plurality of identification devices from a manufacturer of the plurality of identification devices.

6. The method of claim **1** further comprising at least one of:

attaching the plurality of identification devices prior to installing the plurality of components on the aircraft; and

attaching the plurality of identification devices after installing the plurality of components on the aircraft.

7. The method of claim **1**, wherein identifying the event comprises determining whether a period of time during which data is not received from the identification device in the plurality of identification devices exceeds a selected threshold.

8. The method of claim **1**, wherein the data stored on the plurality of identification devices includes a memory available to the identification device and wherein identifying the event comprises determining that the memory available for the identification device is less than a selected threshold.

9. The method of claim **1**, wherein identifying the event comprises determining that a version of the identification device in the plurality of identification devices is expiring.

10. The method of claim **1**, further comprising:

generating, by the processor unit, an alert for display indicating that the event has occurred.

11. The method of claim **1** further comprising:

performing a number of queries to retrieve requested information from the information without requiring user input; and

generating a number of reports in response to retrieving the requested information.

12. The method of claim **1**, wherein the plurality of identification devices comprises at least one of a radio frequency identification device, an optical memory card, a barcode, and a magnetic strip.

13. An apparatus comprising:

a plurality of identification devices associated with a plurality of components on an aircraft; and

a computer system configured to:

identify an occurrence of an event for an identification device in the plurality of identification devices using information about the plurality of identification devices, wherein the information about the plurality of identification devices comprises data stored on the plurality of identification devices that is received from the plurality of identification devices and specification data associated with the plurality of identification devices; and

in response to identifying the occurrence of the event, generate a notification to a user that indicates an operation to be performed wherein the operation is selected from replacing the identification device, removing the identification device, and repairing the identification device.

14. The apparatus of claim **13**, wherein the plurality of identification devices comprises a plurality of radio frequency identification devices.

15. The apparatus of claim **13**, wherein each of the plurality of identification devices is attached to one of a plurality of locations on the plurality of components on the aircraft.

16. The apparatus of claim **13**, wherein the computer system is configured to receive the data stored in the plurality of identification devices using radio frequency signals.

17. The apparatus of claim **13**, wherein the computer system is configured to obtain the specification data about the plurality of identification devices from a number of manufacturers for the plurality of identification devices.

18. The apparatus of claim **13**, wherein the computer system is configured to identify the occurrence of the event by determining whether a period of time in which the data is not received from the identification device in the plurality of identification devices exceeds a selected threshold.

19. The apparatus of claim **13**, wherein the data stored on the plurality of identification devices includes a memory available to the identification device and wherein the computer system is configured to identify the occurrence of the event by determining whether the memory available to the identification device is less than a selected threshold.

20. The apparatus of claim **13**, wherein the computer system is configured to identify the occurrence of the event by determining that a version of the identification device in the plurality of identification devices is expiring.

21. The apparatus of claim **13**, wherein the computer system is configured to generate an alert for display indicating that the event has occurred.

22. The apparatus of claim **13**, wherein the computer system is further configured to perform a number of queries to retrieve requested information from the information without requiring user input and generate a number of reports in response to retrieving the requested information.

23. The apparatus of claim **13**, wherein the plurality of identification devices comprises at least one of a radio frequency identification device, an optical memory card, a barcode, and a magnetic strip.

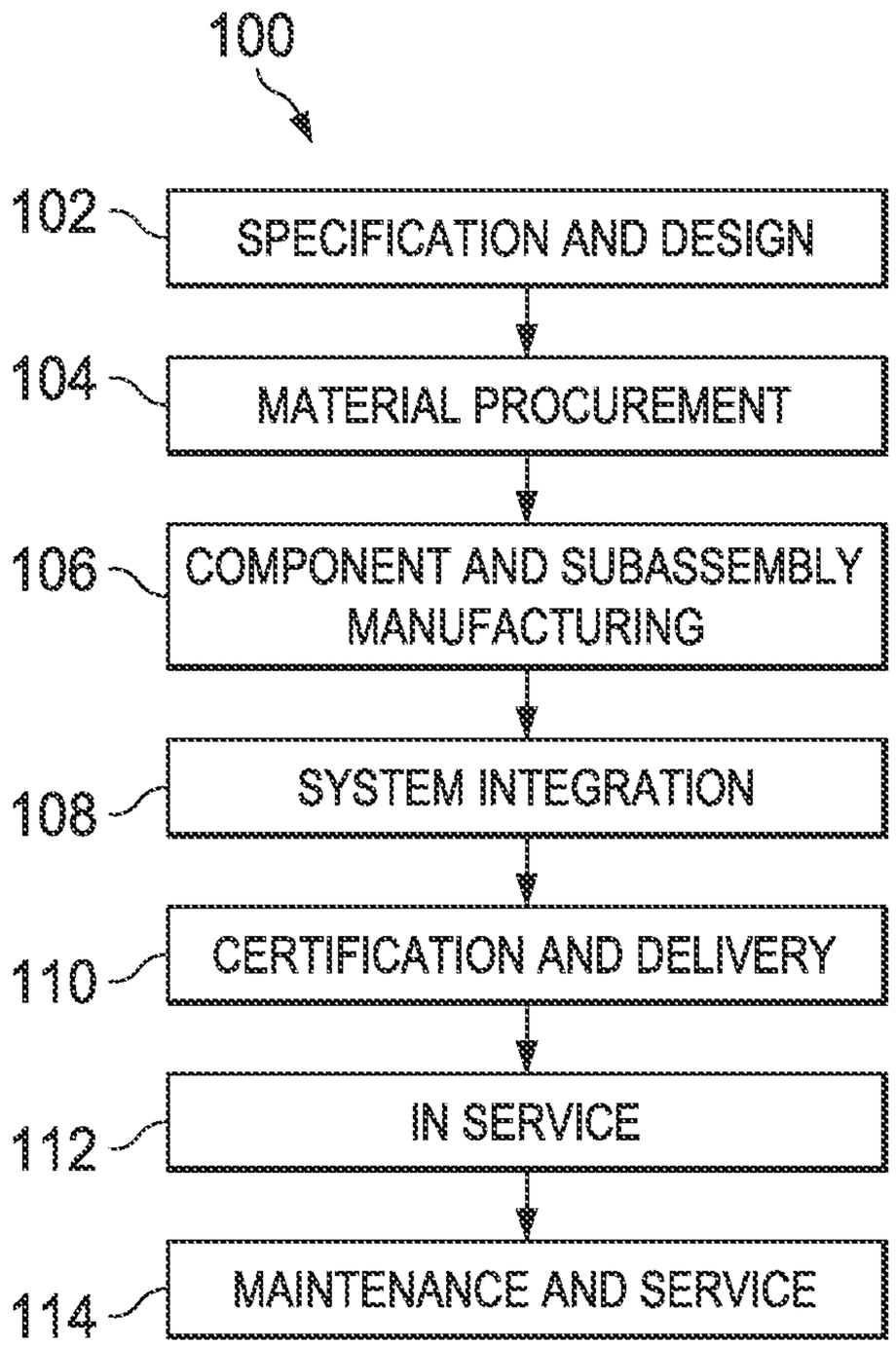

100
102
SPECIFICATION AND DESIGN
104
MATERIAL PROCUREMENT
106
COMPONENT AND SUBASSEMBLY MANUFACTURING
108
SYSTEM INTEGRATION
110
CERTIFICATION AND DELIVERY
112
IN SERVICE
114
MAINTENANCE AND SERVICE

FIG. 1

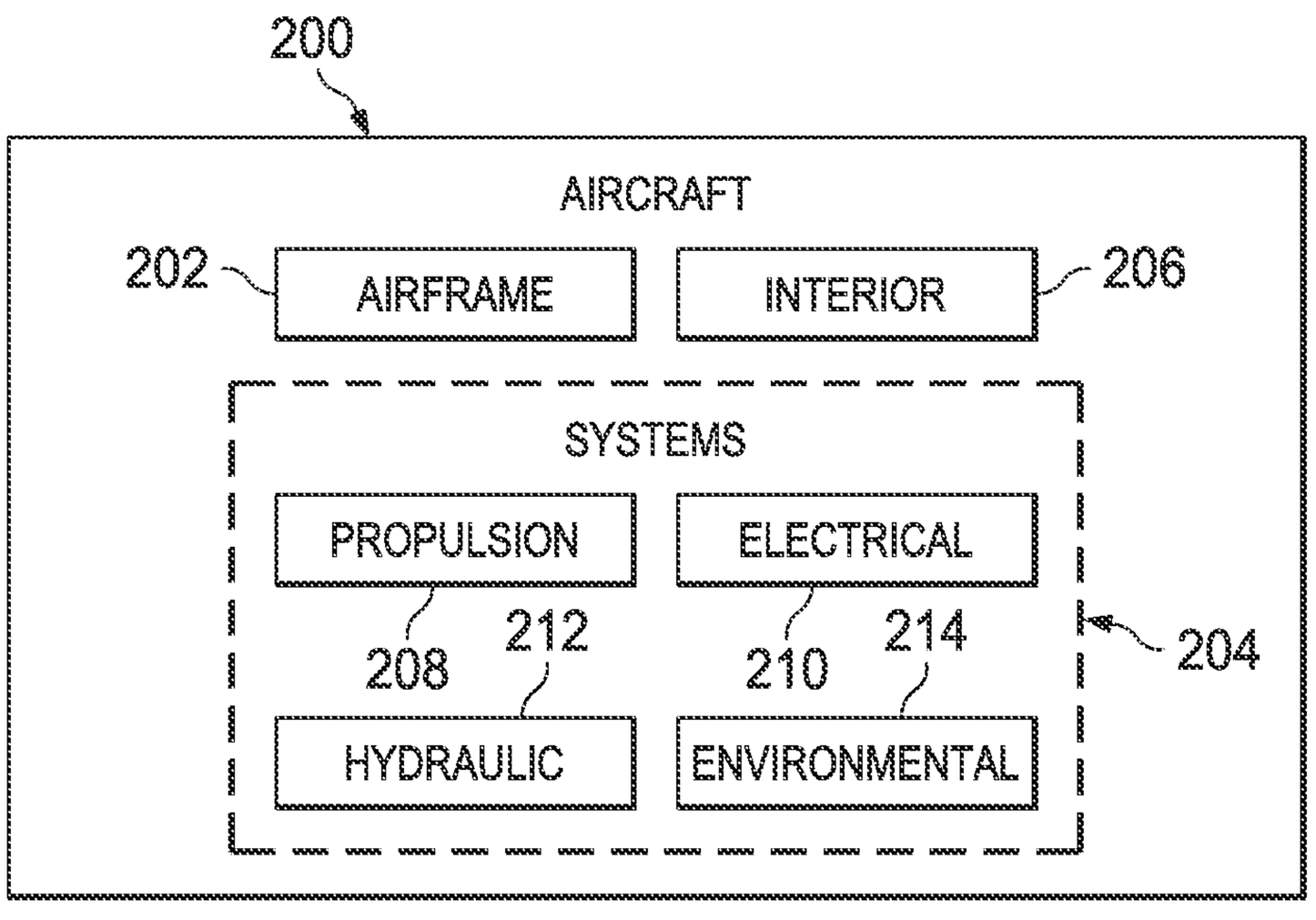

200
AIRCRAFT
202
AIRFRAME
INTERIOR
206
SYSTEMS
PROPULSION
ELECTRICAL
208
212
210
214
HYDRAULIC
ENVIRONMENTAL
204

FIG. 2

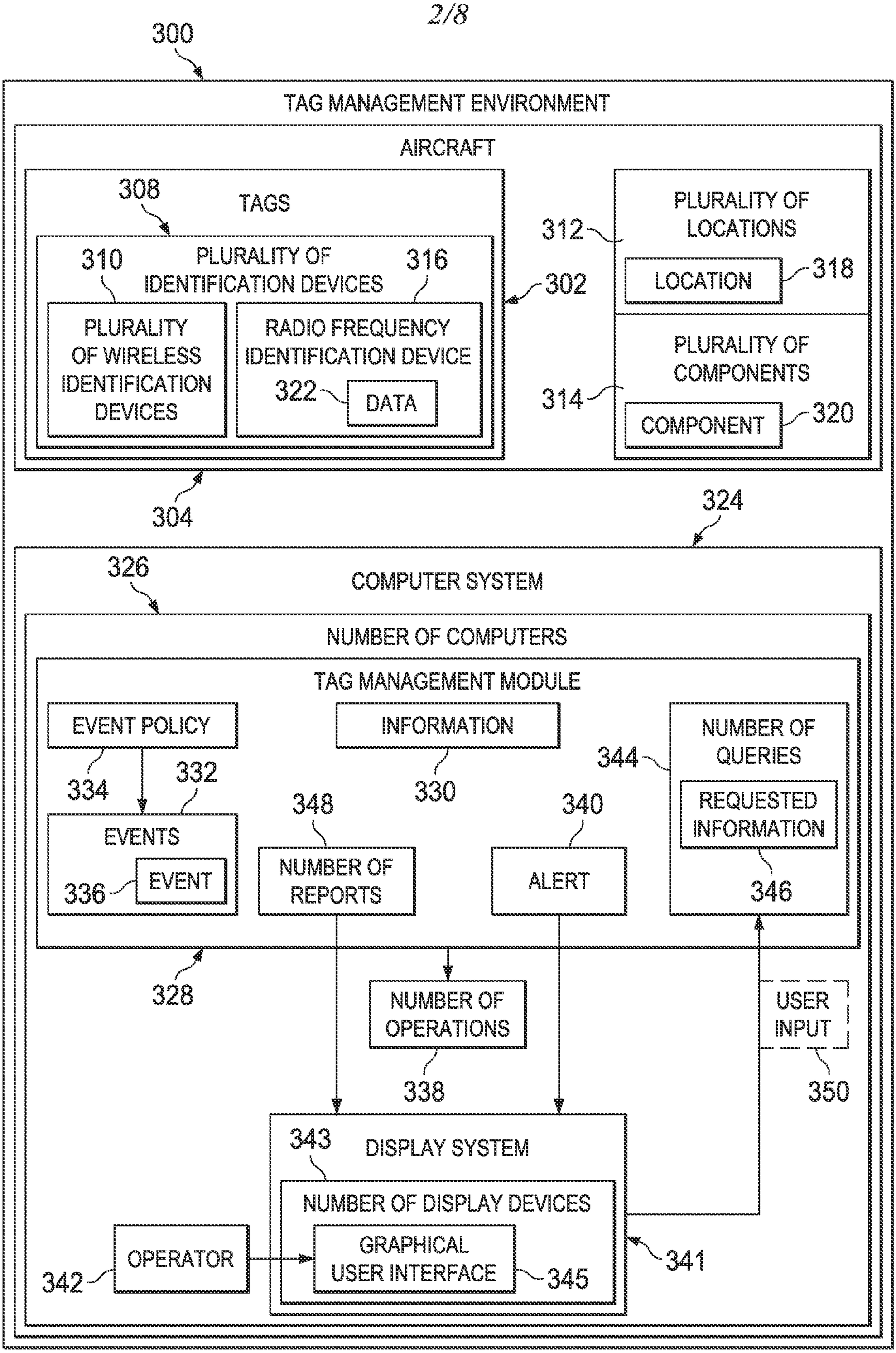

300
TAG MANAGEMENT ENVIRONMENT
AIRCRAFT
308
TAGS
310
PLURALITY OF IDENTIFICATION DEVICES
316
PLURALITY OF WIRELESS IDENTIFICATION DEVICES
RADIO FREQUENCY IDENTIFICATION DEVICE
322
DATA
302
312
PLURALITY OF LOCATIONS
LOCATION
318
314
PLURALITY OF COMPONENTS
COMPONENT
320
304
324
326
COMPUTER SYSTEM
NUMBER OF COMPUTERS
TAG MANAGEMENT MODULE
EVENT POLICY
334
332
EVENTS
336
EVENT
INFORMATION
330
348
NUMBER OF REPORTS
340
ALERT
344
NUMBER OF QUERIES
REQUESTED INFORMATION
346
328
NUMBER OF OPERATIONS
338
USER INPUT
350
343
DISPLAY SYSTEM
NUMBER OF DISPLAY DEVICES
OPERATOR
342
GRAPHICAL USER INTERFACE
345
341

FIG. 3

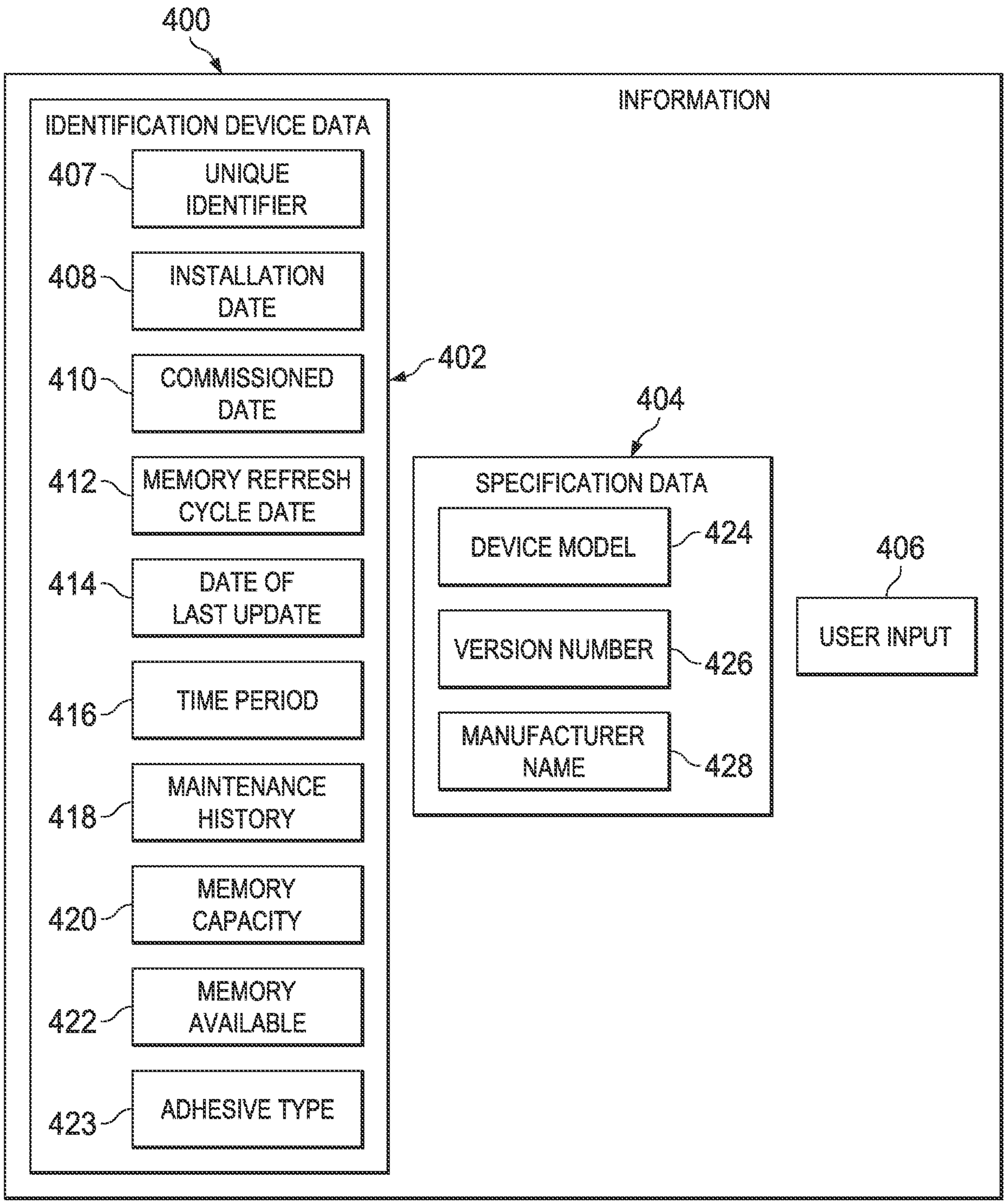
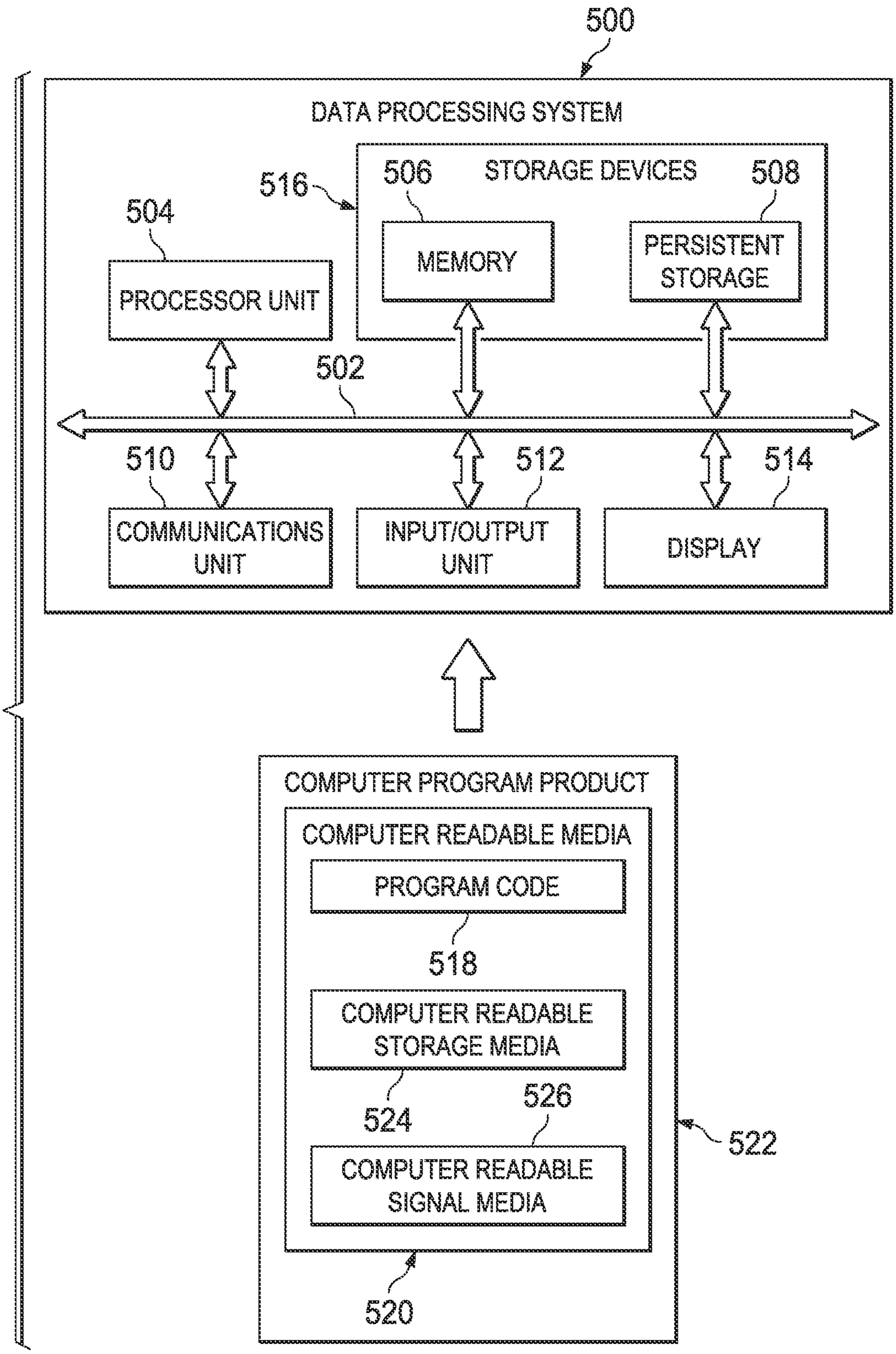

400
IDENTIFICATION DEVICE DATA
407
UNIQUE IDENTIFIER
408
INSTALLATION DATE
410
COMMISSIONED DATE
412
MEMORY REFRESH CYCLE DATE
414
DATE OF LAST UPDATE
416
TIME PERIOD
418
MAINTENANCE HISTORY
420
MEMORY CAPACITY
422
MEMORY AVAILABLE
423
ADHESIVE TYPE
402
INFORMATION
404
SPECIFICATION DATA
DEVICE MODEL
424
VERSION NUMBER
426
MANUFACTURER NAME
428
406
USER INPUT

FIG. 4

FIG. 5


500
DATA PROCESSING SYSTEM
516
506
STORAGE DEVICES
508
504
MEMORY
PERSISTENT STORAGE
PROCESSOR UNIT
502
510
512
514
COMMUNICATIONS UNIT
INPUT/OUTPUT UNIT
DISPLAY
COMPUTER PROGRAM PRODUCT
COMPUTER READABLE MEDIA
PROGRAM CODE
518
COMPUTER READABLE STORAGE MEDIA
524
526
COMPUTER READABLE SIGNAL MEDIA
522
520

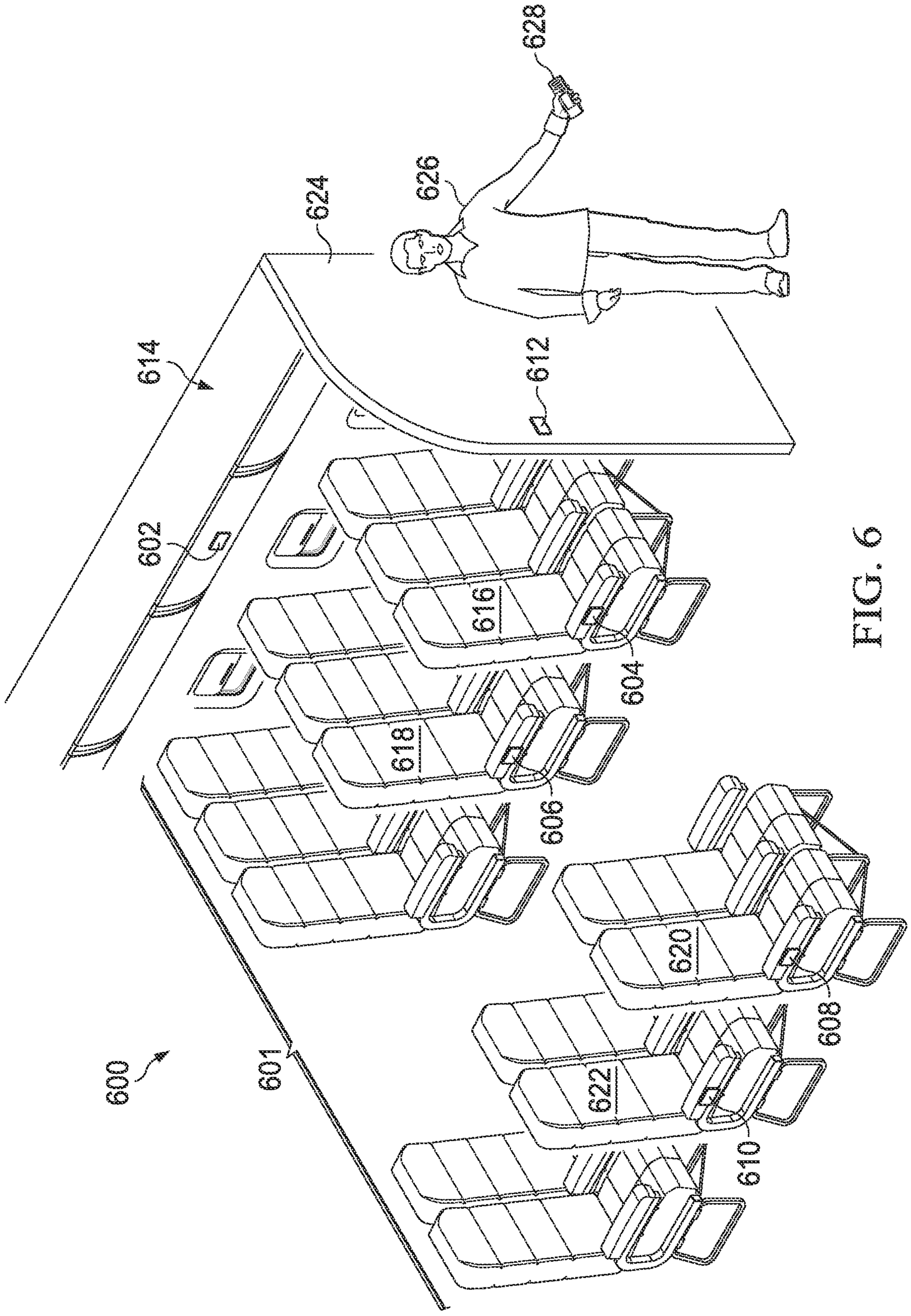
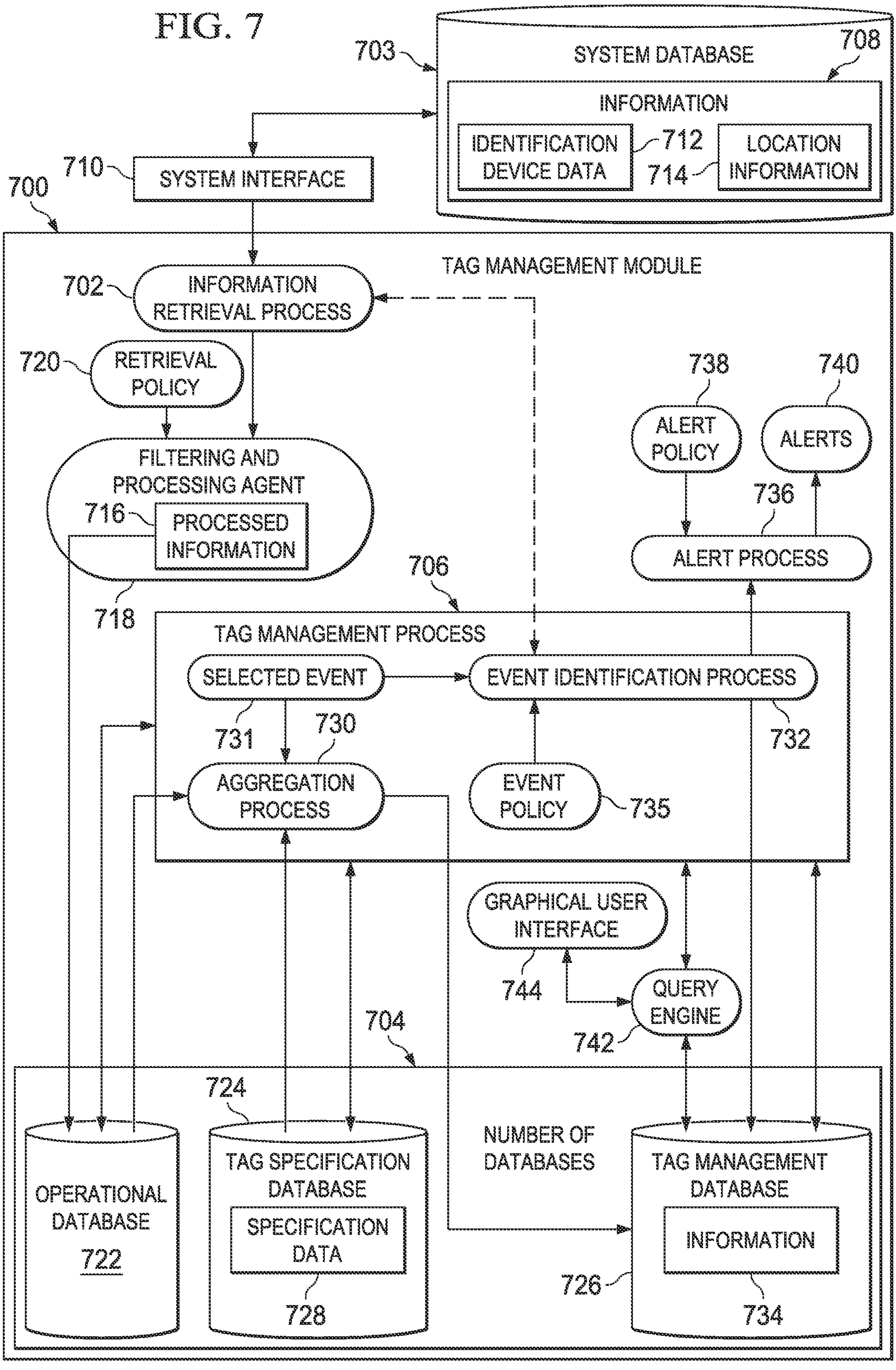


FIG. 6

FIG. 7


703
SYSTEM DATABASE
708
INFORMATION
IDENTIFICATION DEVICE DATA
712
LOCATION INFORMATION
714
710
SYSTEM INTERFACE
700
TAG MANAGEMENT MODULE
702
INFORMATION RETRIEVAL PROCESS
720
RETRIEVAL POLICY
FILTERING AND PROCESSING AGENT
716
PROCESSED INFORMATION
718
706
738
ALERT POLICY
740
ALERTS
736
ALERT PROCESS
TAG MANAGEMENT PROCESS
SELECTED EVENT
EVENT IDENTIFICATION PROCESS
731
730
732
AGGREGATION PROCESS
EVENT POLICY
735
GRAPHICAL USER INTERFACE
744
QUERY ENGINE
742
704
724
OPERATIONAL DATABASE
722
TAG SPECIFICATION DATABASE
SPECIFICATION DATA
728
NUMBER OF DATABASES
TAG MANAGEMENT DATABASE
INFORMATION
726
734

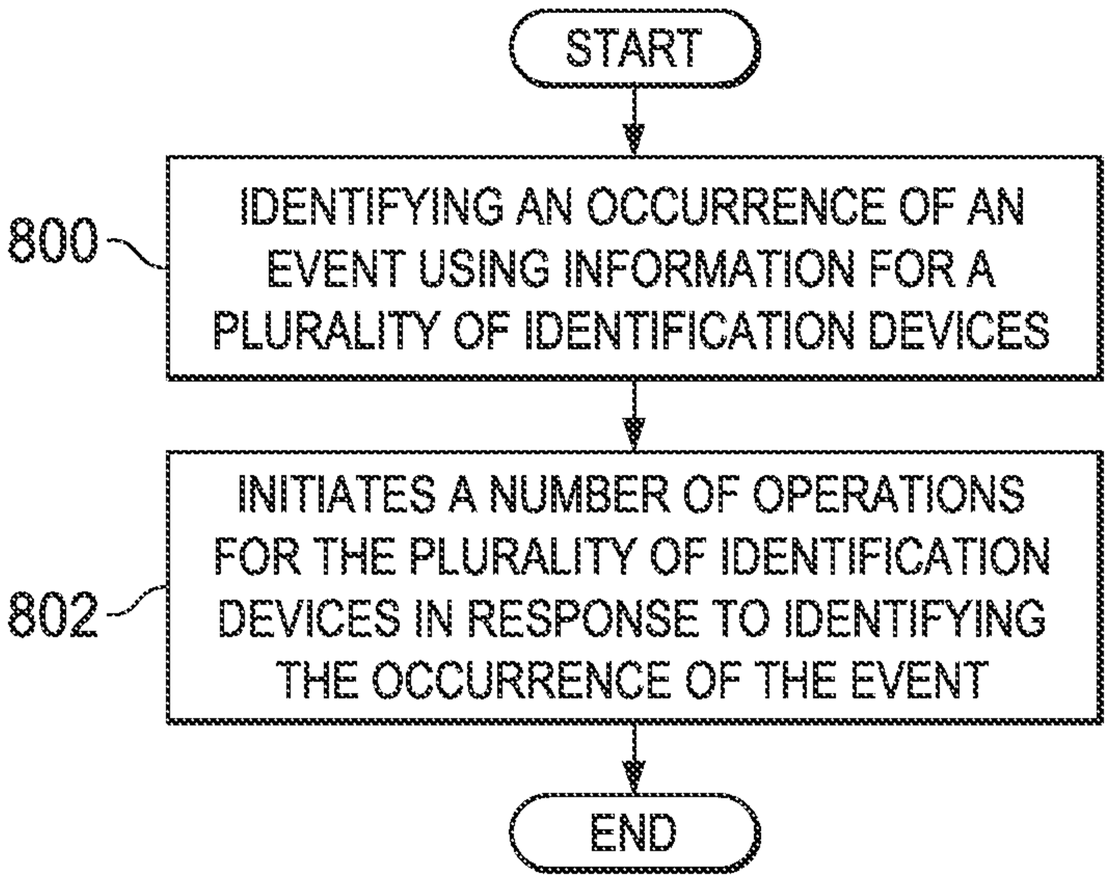

START
IDENTIFYING AN OCCURRENCE OF AN EVENT USING INFORMATION FOR A PLURALITY OF IDENTIFICATION DEVICES
800
INITIATES A NUMBER OF OPERATIONS FOR THE PLURALITY OF IDENTIFICATION DEVICES IN RESPONSE TO IDENTIFYING THE OCCURRENCE OF THE EVENT
802
END

FIG. 8

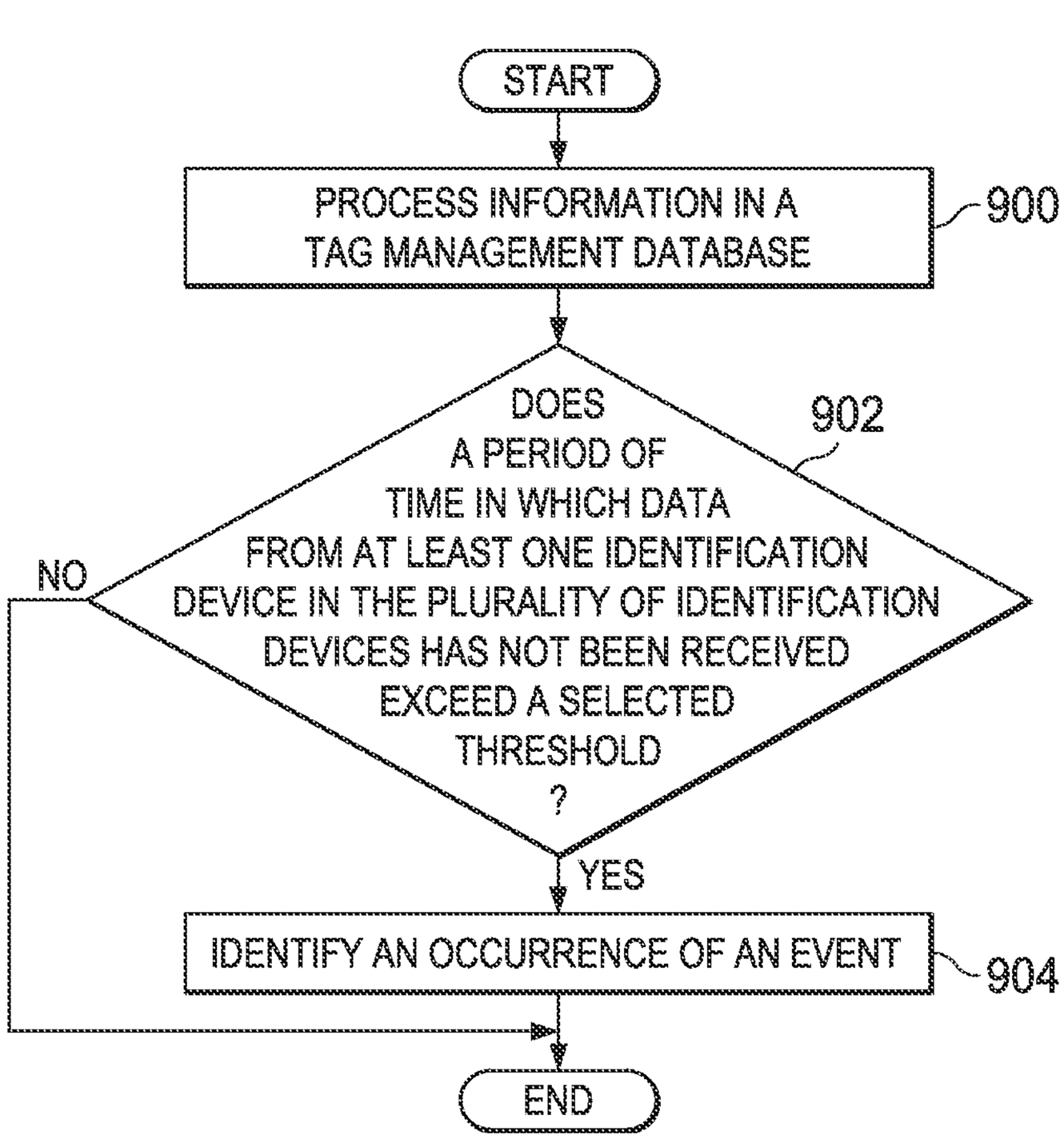

START
PROCESS INFORMATION IN A TAG MANAGEMENT DATABASE
900
DOES A PERIOD OF TIME IN WHICH DATA FROM AT LEAST ONE IDENTIFICATION DEVICE IN THE PLURALITY OF IDENTIFICATION DEVICES HAS NOT BEEN RECEIVED EXCEED A SELECTED THRESHOLD ?
902
NO
YES
IDENTIFY AN OCCURRENCE OF AN EVENT
904
END

FIG. 9

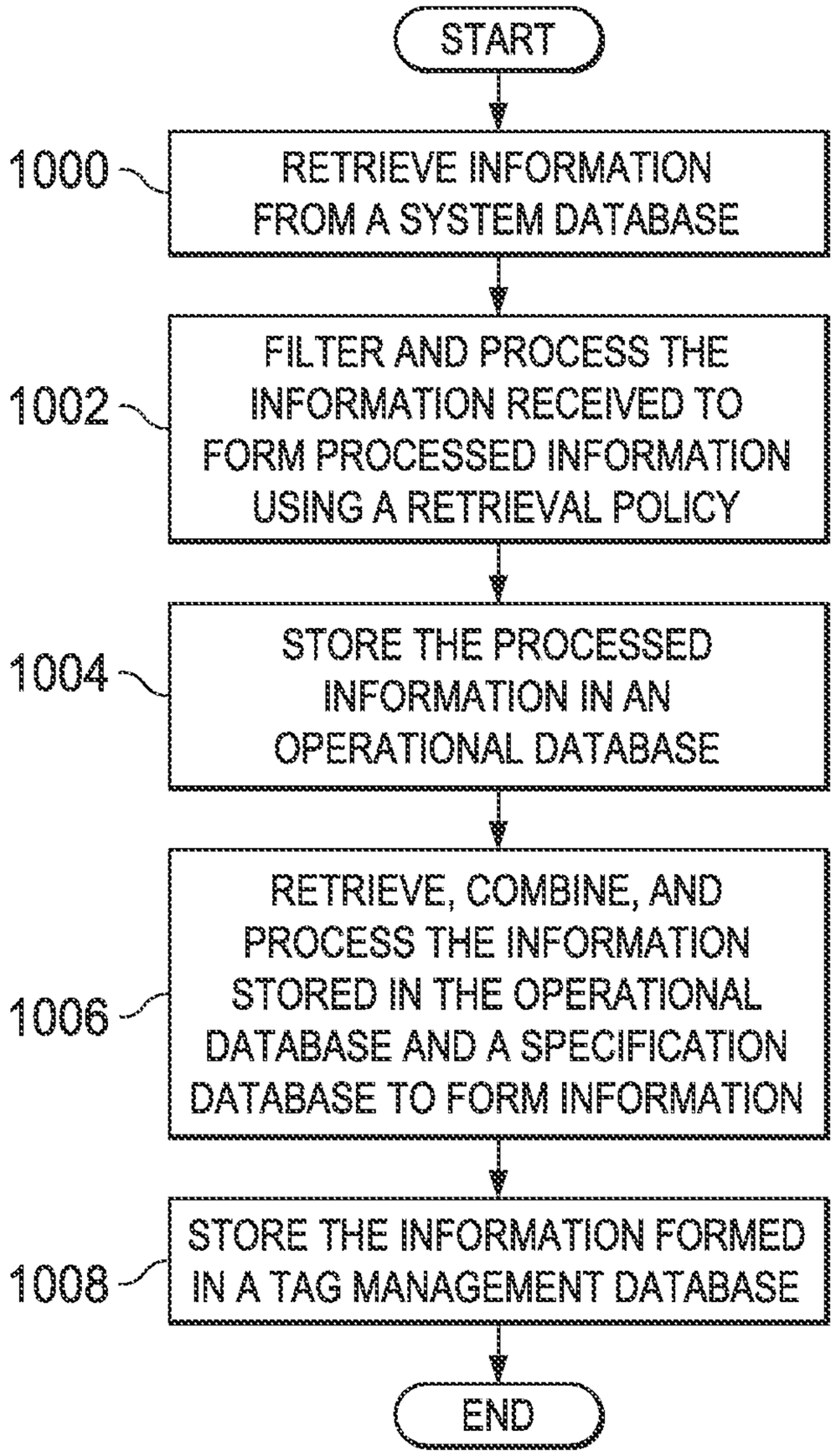
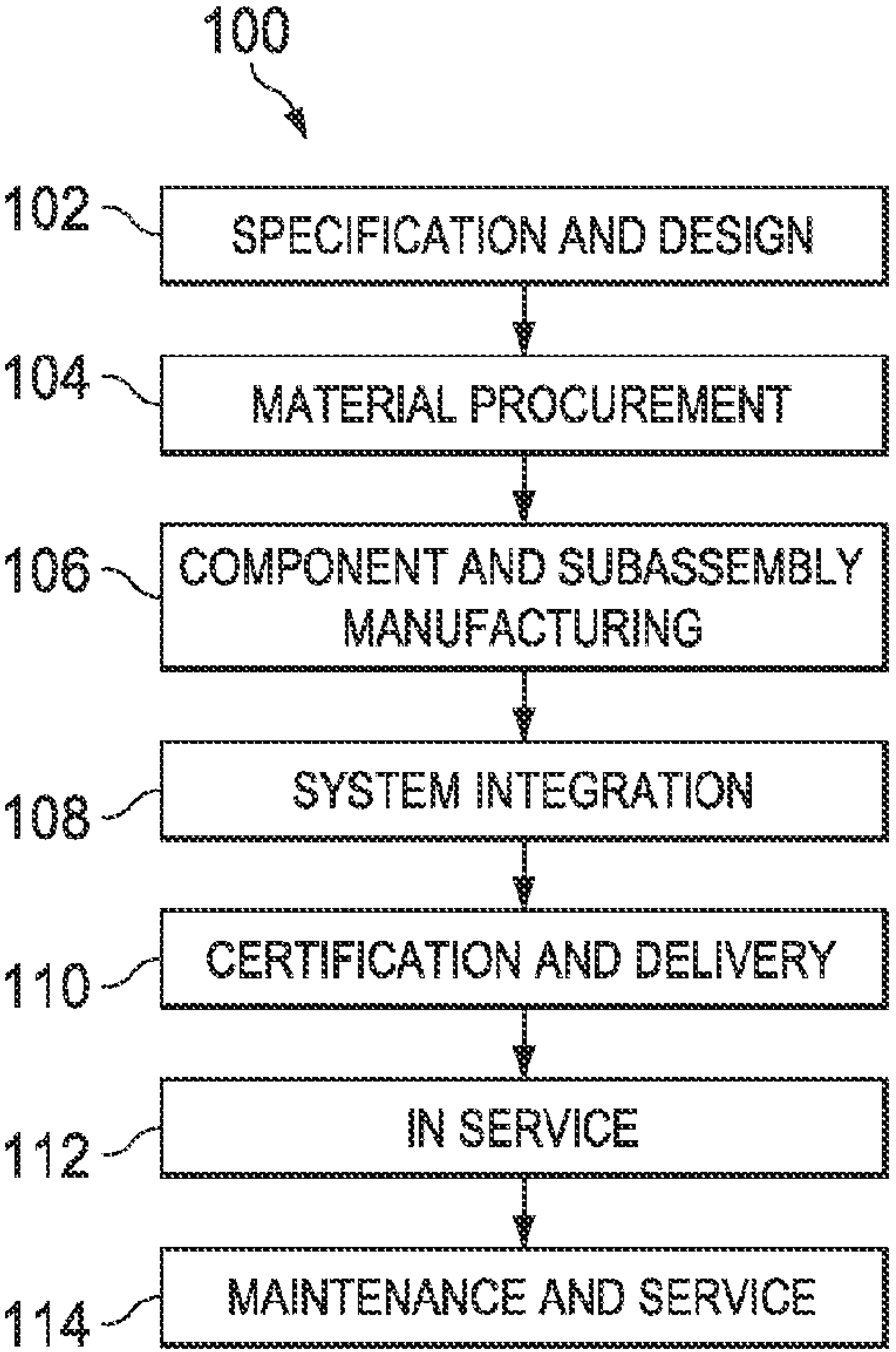

START
1000
RETRIEVE INFORMATION FROM A SYSTEM DATABASE
1002
FILTER AND PROCESS THE INFORMATION RECEIVED TO FORM PROCESSED INFORMATION USING A RETRIEVAL POLICY
1004
STORE THE PROCESSED INFORMATION IN AN OPERATIONAL DATABASE
1006
RETRIEVE, COMBINE, AND PROCESS THE INFORMATION STORED IN THE OPERATIONAL DATABASE AND A SPECIFICATION DATABASE TO FORM INFORMATION
1008
STORE THE INFORMATION FORMED IN A TAG MANAGEMENT DATABASE
END

FIG. 10


100
102
SPECIFICATION AND DESIGN
104
MATERIAL PROCUREMENT
106
COMPONENT AND SUBASSEMBLY MANUFACTURING
108
SYSTEM INTEGRATION
110
CERTIFICATION AND DELIVERY
112
IN SERVICE
114
MAINTENANCE AND SERVICE